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**"The Social Context of GIS Implementation: an empirical
exploration of factors affecting success"**

by

Jeff Hughes B.A. (Hons.)

A thesis submitted to
the Faculty of Graduate Studies and Research
in partial fulfilment of
the requirements for the degree of

Master of Arts

Department of Geography

**Carleton University
Ottawa, Ontario
January, 1997**

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the Faculty of Graduate Studies and Research
acceptance of this thesis

“The Social Context of GIS Implementation: an empirical
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submitted by Jeff Hughes B.A. (Hons.)
in partial fulfillment of the requirements for
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David Bennett, Thesis Supervisor

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January, 1997

ABSTRACT

Geographic Information System (GIS) technologies are increasingly being used outside the academy and the traditional industries within which they were developed (resources analysis, etc.). As new applications are developed in many different fields and for a diverse group of end users, evaluating the components that differentiate successful implementation processes from those which have failed becomes critical. Not only have very few attempts been made to analyse these processes, but the terms of reference within the field have yet to be fully defined.

This thesis explores the concepts of GIS implementation and discusses the difficulties researchers face in evaluating system success. Moreover, this thesis reports and describes my involvement with two very different implementation processes. Projects undertaken with both Ramsay Township and the Regional Municipality of Ottawa-Carleton are reviewed in terms of the four factors that influence successful GIS implementation processes: Implementation impetus; management and political issues; software and database design; simple tasks and organisational goals.

ACKNOWLEDGEMENTS

Despite the fact that my work and research is best formally represented in these pages, the true learning within my Master's program came through both the activities within the case study research documented herein, and the extensive discussions which took place in Dr. David Bennett's office. It should surprise no one that in both environments, the learning went far beyond the scope of the thesis itself.

For the practical and insightful experience gained at both Ramsay Township and the RMOC, I would like to thank those individuals which made it possible, including CSTIER and SHL. For the forum within which to discuss my experiences, I would like to thank Dr. David Bennett for his attention and patience, and for asking the questions which I thought did not have to be answered.

I would also like to thank the Journalism Department at Carleton for providing Jenn Wrightsell with the ability to chop and hack draft after draft of this thesis thoroughly and consistently throughout the writing process. If I might add parenthetically, my work is far superior because of her assistance.

This thesis is dedicated to my mother and the memory of my father.

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PREFACE

This Master's thesis is the product of more than two and a half years of exploration and learning in an area that is still not very well understood. This is, in fact, the reason why the process was often exploratory, sometimes innovative and why it changed direction many times during its course. Research hypotheses were not clear in the beginning, and sometimes were not even considered, as much of the background work took place throughout the journey but outside of what was originally to be the thesis itself. The gaping holes which existed at the outset still exist within the literature and certainly in the classroom. These holes were discovered through an extended process which began prior to my enrolment in the Master's program of which this thesis is a part. Rather than have the reader guess as to how the questions first arose, the following description will describe the process.

After completing my first three years of undergraduate training in geography, my experience with GIS consisted of basic theory supplemented by software training on basic applications which, three years later, are almost completely out of date. Admittedly, the course objectives were designed to give students background, not train them to be technicians. The problem was, however, that none of the course work was devoted to the theme of how GISs worked in organisations, nor how to directly apply it to academic research. If instruction was not directing students to become proficient technicians, nor was it instructing students on how to manage its uses, what was the purpose?

The fourth-year GIS course was intended to address many of the management issues previously ignored. A stream of guest speakers from diverse organisations throughout the one-term course only managed to generate many more questions than were

answered. Every external use of GIS seemed utterly different from every other, had different objectives, and was implemented in different ways at a different rate. Many spoke about political, financial and internal bureaucratic difficulties interfering with the important work of technological development, as if those 'other' issues were a distraction. Looking back this was the beginning of my Master's degree research. While I did not fully understand the scope of the problem at the time, I was beginning to see that certain kinds of issues were simply unrecognised.

Course work during the first year of my Master's program allowed a thorough exploration of the literature on GIS per se and on critiques and problems of application, which subsequently became the second and third chapters of this thesis. Two bodies of literature were identified, which were ultimately inconclusive, insubstantive, and disparate. Moreover, there was a concern that the pace of change within the discipline would mean that anything written more than a few years ago would be hopelessly out of date, not necessarily because the issues were outdated but that, often, a case study reported on positively two years prior, may in fact have been abandoned altogether. One of the difficulties with case studies, as reported by Obermeyer and Pinto (1994, 19), is that often the case studies are reported by active project members who feel compelled to project positive viewpoints concerning their project, despite actual circumstances. Furthermore, many active participants were probably wary about putting into print those aspects of the internal political and managerial decision-making processes which could jeopardise further GIS development. A critique of social implications of GIS applications was unlikely to arise spontaneously from within the community of GIS developers. Likewise, there were no obvious commercial benefits to be had from inviting the scrutiny of academics and

evaluative researchers. A primary difficulty within all of these concerns is that the pace of change within the industry is both quick and dramatic. To analyse organisational use of GIS technologies through the literature was further made difficult by traditional press schedules for both monographs and journals.

Another concern, and one which every individual attempting to understand an external organisation should consider, is the experience of working in such an environment. In an attempt to address both the issues of pace of change and experience, the selection of two interactively experienced case studies was thought to be an acceptable solution. Appreciation and analysis of the problems of GIS adoption by goal-oriented public sector organisations could not come from staying within the walls of the academy. But the academy could provide the territorial base from which forays could be made into two such organisations — Ramsay Township, and the Regional Municipality of Ottawa Carleton — where I could join the process, and, without “going native”, could learn, see, listen and ask, before returning “home” to recollect and interpret my journey. This thesis is the account of those journeys.

CHAPTER 1: INTRODUCTION

The position and continuance of Geographic Information System (GIS) technology in academic institutions is clear. Researchers in geography and related natural and social sciences will utilise the technology to automate previously arduous activities and also to generate genuinely new forms of analyses. A computer system's ability to capture, store, process and retrieve vast amounts of digital spatial data will shelter it from redundancy amongst those who understand spatial processes and can manipulate both software and data to achieve desired goals. For this reason, this tool is an important new aid to researchers within the discipline, and some have argued, to geography as a whole (Dobson, 1983). The sophistication of GIS technology has also spawned a specialised, rapidly growing, industry, the results of which could influence the discipline of Geography much more than the benefits accrued by researchers through their use of advanced technology itself.

The acceptance of GIS technology into organisations which traditionally have not used it, and whose goals and structures pre-date its invention, is of critical importance to the growth of the industry and, subsequently, perhaps to the discipline of geography. GIS and desktop mapping technologies could potentially benefit most small and large public and private organisations. Unfortunately, the adoption or transfer of GIS technology into these organisations has been anything but seamless. Multi-million dollar projects have been abandoned, applications deserted, and systems utilised for only a fraction of what they were intended to achieve (Campbell and Masser, 1995, 3), much to the dismay of those attempting to initiate the system implementation. This thesis explores the

organisational use of GIS technology, and discusses the reasons why adoption has been difficult and some of the ways in which it can be improved.

The amount of research devoted to this topic is sparse. The success of GIS in making a real difference in the real world is almost totally unevaluated. Despite the vast amount of money dedicated to GIS technology development in-house and the money required to generate a database, purchase software and train staff, the failures which have been documented contribute few explanations. The literature relating to these topics is discussed in chapters 2 and 3 of the thesis as two fairly distinct bodies of literature.

The first body of literature discussed is most relevant to the subsequent analysis. The success or failure of organisational GIS implementation and use has actually received very little attention despite the vast amounts of money and time devoted to such implementations throughout the last decade around the world. Identifying the attributes which separate the more successful systems from those which have failed is the primary objective of researchers in this area. Unfortunately, this has not yet become a simple procedure. While most researchers agree that issues of management and diffusion are more important than technical solutions (Campbell, 1994; Campbell and Masser, 1995), exactly which of those issues is most important is still unclear. Chapter 2 addresses both the difficulties with the research and attempts to summarise its conclusions.

The second body of literature is discussed in Chapter 3. It consists of a review of the post-positivist critiques of GIS which have emerged within the social sciences in the last couple of years. This work has documented the difficulties with GIS design and data models, arguing that its origins and continuing location within the positivist sciences restricts its use for alternative applications. The design of GISs for researchers by

researchers can accomplish many impressive and different types of analyses given copious amounts of resources, time and knowledge. The transfer of this technology into organisations involves much more than putting a computer onto every desk. Most end users will not be able to use the technology in the way in which it was designed without significant training. Moreover, issues involving data collection standards, the use of secondary data, and GIS and ethics are discussed. While these issues may at times seem tangential to the concepts of implementation and use within public and private organisations, they focus on improving the technology's ability to help potential users maximise their use.

The most striking deficiency within both these bodies of literature is the lack of suggested alternatives and solutions. Chapter 3 provides the most concrete example of alternatives offered from within the literature. The idea of the use of hermeneutics in order to better understand end-use GIS computer use is postulated (Gould, 1994). Beyond this example, however, the literature very distinctly brings up more questions than answers.

These two chapters review the small body of literature devoted to GIS implementation and use as well as my foray into directed study in order to better understand organisational use of GIS. The constantly changing nature of the discipline, combined with the lack of formal analysis and/or documentation (which are likely related in and of themselves) required the selection of case study examples which could be utilised for analysis with reference to material reviewed in Chapters 2 and 3. The use of case study analysis and participant observation in the study of organisational use of GISs is still in its infancy. The research in this thesis is novel in this regard. Chapter 4 discusses the use of case study research and the use of participant observation. The nature of the

project in terms of understanding the management and use of GIS technology required in-depth analyses while the scope of the project dictated that only one or two organisations could be involved. The research is quite deliberately intensive and exploratory, rather than extensive and confirmatory. Fortunately, two organisations were undertaking the implementation process during the research period in question, and both were willing to allow me to become involved with the projects to varying degrees. Subsequently, Ramsay Township and the Regional Municipality of Ottawa-Carleton (RMOC) were selected as the case studies from which the analysis portion of this thesis is derived. My participation in projects, evaluation and application development was an imperative component in my involvement. Pure observation was not a possibility for either organisation. In neither case was the nature of the project involvement the most important component of my research, however. The *process* of involvement, the individuals with whom I interacted, and internal workings of active GIS implementation processes are the focus of this thesis. The applications and projects I worked on at both Ramsay Township and the RMOC were vehicles through which a greater understanding of the organisational use of GIS emerged.

The value of case study research is considered negligible by some largely because generalisations fail to apply to all situations. While this criticism may have some merit, vast amounts of unquantifiable information exists. If, initially, this information can be captured only through qualitative analyses of individual situations, so be it. Increasing our level of understanding, perhaps very slowly at first, will hopefully allow the development of theories and concepts which will not only allow more standardised and effective methods for measuring both implementation success and failure, but also those components which influence the outcomes.

Chapter 4 discusses in more detail the reasons for which organisational involvement was utilised and the use of participant observation as a research method within the social sciences. The two organisations selected as case studies, Ramsay Township and the Regional Municipality of Ottawa-Carleton (RMOC), both undertake provincially legislated municipal activities. The scope of the two organisations and their utilisation of GIS technology address similar functions within completely different contexts and at different spatial scales.

Chapter 5 compares and contrasts components of GIS utilisation within the chosen organisations with reference to the material covered in the background portions of the thesis. Primarily, the effective use of routinised information delivery is considered to be very important and will be discussed. Achieving a small number of highly effective systems dedicated to improving service in the short term can dramatically improve morale with reference to the system. While this did occur in the case of Ramsay Township - and it seems as if the potential existed at the RMOC - there are many difficulties which stand in the way.

The focus on management both utilising the system and on the management of implementation recurs throughout the work as well. In conjunction with the political influences involved in an organisation (perhaps more overtly within public institutions), the use of the technology becomes problematised in many different ways, and will be discussed in reference to both case studies. Specifically, problems encountered through my own involvement at the RMOC will be used to document political obstacles.

The themes of the third chapter, specifically those of data model ontology, data collection and ethical use of data, are brought out in several ways within the analysis.

While it is often difficult to analyse data model design solely through the *use* of a system, rudimentary understanding of data structure, as will be illustrated, is critical to the proper use of the technology. An end user who does not possess the knowledge to ask answerable questions will encounter many difficulties and frustration, and may eventually stop using the system. While this would be problematic, perhaps an even more damaging outcome, however, is the use of answers by users who do not fully understand how the answers were derived, nor the inherent accuracy of the products being generated. Comprehending the system's limitations is of considerable value to any end user, aspects of which are rarely communicated through formal documentation.

These themes will be discussed throughout the thesis. It is important to recognise that any organisations should make decisions that are in the best interest of the organisation. To that end, decisions are made to achieve the organisational goals outlined either legislatively or in the "bottom line". In an era of rationalisation, public institutions are more readily utilising the "bottom line" than any other evaluative measure. For this reason, it is important to view the technology in the light of more efficiently and effectively achieving organisational goals at every stage, be it clerk, technician, or management.

This introduction has discussed many themes, specifically: simple tasks, management, software and database design, training and organisational goals. While these themes recur, it is important to note that they are not mutually exclusive and all are inter-related in one way or another. While an attempt will be made to delineate the themes discussed with reference to each case study, separating out each factor is as difficult as analysing the cumulative benefit of a GIS in an organisation over its life-span.

While the following two chapters review the pertinent literature related to the topics of organisational and effective use of GIS technology and design, they also provide a description of the problems facing GIS development and use in general.

CHAPTER 2: GIS IMPLEMENTATION SUCCESS AND FAILURE

Introduction

The relative *success* of any individual Geographic Information System, let alone groups of systems, has received very little attention within geography. From the few studies which have been undertaken, even fewer conclusions have been drawn which help to explain system success or failure. This chapter provides the background required to understand the nature of the problem and why it is so difficult to study. Efforts have been made within the literature, however, to review those components more highly associated with successful systems, and will be reviewed.

GIS use, within the scope of this thesis, is defined as the use of a Geographic Information System (either 'off the shelf' or designed 'in-house') for the purposes of storing, analysing, and retrieving spatially referenced information within a private or public organisation. As the size, structure and goals of each organisation vary considerably, it should not be expected that any two would undertake the implementation process in the same way. For example, two public organisations of similar size and (often legislated) responsibility which purchase identical products may experience different levels of 'success'. This could be due to organisational ability to adapt at every level, the position of the so-called 'GIS champion(s)' within the organisation, the level of resources devoted to implementation success, not to mention management strategies or political motivations.

The issues outlined above are not purely technical, and cannot necessarily be solved in a technical manner. Nor is the study of these issues simply a technical exercise. The complexity of organisational issues and technology has occupied many researchers

interested in Management Information Systems, concerned with both the managerial decision making processes and the nature of bureaucracy. Approaching the concepts of use and implementation from a management perspective, rather than a technical perspective, an effort will be made here to more fully understand the issues involved in a successful GIS implementation.

Nature and Scope of the Problem

It is wrong to argue that Geographic Information Systems encapsulate a new concept. Obermeyer and Pinto (1994, 4) argue that a paper map is a geographic information system. Organisations have perpetually had to 'handle' geographic information and organise it efficiently in order to facilitate its use and re-use. In much the same way as a database organises records in fields in order to facilitate cross-referencing and search queries, a GIS stores geographic information in order to achieve the same result. The capabilities of a GIS, however, allow an operator to generate a cartographic-like representation of the data. Moreover, a GIS allows an operator to carry out complex geographical analyses and models which allow users to exploit the computational power of desktop and mainframe computers. Many of the functions could have been carried out cartographically in the past but would not have been attempted due to the resources — mainly time and associated labour costs — required to undertake such endeavours.

Understanding the fact that a GIS at first simply replaces the original ways organisations have handled geographic information, and that analytically, a GIS only automates previously arduous tasks is critical to this thesis. The introduction of a GIS requires that either new organisational procedures be put in place to accommodate the

system itself, or the GIS must be adapted to match best the previously established organisational practices. In either case, a significant amount of disruption will occur, requiring changes to established organisational practices.

Most researchers acknowledge that a successful implementation involving the new technology will, at the end, come down to management issues. “The success or failure of new technologies such as GISs is often directly related to the success or failure of an organisation’s management of the innovation” (Obermeyer and Pinto, 1994, 3). The traditional focus on seeking technical answers to essentially non-technical problems is usually emphasised. “Evidence from agencies with relatively mature GIS suggests that initial efforts are centred on resolving technical and data-related issues to the detriment of proper consideration of organisational factors” (Campbell, 1991, 259-260). Moreover, research illustrates that there is not necessarily a simple connection between the technical merits of the technological innovation and its successful implementation (Campbell, 1994, 310).

That Information Systems (IS) fail outright or achieve only marginal gains in productivity more often than not (Danziger and Kraemer, 1986, 2; Campbell, 1994, 310; Campbell and Masser, 1995, 3) with no correlation to technical difficulties forces a re-conceptualisation of what an IS really is. Campbell (1991) summarises Hirschheim’s conception of ISs as: “...not technical systems which have behavioural and social consequences, but are social systems which rely to an increasing extent on information technology for their function” (Campbell, 1991, 262). In recognising that ISs are social systems requiring the management of both human and technical components, evaluating GIS success or failure becomes much more complex.

Methodologies: The Study of GIS Success and Failure

Interest in understanding the critical factors which influence GIS success and failure is understandable given the resources devoted to GIS implementation in both private and public organisations. Meeting the technical requirements of a specific project is only one component of understanding whether or not an implementation was successful. Researchers acknowledge that full adoption only evolves after the initial implementation, but cannot, however, agree upon a definition of implementation success, let alone the appropriate way to measure it.

In much the same way as there are no two identical GIS installations, nor are there completely identical implementation processes. As implementation progresses and evolves it becomes increasingly difficult to even choose an appropriate point or stage at which to measure potential success and failure (Obermeyer and Pinto, 1994, 24). Additionally, variations amongst organisational goals require a different set of success requirements for each organisation on a case by case basis. For this reason, many of the assessments of GIS success and failure “consist(s) of single case studies reporting on success or failure of their particular implementation effort” (Obermeyer and Pinto, 1994, 19). The assumption is that generalisations arising from some installations can aid others in similar situations. While this is not necessarily an erroneous approach, establishing common criteria upon which system success or failure can be measured has not yet occurred and is still an ambition within the research community.

The debate concerning evaluating GIS projects focuses on either actual usage or user satisfaction as an index for system success but fits into a larger debate as to whether or not qualitative or quantitative methods of evaluation should be utilised.

While researchers have argued that the research emphasis in the field has been either too qualitatively based (Weller, 1988) or too quantitatively based (Obermeyer and Pinto, 1994, Campbell, 1994), there are many potential quantitative and qualitative research methods to be pursued in order to assess a system's usefulness, particularly when used in combinations appropriate to the setting (Obermeyer and Pinto, 1994, 20).

Obermeyer and Pinto (1994) summarise work in the field of Management Information Systems (M.I.S.) and outline the following methods of evaluation which can be used individually or in combination: mathematical modelling, controlled experiments, quasi experiments, surveys, longitudinal studies, field studies, archival and secondary research, futures research and forecasting, content analysis, case studies, focus groups, and interpretive and critical approaches (Obermeyer and Pinto, 1994, 20).

The techniques outlined above are designed to isolate factors thought to be critical to GIS success. Whether these factors are seen as primarily technical issues or social issues, no one single factor has correlated significantly with GIS success over time. Moreover, isolating factors at any one time and interpreting their relative importance in the implementation process is highly problematic. The question becomes whether or not one is able to isolate GIS provoked change in an organisation "from other organisational changes which have occurred" (Obermeyer and Pinto, 1994, 24). As will be argued, subsequently, the only generalisations which can be made are based on broader management issues.

User satisfaction vs. Utilisation as correlates of success

The inclusion of organisational factors into the evaluation of GIS success has prompted a shift away from purely technical analyses of system success and more towards a focus on the end user. It seems clear that a system that is being used is far more “successful” than a system which is not being used at all. And clearly, a system which responds to the needs of the user will be used more readily than others. As stated by Davies and Medyckyj-Scott (1994), “it seems intuitively likely that any technology which is not simple or comfortable to use will be used as little as possible by its intended users” (Davies and Medyckyj-Scott, 1994, 176). Usability, however, is not a completely accurate correlate of success.

Researchers initially attempted to measure use directly. While this seems natural, others have argued that it is not necessarily correlated with system success (Ives et al., 1983, Igbaria and Nachman, 1990, Obermeyer and Pinto, 1994). An individual may be forced to use a cumbersome, perhaps inaccurate and generally unresponsive system if that is the only option available to that individual, while others may use a system infrequently, yet derive a great deal of value from it. System usage “is not strongly related to the quality of decision making” (Igbaria and Nachman, 1990, 74). Additionally, levels of use are dependent upon the stage of implementation the system has achieved, as well as the number of departments or users which are utilising the system. It becomes evident that there is a need to address the “full process of adoption: i.e. acquisition, initial implementation, and use of the innovation by the organisation” (Obermeyer and Pinto, 1994, 22). This includes an analysis of the post-acquisition implementation process

among the many departments in the organisational structure through which the technological diffusion is flowing (Obermeyer and Pinto, 1994, 22).

Due to the inability of a direct measurement of use to gauge system success, others have argued that *perceived* success is a more realistic correlate.

“... an information system which meets the needs of its user will reinforce satisfaction with that system. If the system does not provide the needed information, the user will become dissatisfied and look elsewhere. Although ideally one would like to evaluate the effectiveness of an information system based on its degree of use in decision making and the resultant productivity benefits this ‘decision analysis’ approach is generally not feasible.”

(Ives et al., 1983, 785)

The discussion to this point has not yet recognised the reason or reasons that organisations even consider the adoption of a GIS. We have simply assumed that the system will help personnel complete their job more efficiently, thus improving either service or productivity, to the benefit of the organisation as a whole. For net benefits to be achieved, however, they must outweigh the costs of the system. As reported, many systems have failed (Campbell, 1994, Obermeyer and Pinto, 1994), illustrating that, in those cases, “costs” have certainly far outstripped benefits. There are, however, many examples wherein benefits have been seen to, at a minimum, approach costs, or even exceed them. The factors which differentiate these systems from others will be reviewed after discussing the inherent difficulties in using strict benefit-cost models for system effectiveness evaluation.

Benefit-cost analysis

In principle, the benefit-cost analysis model provides a conceptually simple, yet effective way to determine the viability of any potential information system. Simply stated, the model can be expressed as the net benefit derived by a subtraction of all costs from all benefits assessed over the lifetime of the system in question. In private industry, a favourable net result yields profits, while in a public organisation, the goals are captured somewhat differently. The “public sector operates under economic constraints different from those in the private sector because of the absence of traditional pricing mechanisms” (Obermeyer and Pinto, 1994, 86). While assessing costs is relatively much easier than measuring benefits, the principal difficulty in utilising the cost-benefit model in either the public or private spheres is assigning a dollar figure to aggregate effects produced over the useful life of the system.

The difficulties in assigning benefits within the public sphere in dollar amounts are plentiful. At the broadest level, a GIS in the public sphere can be seen as a ‘pure’ public good (a service which cannot specifically and intentionally be withheld from an individual, i.e. police protection). Assigning a dollar amount to a pure public good has proven to be difficult as it necessarily redistributes the wealth of a community in some way (Obermeyer and Pinto, 1994, 88). For example, each citizen does not re-coup his or her individual value from the system based on their individual level of taxation.

In terms of service(s) provided, it is difficult to assess whether or not ‘better’ decisions are being made as a result of the IS (Ives et al., 1983, 785, Igbaria and Nachman, 1990). Not only is it difficult to isolate the variables which influence the

decision making process, but the potential outcomes of the alternatives which were discarded can never truly be assessed.

At the organisational level, most benefits attributed to GIS implementation exist in the form of time savings on the part of staff. While savings in waged labour through the use of a GIS are potentially great, determining the exact amount of time saved per task or tasks and extrapolated out through many years, while subtracting the amount spent on training and changeover, is extremely difficult. It is made more difficult by the fact that the GIS itself is not constant over time, but evolving in terms of power and capabilities.

Entering into each of these areas is the issue of intangibles. While caution is recommended when utilising the cost-benefit model (Ives et al., 1983, 786, Obermeyer and Pinto, 1994, 86), others have argued that a full cost-benefit analysis *can* accurately rationalise GIS initiatives (Smith and Tomlinson, 1992).

“... we attempt to provide approaches to some of the problems that have been characterised as too complex for the basic benefit-cost model. Contrary to this suggestion, we argue that straightforward benefit-cost analysis remains the best framework for analysing the contributions of a GIS and that the supplements that they recommend are generally not necessary.”

(Smith and Tomlinson, 1992, 248)

Smith and Tomlinson (1992) argue that “intangibles are not as much a separate category as they are a benefit category that is more difficult to quantify” (Smith and Tomlinson, 1992, 249). The next section explores the managerial and bureaucratic complications which evolve through the GIS adoption and implementation processes. Given the difficulties encountered by other researchers in understanding these processes themselves, accurately assigning dollar amounts to all benefits which emerge at each stage seems highly problematic

Implementation Strategies / Studies

Until recently, the term implementation was synonymous with installation. Once the computer system (hardware and software together) was installed on any user's desk, implementation was said to have taken place. Since then, the definition of a GIS implementation seems to have expanded considerably. One could argue, in fact, that implementation begins once an individual or group within an organisation begins debating the usefulness of possible GIS adoption, and implementation does definitively not conclude unless the system is abandoned at any point, even after its installation. Before the decision to adopt actually occurs, many decisions have been made and lines drawn which could ultimately affect system success or failure.

Increasingly, researchers are recognising that innovation diffusion strategies and those management techniques which have emerged through the study of management theory are critical to adoption success (Budic and Godschalk, 1994, 285). While few empirical studies have been carried out (Obermeyer and Pinto, 1994, 13), it is recognised that the purchase of the technology is often only the beginning of a long process of diffusion (Budic and Godschalk, 1994, 286).

The Decision to Adopt

Incentives to adopt new technologies may originate from anywhere within an organisation and may diffuse in different ways. Budic and Godschalk (1994) classify organisational hierarchies into three categories: organisations, organisational units and organisational sub-units. These are the 'target' groups for potential GIS utilisation (Budic and Godschalk, 1994, 187). The paths upon which diffusion can travel are fourfold:

Table 2.1 PATHS OF DIFFUSION

1.	top-down	from the organisation as a whole toward its units/subunits
2.	bottom - up	from an organisational subunit toward other organisational units or organisation as a whole
3.	bi-directional	from one "middle-level" unit/agency toward its subunits and toward the organisation as a whole
4.	lateral	from an organisational unit/subunit toward other units/subunits

(Budic and Godschalk, 1994, 288)

Moreover, implementation can either be 'selective' involving particular units or subunits exclusively or 'holistic' incorporating the entire organisation. Training on the system can either be 'formal' or 'informal' (Budic and Godschalk, 1994, 288). While Budic and Godschalk (1994) identify and classify several of the different organisational characteristics which influence GIS implementation prior to installation, the direct impacts any of these characteristics have not yet been fully described. Developing operable definitions, however, common to implementation studies helps researchers discuss differences between case studies on common ground.

Implementation

The emphasis in the literature upon case study review only lends strength to the argument that each implementation process is different and must be viewed within its own parameters (Campbell, 1994, 260). "Diffusion of GIS technology in local government organizations is a complex, selective and situation-bounded process" (Budic and Godschalk, 1994, 295). While case study review can be beneficial, there are difficulties with it as well. Often those involved in providing the data are very close to the system in question and may only fully understand the nature of their own proprietary system (Obermeyer and Pinto, 1994, 21). Moreover, if the individual is a stakeholder in the system's success, biases may influence the findings.

Within case study reviews, Obermeyer and Pinto (1994) point out, the literature does not usually differentiate between types of implementation or the use of multiple implementation strategies (Obermeyer and Pinto, 1994, 15). Budic and Godschalk (1994) do, however, provide a summary of implementation strategies which are based on Eason (1988).

Table 2.2 IMPLEMENTATION STRATEGIES

Strategy	Description of basic characteristics and principles
Big Bang	Instant changeover with simultaneous technological and organizational change; involves great risk; requires substantial planning, preparation for change and extra funding; centrally managed; creates stressful conditions; suitable for applications that need 'critical mass' of users
Parallel Running	Slower process with technological change preceding organizational adjustments; requires careful planning, extra time and funding; problems with lagging organizational change; suitable for avoiding implementation risks
Phased Introduction	Slower process with gradual introduction of both functionality and users; technical issues do not dominate; sequence of system delivery is critical; does not require extensive resources; risk is very low; suitable for independent set of users
Trials and Dissemination	Small-scale implementation intended for testing technical systems and for identifying possible problems and needs; does not require a lot of planning and extra resources; risk is low; lessons/experiences are hard to disseminate; solutions are unique for each group; suitable for environments with many problems
Incremental Evolution	Slow, time-consuming process; often lacks planning, but requires an overarching policy infrastructure and strong user support; advantageous for local user-led design for professional and managerial groups; ad hoc approach can lead to dead end and difficult transfer of information

(Budic and Godschalk, 1994, 290)

Although there are five separate implementation strategies listed in table 2.2, no one provides an all-encompassing approach to GIS implementation, in that processes will diffuse at different rates among different users. In fact, Onsrud and Pinto (1993) emphasise that many GIS implementation processes *require* a "combination of both centralized and decentralized processes for the effective diffusion through most classes of

potential users” (Onsrud and Pinto, 1993, 18). There is still a considerable amount of room within each implementation strategy for organisational and bureaucratic differences to influence, either positively or negatively, the implementation process.

“GISs are multipurpose tools offering advantages to different classes of users which diffuse them at different rates. Within each class, considerable adaptation or ‘reinvention’ appears to occur before the operational characteristics and information product capabilities are perceived to be beneficial across the class”.

(Onsrud and Pinto, 1993, 18)

If this is the case, and each class of users must undertake a certain amount of re-invention before benefits can be achieved, determining the length of time and possible outcome of any implementation process appears to be an extremely complex task.

The degree to which adaptation or re-invention must be carried out is, in itself, related to a number of issues. As already discussed, previously enshrined tasks or procedures will influence acceptance, as well as the organisation’s overall ability to adapt to change. Danziger and Kraemer (1986) define (within the field of IS) another important aspect which underlies organisational acceptance of information systems. The concept of ‘sociotechnical interface’ is described in reference to the overall proficiency of staff with computing and their skills in general in adapting to new technology (Danziger and Kraemer, 1986, 10, Budic and Godschalk, 1994). The use of the system will depend not only on the user’s *ability*, but also upon the *functions* which must be carried out by the user. Whether use is direct, indirect or passive, adds another variable into the equation of both user acceptance and use (Danziger and Kraemer, 1986, 9). Familiarity with similar types of systems would obviously facilitate the potential adoption of an IS.

It has been established that the most successful GIS implementations are accepted at every user level within an organisation (Obermeyer and Pinto, 1994, Budic and Godschalk, 1994). As the level of skill and comfort with the sociotechnical interface will vary considerably throughout the various user levels within an organisation, it seems apparent that reinvention will have to occur in different ways and at different speeds throughout an organisation, thus necessitating a complex combination of implementation strategies.

In summary, this section has outlined the various factors which differentiate levels of success of system adoption both within organisations and between organisations. The almost chaotic way in which systems are implemented complicates the task researchers face when attempting to delineate those factors which characterise successful systems versus failed systems. This has not, however, kept researchers from attempting to make generalisations and isolate trends. The following section will discuss these themes in more detail in relation to Management, M.I.S. and bureaucracy.

User Groups: Management and Bureaucracy

Although implementation will vary within organisations within every department, and between individual users, it is possible to break down user groups into two fairly distinct categories. On one side are employees who require GIS and IS in general to complete their tasks on a routine basis. Administrative officers or clerical staff require systems to provide them with needed information to carry out projects or administrative duties. Managers, however, have separate functions, and can be analysed separately from the bureaucratic employees within an organisation.

Management

The discussion so far has focused upon the role of management in the implementation process. It has been argued that management issues are ultimately of more importance than technical issues in achieving a successful implementation. There is, however, a significant difference between GIS management activities and the role of GIS as a management tool. Managers, as a user group, not only control organisational use of an information system, but also utilise information so generated to carry out many other control functions. Their use of GIS, particularly when intertwined with Management Information Systems (MIS), is the focus of the following section.

Managerial Decision Making

The traditional decision making process is often undertaken in an unstructured manner but necessarily involves the steps outlined in figure 2.1. At each of these stages, information is required in some form, yet the idiosyncratic ways in which different managers search out information complicates the articulation of this inexact science.

Figure 2.1

(Obermeyer and Pinto, 1994, 43)

It is possible to identify the information needs for different levels of management. First level managers require diagnostic information to “enable correction of deviations from specific schedules and budgets” (Obermeyer and Pinto, 1994, 41). Requests are often specific and are normally generated internally. At the level of middle management, requests for information are still mostly internal, yet include a mixture of both general and specific requirements (Obermeyer and Pinto, 1994, 41). For top level management, information is required from many external sources, pertaining to wider, more general, fields of knowledge (Obermeyer and Pinto, 1994, 41). Fulfilling these requirements within an IS, or even a system of ISs, would likely be a challenge to any experienced system designer.

Management Information Systems (MIS) are designed, created and maintained to supply the informational requirements of managers at every stage in the decision making process, including the feed back loops (see figure 2.1 above). The strengths of an IS are obviously its ability to handle, track and store vast amounts of information, and allow the user to recall and query specific data sets. These processes are most easily recognised within the systems’ ability to aid in steps 1. Problem recognition, 3. Alternative evaluation, and 5. Feedback (in figure 2.1).

An IS’s ability to identify problems is perhaps its greatest power due to it’s ability to search vast amounts of data and find anomalous situations. “ ‘Problem finding’ is the key activity to which professionals apply computing” through “extremely simple, non-analytical models, mainly involving data comparisons” (Danziger and Kraemer, 1986, 6). Although an IS may be quite adept at comparing alternatives, and aiding in evaluation and selection (step 3), this requires that the correct set of solutions are chosen (step 2) and the

evaluation criteria within the models be very accurate. Finally, an IS can be highly proficient at tracking and feedback, as it can keep track of a great number of previous situations, evaluate which are similar to the present situation, and help provide future solutions, assuming, once again, that the evaluation criteria are sufficiently accurate.

Geographic information only comprises one component within the overall structure of an MIS. Along with market and consumer data, human resources information, inventory and order entry information, and along with financial and operations management databases, an integrated MIS offers a wide set of resources to management at all levels. More importantly, these separate systems can achieve more complex and complete data analysis when used in combination, particularly GIS. GIS technology is becoming sophisticated enough, that when used in combination with a strong database management system, many tasks which incorporate sophisticated GIS analysis are utilised seamlessly, or in some cases, transparently, within other applications. As will be discussed, however, the implementation of GIS technologies to meet organisational goals is complex within a simple system, let alone, more complex ones.

Bureaucracy

While managers and the management of GIS technologies can be studied as separate entities, managers are also part of the bureaucracy of an organisation along with staff, technicians, clerks, etc. The bureaucratic factors discussed here, therefore, pertain to all members of an organisation, including managers, as their collective tasks and practices make up a bureaucracy.

The enthusiasm of those interested in the use of GIS and its potential power once integrated into working systems is tempered by two factors. On the one hand, bureaucracies and organisations tend to be resistant to change, and on the other, professionals are trained to look for non-geographical information for solution generation. Obermeyer and Pinto (1994) argue that due to:

“standard operating procedures ... public organisations favour the status quo, while public administrators screen out the unfamiliar (in this case, geographic) components of professional tasks and problems and rely on their traditional tools (words and numbers) thus overlooking spatial patterns as a possible basis for analysis and communication.”

Obermeyer and Pinto, 1994, 72

Bureaucratic stagnancy is an oft criticised by-product of organisations both large and small, particularly within the public sector. Obermeyer and Pinto (1994) remind us, however, that the bureaucratic structure is the driving force behind the gains in efficiency achieved within any organisation, but it is also an area whose costs are inflexibility and resistance to change.

Management Solutions

The important role that management and bureaucracy play within the implementation process is evident. Researchers have been unable to correlate technical achievements with system success (Campbell, 1994, 310), and have subsequently focused upon management issues. The conclusions which are outlined are, for the most part, simple solutions to what appear to be common problems. The focus on these issues, however, indicates that relatively minor impediments have limited the potential success of

highly complex and very expensive IS and GIS implementations. For example, Campbell (1994) outlines four factors which seem to increase the likelihood of system success:

Table 2.3 Factors associated with system success

- simple applications producing information which is fundamental to the work of potential users
- user directed implementation involving the participation of all the stakeholders in the project
- an awareness of the limitations of the organization with respect to the range of available resources
- a high degree of stability with respect to the general organizational environments, or alternatively an ability to cope with change.

Campbell, 1994, 309

while Obermeyer and Pinto (1994) outline the following differences between systems which have failed and those which have succeeded.

Table 2.4 Elements of GIS Project success and Failure

Activity	Success	Failure
Planning	Rigorous	'Run and Gun' style
Requirements	Focused	Diffused
Appraisal of effort	Realistic	Unrealistic
Staffing	Dedicated, motivated	High turnover
Funding	Adequate	Inadequate, conjectural
Time estimates	Thoughtful	Rushed or prolonged
Expectations	Balanced	Exaggerated

Obermeyer and Pinto, 1994, 20

It should surprise no one that the system outlined on the right side of table 2.4 is doomed to failure. That researchers are required to point this out perhaps says a great deal about the expectations of organisations in each of the activities outlined above. The implementation of a GIS requires a great deal of effort and resources, along with the

rational expectations one would expect when introducing a relatively unfamiliar new component into an existing operating environment.

Conclusion

This chapter has focused on the implementation and use of GIS within public and private organisations, while the following chapter discusses the philosophical underpinning of GIS design. Unfortunately, one is capable of discussing these two issues in isolation, for they should be much more inter-related within the literature than at present. While not explored entirely within her work, Campbell (1994) touches on an important connection between the two bodies of literature which will be explored more fully within this work. The first recommendation offered by Campbell (1994) in Table 2.3 reads “simple applications producing information which is fundamental to the work of potential users” (Campbell, 1994, 309). The literature at all levels ignores the fact that technology must be used to carry out ‘fundamental work’. Given that GIS technology at present is incapable of consistently carrying out simple applications which meet user’s needs, should we expect more from more complicated tasks, i.e. integrated MIS technology. To explore the reasons why GIS technology is incapable of meeting the most basic of organisational requirements, many have argued that GISs are not, and have never been, designed for organisational needs from a theoretical or philosophical perspective. The next chapter focuses on these, and other issues, related to GIS in general.

CHAPTER 3: CONCEPTUAL FRAMEWORK

Post-Positivist Critiques of GIS

The development of Geographic Information Systems, spatial information (representation) and data models has undergone increasing scrutiny as these fields expand within the discipline of geography. Primarily issues of data collection and representation, as well as those of control and value have dominated the literature, and will be the focus of this chapter.

The traditional cartographic communication model (see fig. 1) has been a dominant construct within and beyond the field of GIS and lies at the heart of many post-positivist critiques of Geographic Information Systems. It is argued that the model's familiarity and its compatibility with the positivist framework (Gould, 1994, 1107; Curry 1994; Chrisman, 1987) has skewed the development and application of GIS throughout their existence.

"The model is based on a map reader/GIS user who is a passive receptor, not directly involved in the map-making process and, thus, having no explicit control over the information provided" (Gould, 1994, 1107).

Figure 3.1 The Cartographic Communication Model

(reproduced from Chrisman, 1987, 35)

Within this criticism of GIS development, designers have adopted the positivistic assumptions of cartography (as in Martin, 1991 according to Pickles, 1995, 15) which are undermined in and of themselves (Goodchild, 1995). Digitally captured spatial

information, however, offers many more possibilities in terms of representation and interactivity than hard-copies ever could (Chrisman, 1987).

Rapid and constant improvements in computer technology, specifically a remarkable improvement in the power/price ratio, have extended the range of analytical and computational techniques available to everyday users. With few modifications to the basic principles of Boolean logic, spatial analysis techniques became much simpler using GIS technologies. “Undoubtedly, GIS, especially when integrated with spatial analysis and modelling techniques, adds immensely to urban geographers’ analytical capabilities in urban empirical research” (Sui, 1994, 263). It is argued that the focus on quantitatively based spatial analysis has emerged so pervasively because it is based on the scientific community’s attempt to reaffirm and revitalise the scientific research paradigm within the social sciences (Lake, 1993, 404; Sui, 1994, 263–4).

Curry (1994) offers an explanation for the assumptions upon which GIS is rooted in the positivist/scientific tradition. “The ideal of science expressed in equations and models, is after all the creation of a language that is a completely formalized set of terms and relationships” which is “... easily applicable to information systems and Geographic Information Systems. This is because such systems are so readily imagined as databases, consisting of items and attributes, where location may be either an attribute of an item, or an item of which attributes are predicated” (Curry, 1994, 443). The focus, however, on these traditional methods of spatial analysis has hi-jacked the technology, and, as this chapter will suggest, has hindered the exploration of other areas in which knowledge could be created. In particular, the concepts of error representation and GIS and ethics are critical in the effectiveness of any system and are highly dependent upon user

knowledge. However, the manner in which a GIS or database is designed can facilitate or magnify this problem.

Data Models as GIS Ontology

The manner in which data are represented within a database, or its structure, is dictated by the data model which is utilised in its development. The data model will often dictate which types of information will be collected, in what manner, and ultimately, how that information will be externally represented to the user. The creation of the data model will depend somewhat on technological limitations, but is often dictated primarily by the ontological assumptions of the designer during database development. The data modelling process, as described by Goodchild (1991), is to study “how the infinite complexity of the geographical world can be represented within a discrete finite machine” (Goodchild, 1991, 195). The unquestioning acceptance of Cartesian representations of discrete boundaries and modifiable areal units, for example, is of primary importance to the post-positivist geographer (Sui, 1994, 264).

The concept that positivist ontological assumptions have driven the development of GIS alarms some academics and researchers due to the discipline’s unwillingness to recognise that this is potentially problematic.

“Some authors even argue that the real danger of such an ontological assumption is that the wide proliferation of GIS espouses an attitude change that increasingly seems to be dominated by the structure of the technology, rather than by the structure of the problems facing modern society”.

(Sui, 1994, 265)

Goodchild (1995) directly compares the assumptions of GIS to those of cartography. "... it is GIS's supreme conceit that one can structure a useful representation of geographical knowledge in the absurdly primitive domain of the digital computer, just as it is cartography's conceit that one can accomplish the same objective with pen and paper" (Goodchild 1995). The unproblematic acceptance of the positivist data model may lead to difficulties in the way in which results can be utilised. Foremost is the ability to address causation. The terms 'varies with' and 'causally determined' are often used interchangeably (Taylor and Johnson, 1995, 60). For example, ranking locations using a multi-criteria analysis might imply that one location should attempt to be 'more like' another if it is to rank higher in the future. The factors primarily responsible for its poor or strong placement may not be recognisable (Taylor and Johnson, 1995, 60). As will be discussed, difficulties with results are compounded even further when results are utilised to address responsibilities outside the domain within which they were intended to respond.

The criticisms levelled at GIS and GIS development are many, and often harsh: "To most GIS critics, positivists' insistence on the nomothetic laws about reality is, at best, naive, and, at worst, an arrogant fantasy" (Sui, 1994, 265). Underlying many of the post-positivist's critiques there appear to be arguments which broadly discuss the potential which the technology offers to researchers and practitioners alike (Curry, 1995). Taylor and Johnson (1995) state that: "Many (most) geographers want to understand the worlds in which they live in order that they can help people to create better worlds", but add: "that goal involves much more than identifying empirical regularities in spatial forms and movement patterns" (Taylor and Johnson, 1995, 57). That which makes the positivists'

interpretation unpalatable (the unproblematic representation of reality in digital form) leaves room (the 'other' if you will) for the ability to construct or reconstruct new realities within the bounds of the technology.

“... GIS is part of a contemporary network of knowledge, ideology, and practice that defines, inscribes, and represents environmental and social patterns within a broader economy of signification that calls forth new ways of thinking, acting and writing.”

(Pickles, 1995, 4)

It is the failure, however, to even broadly acknowledge these concerns, let alone begin explorations into new areas, that seems to drive the criticism as a whole.

The ability of automated spatial analysis to respond successfully to the tasks for which it was specifically assigned is not under question here. The focus amongst those critical of GIS has been that it has failed to address other areas of study specifically within the realm of geography whilst simultaneously claiming that GIS can somehow unite and revitalise the discipline as a whole. Moreover, the few attempts amongst the GIS community to address concerns outside those normally associated with GIS have been completed within an inappropriate research paradigm. Sui (1994) classifies these deficiencies as 'epistemological inflexibility'. Very few true 'alternatives' to the positivist tradition have been proposed within the realm of GIS (although summaries of attempts are offered by Curry, 1994, 448 and Mark and Gould, 1991, 1429-31). The idea of hermeneutics, however, has been postulated in order to develop applications and data models for many different types of prospective users. Philosophically, hermeneutics is based within Habermas' tri-partite classification of knowledge (which includes positivist knowledge) (Taylor and Johnston, 1995, 55) and has also been significant within the

broader development of computer applications (Winograd and Flores 1986, Waters, 1993).

Much of the focus of hermeneutics is upon user-centered design or 'soft system design' models, and thus relates directly to the ideas presented in the second chapter dealing with user needs and systems success and failure. Philosophically, the idea of hermeneutics can be viewed as a response to the positivist assumptions previously outlined, and will therefore be reviewed prior to a discussion based on the operational uses and deficiencies of GIS in practice from a broader standpoint.

Hermeneutics

Hermeneutics is broadly defined by the concept that literature, theories, maps, etc. are all texts which individuals interpret based on their experiences and history (Gould, 1985, 325). Individuals give meaning to these texts through interpretation, but that interpretation can be different from another person's, or it can change if an individual's experiences change. The introduction of philosophical debates into the realm of computer development in general is a relatively recent phenomenon. Winograd and Flores (1986) were almost apologetic when introducing the issue as recently as ten years ago.

"Readers with a background in science and technology may find it implausible that philosophical considerations have practical relevance for their work. Philosophy may be an amusing diversion, but it seems that the theories relevant to technological development are those of the hard sciences and engineering. We have found quite the opposite. Theories about the nature of biological existence, about language, and about the nature of human action have a profound influence on the shape of what we build and how we use it."

(Winograd and Flores, 1986, xii)

Winograd and Flores (1986) proceed to introduce the concepts of hermeneutics as outlined primarily by Gadamer (1976) and Heidegger (1962), as far as the authors feel they relate to computer technology in general. Winograd and Flores' (1986) work appears to be consistent with the Human Computer Interface (HCI) research of the late 1980s which Waters (1993) argues developed quickly within computer technologies in general, with the notable exception of GIS (Waters, 1993, 63).

Development of alternative data models and a greater awareness of user's needs has been a much more recent phenomenon within the realm of GIS. Greater use in general, and a disproportionate number of early failures has likely stimulated this activity. While most literature in this area tends to focus upon usability in terms of organisational acceptance and software\hardware ergonomics (Medjyck-Scott, 1993, Davies and Medjyck-Scott, 1994, Campbell 1994, Campbell and Masser, 1991), some light has been focused upon the philosophical underpinnings of GIS design in general.

The acceptance of the (inter)contextuality of all things, and the recognition of the existence of some socially constructed phenomena are critical to an understanding of an alternative to the positivist paradigm of GIS development. Not only is understanding based on interpretations by separate individuals at any one particular time, but such an understanding might evolve or develop differently based on the individual's experiences.

"Gadamer's approach accepts the inevitability of the hermeneutic circle. The meaning of an individual text is contextual, depending on the moment of interpretation and the horizon brought to it by the interpreter. But that horizon is itself the product of a history of interactions in language, interactions which themselves represent texts that had to be understood in the light of pre-understanding. What we understand is based on what we already know, and what we already know comes from being able to understand."

(Winograd and Flores, 1986, 30)

Within hermeneutics, arguing that each text, its meanings and interpretations, are contextual does not necessarily imply, however, that there doesn't exist a 'shared world' (Gould, 1994, 1112). That humans share experiences, both in the way they think and in their actions, is critical to the existence of hermeneutics. "The shared world concept is what makes possible the conceptual level of GIS database design, which cannot, by definition, allow the coexistence of n relativistic external models for n users" (Gould, 1994, 1112). In recognising the potential differences between 'shared worlds', a researcher, for example, would be practising hermeneutics.

Instead of dealing with the philosopher's interminable task of refuting psychological idealism as expected, Heidegger challenges the concept itself.

"Heidegger rejects both the simple objective stance (the objective physical world is the primary reality) and the simple subjective stance (my thoughts and feelings are the primary reality), arguing instead that it is impossible for one to exist without the other. The interpreted and the interpreter do not exist independently: existence is interpretation, and interpretation is existence."

(Winograd and Flores, 1986, 31)

Within this interpretation, the degree to which our conceptions are based on the objective world or the subjective world lie, it seems, along a dynamic continuum of sorts, along which understanding is positioned somewhere in-between.

Differences in the meanings attached to language and interpretation practised by each individual while utilising the same words or phrases, in many cases eliminates the contextuality of the ideas which are to be communicated. Hermeneutics "is based on everyday practice, not everyday concepts; on what people actually do and not what they say they do or are hypothesized to do" (Gould, 1994, 1112). This idea plays itself out in

what Heidegger refers to as 'thrownness' (Winograd and Flores, 1986, Gould, 1994). The inability of an individual to view his/her own situation as if he/she were simply an observer, while being unable to predict actions or their effects is inescapable (Gould, 1994, 1113, table 3.1).

Table 3.1 - Observations of thrownness

- You cannot avoid acting
- You cannot step back and reflect on your actions
- The effects of actions cannot be predicted
- You do not have stable representation of the situation
- Every representation is an interpretation
- Language is action

Winograd and Flores, 1986, 34-35

The concept of thrownness illustrates an alternative to the rationalistic model which underlies the methods of structured system design. "In the practical world, however, we find that the rationalistic model does not conform to what we observe in the daily workplace" (Gould, 1994, 1113). While hermeneutics emerged from the humanist reaction to scientific method, it now seems somewhat akin to the deconstructionist methodologies popularised through post-modern research. The bias towards the positivist framework within the development of GIS has had a direct impact, however, in the way in which the technology is applied and practised in everyday life. As previously alluded to, difficulties specifically within organisational applications of GIS have led to a certain degree of criticism from within the discipline. The following section will deal with some of the more general criticisms of GIS in practice.

Data and Data Collection

Curry (1995) likens the research practices of GIS in general to those of research in general. Specifically, the role of the researcher is to amass data, analyze it, and produce results, while maintaining a moral responsibility to undertake 'good work' throughout the research process (Curry, 1995, 70-1). It is the lack of emphasis, however, upon the theoretical framework guiding the collection of data, which Curry (1995) and others (Sheppard, 1993, Pickles, 1993) feel jeopardizes the research process before it has, in effect, even begun.

Given the criticisms levelled against GIS research outlined above, it follows that they would be repeated when brought into the realm of application. "Most philosophers of science accept that theory informs data collection through its influence on how the above questions are answered in any data collection exercise" (Sheppard, 1993, 458). The implications, therefore, of a singular and relatively static theoretical base (positivist science), are potentially great. This is compounded by the complexity of the technology which encourages specialisation in specific areas (Curry, 1995, 75), thus limiting the ability of the researcher to maintain an overview of the entire research.

It has been recognised that subtle differentiations in data collection methods can dramatically affect research results (Sheppard, 1993, 458). Sheppard (1993) describes a scenario whereby changes in the U.S. census bureau's classification of occupational categories made Weberian theories of class easier to evaluate empirically, while Marxian theories became more difficult to evaluate (Sheppard, 1993, 458). "The emphasis on what to do with the data neglects the fundamental questions of which data are to be collected in

the first place, and what basic categories should be used in making the original observations” (Sheppard, 1993, 458).

Unfortunately, very few researchers in the field of GIS are at liberty to collect primary information for individual research programs. The cost of data collection is far too great, forcing most researchers to rely heavily, if not exclusively, on secondary data. It follows, then, that whoever is responsible for the collection of data will have a great deal of influence, ultimately, upon the results of the research which can be and is undertaken. It can be argued that in many circumstances the collection of data falls under the purview of the state. The “state represents a concentration of formal power that both facilitates and relies upon the collection of information” (Taylor and Johnston, 1995, 58). The influence of the ‘state’s geography’ is, of course, incredibly difficult to quantify. While some critics have ventured into increasingly more speculative and paranoid territory (the surveillant ability of the state and military and corporate control, Pickles, 1995, Curry, 1995), few would likely argue that it has no influence at all. “The data manipulated in GIS are secondary data collected by public or private agencies. The agendas of such agencies affect how data are collected” (Sheppard, 1993, 458). The ethical use of GIS within applications will be addressed in more detail later, we now turn to a brief discussion of error and its representation.

Error and Error Representation

The construction of a model of reality as it exists in a GIS must necessarily contain error. A model of reality (other than an exact replica) has not yet been able to capture all components of any spatial area. When one considers that each individual’s perception of

reality may differ from every other's, as already discussed, the problem is compounded. For this reason, error is an inherent component of any GIS and must be dealt with. In most circumstances it pertains to the amount of data lost during the process of data capture, but error can be generated through computation and analysis as well. As will be discussed, these are only two of the issues regarding error which emerge during the operational use of GIS and desktop mapping technologies.

While many of the aspects concerning the communication of error to the user (or operator) are HCI factors, the inclusion of error modelling capabilities into GIS design is critical. Most commercial GIS products offer little in the way of metadata which delineate the type, extent, and quality of data required to obtain statistically significant results given the use of various GIS operators which produce derived geographical data (Openshaw et al., 1991, 78).

“The typical end-user of GIS output will probably care or know little about the cartographic and uncertainty characteristics of the map data being used, while the GIS itself has no procedures for handling the varying accuracy and reliability of the digital map data being processed. A GIS gives the user complete freedom to combine, overlay and analyse data from many different sources, regardless of scale, accuracy, resolution and quality of the original map documents and without regard for the accuracy characteristics of the data themselves”

(Openshaw et al., 1991, 78-9)

While measurement, representation and correction of errors can be undertaken on a system-by-system basis and rectified given the correct amount of knowledge, experience and resources (The Monte Carlo Simulation is a good example, Openshaw et al., 1991), most end users do not have the wherewithal to undertake such an exercise.

Complete data coverage of each and every attribute in a given study area is virtually an impossible task. Without such a complete data-set, inherent error will be

inevitable. The focus has, therefore, become one of data error handling, as opposed to data error elimination. While it is argued that more effort should be expended to collect the correct types of geographic data for the application in question (Tsui, 1993, 82), new methods of error identification and representation within GIS software packages have been encouraged (Hunter and Goodchild, 1993, 56). The ability to provide the user with uncertainty surfaces, or probability maps for each data layer within a GIS would benefit the user immensely should they utilise these additional components responsibly (Hunter and Goodchild, 1993, 56). Simply the attachment of metadata to data files (indicating where, when and how the data was collected) would greatly enhance the usability of the product. Many data models do not accommodate such addenda, let alone, incorporate them as an integral component in the functionality of the system.

The manner in which data is represented can not, however, be a standardised function. The user's needs, the operations they are performing, and the use towards which the information will be assigned, are all factors in the error representation schematic. Table 3.2 below is a reproduction of Beard's (1989) taxonomy of spatial information usage.

Table 3.2 Taxonomy of Spatial Information Usage

Siting	finding optimal locations
Logistics	movement or distribution through space
Routing	optimal movement through a known network
Navigation	way finding, may or may not involve a known network
Inventory	count and location of objects for a given time period
Monitoring/analysis	examination of processes over space and time

(Reproduced from Hunter and Goodchild, 1993, 57)

The method by which error should be represented, therefore, would be highly dependent upon the function being undertaken and the desired level of accuracy required for that

specific function. For example, if a municipality collected data on roads for routing garbage collection services, then road centerlines, traffic regulations (one ways, etc.) and distances would have to be as accurate as possible. If this information was collected properly the data set might be considered error-free by those who use this data. However, if this same data set was used by Public Works to determine the road re-surfacing program for the following year, it would have serious limitations. The data-set might not have information as to number of lanes, width of shoulders, whether they had sidewalks, curbs, storm sewers etc. and would subsequently be considered error-laden.

It should also be noted that while the manner in which errors should be represented may be readily apparent to the experienced user, it would present quite a challenge to an inexperienced user. Therefore, not only the incorporation of stronger error representation capabilities is required, but also the ability to allow the user to determine which type of error representation most suits their needs (an expert system, of sorts).

While the discussion pertaining to error and its representation deviated somewhat from the focus of this chapter, it illustrates some of the ways in which individuals conceive of error and their capacity to incorporate those conceptions into the data model provided by developers. Moreover, it further reinforces the previously mentioned notion that data collection is highly dependent on potential use, which in turn, affects each project towards which it is applied.

GIS and Ethics

Critiques of deficiencies in applications as outlined above, as well as the critique of GIS as a whole, are ultimately based on its use and effectiveness as a tool to be used by

individuals. Effectiveness, however, is contingent upon the tool's compatibility with the desired objectives the operator wishes to achieve. As GIS technology diffuses into organisations, its uses become much more varied. Critics question whether the seemingly narrow design parameters of GIS could possibly accommodate the conceptual requirements of all (potential) users. Literature pertaining to ethical considerations in GIS is non-existent. "Geography has no history regarding discussion of matters of ethics and when one turns specifically to GIS, one is faced not with a single source of authority, but with multiple possible sources" (Curry, 1995, 68). The fact that it is now being used in a variety of ways never before conceived of can only complicate this field. The GIS community will likely be forced to address the concerns of its diverse clientele as the utility of GIS is called into question, specifically within fields which it was not originally designed to address.

The literature directly related to GIS and ethics is limited and, for the most part, not terribly focused. As mentioned previously, the ethical considerations surrounding the surveillant nature of the discipline (Pickles, 1993, 453; Curry, 1995, 79-80) have perhaps received the most attention. Notwithstanding, these same authors have played an essential role in the identification of ethical issues in GIS (Lake, 1993, 405).

Curry's (1995;1995) discussion is premised on the 'inevitability of ethical inconsistency' within the discipline of GIS (Curry, 1995, 68). While many conflicts are delineated within Curry's (1994; 1995) work, issues surrounding the independence of GIS researchers in relation to both the technology and the organisational structure of GIS development are of interest.

In contrasting the moral theories of utilitarianism to those within the deontological tradition, Curry (1995) argues that scientific research (in this case, GIS) falls into the latter category (Curry, 1995, 74). Curry (1995) argues that the “deontological tradition” allows researchers to “deny autonomy” within the research process and subsequently make assumptions within positivist science. It is argued that both “science and academics rely on a notion that ‘good’ research can be carried out in a purely autonomous fashion” (Curry, 1995, 74). Curry’s (1995) argument follows:

“When one denies autonomy to oneself, where one claims that there is some other force in control of one’s life, one is said to be heteronomous. Nowhere is this heteronomy more clear than in GIS, where the notions of rationality, or representation, of universalism, of space and time, and especially of technological developments lead one to see the choices that one makes as *driven* in very particular ways”

(Curry, 1995, 75).

Curry (1995) argues that there are three ways in which this plays itself out. The first is that somehow the technological development, and specifically, its direction, is always optimal, and that each innovation adds immeasurably to the use of the technology (Curry, 1995, 76). Second, once technological development becomes the leader, the drive towards greater *accuracy* becomes an unquestioned ideal in and of itself (Curry, 1995, 76). The third conflict arises as the complexity of the technology increases, as do its applications. “As technology becomes more complex, it has been increasingly difficult... for anyone truly to understand the nature of any one system” (Curry, 1995, 76). This often leads to increases in the division of labour which inhibit an overall perspective on the functionality of the operations being undertaken.

Inevitably, a discussion addressing GIS and ethics, specifically within the context of non-academic research, will focus upon the impacts of organisations and their influence

on GIS development. The responsible use of both the software and the data is ultimately in the hands of the user. While it is the responsibility of the implementation process (i.e. management) to empower users with the ability to act responsibly, there are many design improvements which could facilitate this process. The ethical use of the technology, directly related to its functionality, is of critical importance to technological development in general.

Conclusion

The introduction of this body of work acknowledges the deficiencies within the present technology. For the most part, the criticisms levelled against the discipline would still exist if the technology was used primarily for its intended purpose. Challenges would face GIS development irrespective of its use, given the various (re-) conceptualisations of space proposed from within the discipline (Curry, 1994, 448). The scope of the problem, however, is far-reaching. GIS technology is becoming common within many disciplines and is performing many disparate functions.

Goodchild's (1995) work attempts to summarize the successes and failures of GIS as a whole and offers an analysis which encapsulates both the critiques of GIS and the concern for its use outside the academe, or even outside geography departments.

"It is perhaps remarkable given these limitations that GIS has attracted such interest, and has been adopted by so many agencies, governments, companies and scientific researchers, who are able to find beneficial uses for the current technology despite its comparative crudity."
(Goodchild, 1995, 41)

As was discussed in chapter 2, the organisational use of GIS technologies has often been hampered by difficulties encountered during the implementation process. It is argued that

management's lack of focus upon meeting organisational goals through the proper implementation of many simple tasks (as opposed to more complex tasks) is at the centre of these difficulties. The case study which follows addresses these issues in a more direct way.

The ideas brought out in chapter three are also discussed in relation to the case studies but are in many ways more difficult to discern. Specifically, comprehension of system limitations by end users is of critical importance to effective GIS use. Understanding ways in which error is incorporated into end products, and the subsequent ethical use of these products will ultimately affect the degree to which the system is trusted. Ultimately, if a system is not trusted, the likelihood of its use decreases and subsequently it fails to meet organisational goals. Part of the ability to discern the usefulness of products and the ease of use works back to the way in which a system is designed. For these reasons, the concepts of GIS design discussed in this chapter very much relate to the case study analysis which follows. The following chapter discusses how the case study organisations were selected, the work which was completed and how this thesis evaluates the implementation process.

CHAPTER 4 - METHODOLOGY

Introduction

The two sets of literature discussed in Chapters 2 and 3 can be discussed independently as they emerge from two groups of academics. The post-positivist critique of GIS as outlined in Chapter 3 emerges from within the discipline of geography while the study of the use of GIS through implementation studies is offered primarily by planners and information system specialists. Part of this thesis involves connecting these two bodies of ideas and discussing the ways in which they interact. The lack of material or source data, however, necessitates the application of theory to actual organisational use. It has been established that there are many non-technical components involved in GIS adoption, implementation and use. Field work for this thesis was designed to explore these areas.

There were not, nor are there at present, definitive methodologies through which the organisational use of GIS can be better understood. Of the methods outlined previously by Obermeyer and Pinto (1994, 20), many were simply not possible. Mathematical modelling, controlled or quasi experiments, archival and secondary research and content analysis methods were ruled out given the amount of literature and the subject matter. Within the scope of my project a longitudinal study would not have been possible, nor would a structured survey which would require many different versions to capture all of the relevant information. To approach the issues that are most relevant to GIS adoption and success (as outlined in Chapters 2 and 3), a combination of interpretive

techniques were used, including participant observation and unstructured interviews within case study research.

Studying Social and Technical Systems

In keeping with the format outlined above, this discussion concerning methodology draws from the two bodies of literature discussed. From within the discipline of Geography, interpretive geography encompasses a wide group of qualitative research methods (Eyles, 1988), while Kling (1987) lays the foundation for qualitative research methods within the field of Information Systems (ISs).

Attempts have been made to categorise and quantify social and psychological phenomena through the use of scientific methods. Eyles (1988) argues, however, that “order cannot simply be imposed on the world” (Eyles, 1988, 1) because an ‘order’ does not necessarily exist. The study of our world “requires methods which allow the acquisition of ‘insider knowledge’ through interaction, observation, participating in activities and informal interviews” (Eyles, 1988, 2).

To date, only one significant attempt has been made to gain the ‘insider knowledge’ in terms of organisational use of GIS. Campbell and Masser (1995) conducted a longitudinal study of British local governments based on telephone surveys with over 514 public organisations and 12 case studies over three years. The first round of surveys in 1991 were purely exploratory in order to gain a sense of what percentage of institutions used GIS technologies and in what capacity. As a result of this information, the second round of interviews and the case study analysis was constructed. There have been no other attempts to devise methodologies for this type of work.

Once again, work of this nature must rely on research generated by those in the field of Information Systems. The two forms of research outlined by Kling (1987) are discussed in his work with reference to computer systems in general. Discrete-entity approaches focus on the “formal-rational conceptions of the capabilities of information technologies” (Kling, 1987, 308). “Systems are assumed to be loosely aggregated collections of equipment, people, procedures and beliefs, which may easily be broken down into separate elements, and costed and evaluated independently” (Kling, 1987, 308). This form of analysis, according to Kling (1987, 309) is very popular academically and professionally.

Conversely, web-based models are designed to seek out information that may not so easily be broken down, costed and evaluated.

“Web models treat computerized systems as a form of social organization with important information processing, social, and institutional properties: they are not only flexible information processing tools. Their ‘shape’, the way they are used, the leverage they provide, and the interests they serve depend upon the interplay of stakeholders, resources, and social games within which they are deployed.”

(Kling, 1987, 309)

The capture of this data requires a more flexible research methodology that allows the researcher the room to explore both the subject matter and the research objectives throughout the research process. As a result, both Kling (1987) and Masser and Campbell (1995) recommend the use of “semi-structured or unstructured interviews, participant observation and longitudinal studies” (Masser and Campbell, 1995, 61).

Informal interviews took place within the scope of my research, but in most cases, were used within the projects I was working on, and did not address the thesis research material directly. The concepts of system design, simple tasks and management styles and

structure emerged continually throughout my involvement but often took place within the context of the work I was completing. In both operational environments within which I worked I was evaluating the effectiveness of the technology on behalf of the organisation in question (Ramsay Township and WOTR). These acts of participant observation allowed insight and access to individuals that could not have otherwise been achieved. The following section describes the benefits as well as the drawbacks and concerns involved in participant observation.

Participant Observation

Frustration concerning the inability to explore those aspects of GIS implementation and use alluded to in the literature, yet not fully investigated, was the impetus to begin direct involvement with external organisations. This process proceeded and largely pre-empted rationally disinterested plans as to what form my thesis would take, let alone, its topic. The process was highly iterative and it developed as much through hunches and on-the-fly analysis as it was directed by the literature. “Data analysis in qualitative field research is an ongoing process. Observers formulate hypotheses and note important themes throughout their studies. As the research progresses, some hypotheses are discarded, others are refined, and still others are reformulated” (Nachmais and Nachmais, 1992, 282). Not fully knowing the questions to be asked is an important component of both fieldwork and participant observation in the social sciences.

Participant observation is a qualitative research method used in the social sciences to allow a researcher to “attempt to understand behaviour and institutions by getting to know the persons involved and their values, rituals, symbols, beliefs, and emotions”

(Nachmais and Nachmais, 1992, 272). Developed primarily for ethnographic researchers in the 'field', most methodological accounts warn against the difficulties with 'going native', the problems with 'immersion', or the difficulties of 'leaving the field' (Wax, 1983, Van Manaan, 1983, Nachmais and Nachmais, 1992). While my work was not traditional field work as outlined by ethnographers and anthropologists, the issues raised are important. As an observer, however, I was much more 'invisible' as I could more easily 'participate'. I was able to offer something back to the organisations through my own experience and training and was subsequently better able to speak 'their' language.

The methodological literature points out the benefits of participation in explaining that one "may also gain different levels of insight by actually participating rather than only observing" (Nachmais and Nachmais, 1992, 276). Within the case studies themselves, the act of participating certainly allowed me to "attempt to adopt the perspectives of the people in the situation being observed" (Nachmais and Nachmais, 1992, 276).

It is clear that within such a methodological framework that bias, previous knowledge or education and happenstance will influence both the study itself and the results. The fact that both organisations initially approached Carleton University will itself have an effect. In illustrating the development of my involvement, these possible biases and other more intangible aspects of the study will be identified.

As a participant observer my position in society influences the study as I necessarily become an active participant in the entire process. The position of 'student' and my age during the time of this involvement (22-24) are likely the two most influential personal factors within this study, as well as the fact that I was not formally employed by either institution during the research phases of my work (as opposed to almost all of the

people I was dealing with at both organisations). While in some case this was a hindrance, in other cases it was beneficial.

As a student, my activities were mostly informal and paid employees were never required to contact me or devote their resources towards my work, although most voluntarily did. Conversely, once contact was established, and meetings were arranged, my position was quite unthreatening, and as an individual who had no stake in the institution (as I was not being paid), probably helped to elicit more candid responses from certain participants on certain topics. "... being an outsider can sometimes be less threatening, provide access to the field, and contribute to the perceptiveness that the researcher brings to the field" (Nachmais and Nachmais, 1992, 278). The issue of contact and resources devoted towards my work within both organisations will be explored more fully in the next chapter.

In a field based primarily within the positivist method of scientific enquiry, attempting to use social science research methods is a risky proposition. Becker and Geer (1983) examine the use of participatory observation and delineate the inherent difficulties with its use. Becker and Geer recognise the iterative process previously outlined by Nachmais and Nachmais (1992) in stating:

" Research aimed at discovering problems and hypotheses requires a data gathering technique that maximises the possibility of such discovery. Obviously, the more structured a technique, the less likely the researcher is to find facts whose existence he had not previously considered or to develop hypotheses he had not formulated when he began his study."
(Becker and Geer, 1983, 239)

Becker and Geer (1983) proceed to argue, however, that this process "need not be untheoretical" (Becker and Geer, 1983, 239). The inability to recognise the research

hypotheses that most appropriately explore the specific variables or key indicators in a field is not uncommon.

The impact that the iterative process has upon the data gathering process is twofold. On the one hand, the data are gathered at one particular moment in time. The stage in which the data are collected, and the hypotheses and research focus which are most current, will undoubtedly affect the substance of the data collected. "The fact that the observation follows no 'design' means that the data reflect the shifting emphases dictated by the new discoveries" (Becker and Geer, 1983, 240). On the other hand, qualitative methods can create vast quantities of data (consisting primarily of notes) all of which could not possibly be presented (Becker and Geer, 1983, 240, Van Manaan, 1983, 275), nor would they necessarily be helpful in this detail.

Becker and Geer (1983) lament the fact that all of the data collected through participant observation will necessarily lack the ability to convince all readers of the conclusions generated. The "reader of his research report has no way of knowing whether a solid basis of fact underlies this. The reader does not have the data available with which to convince himself and must rely on his faith in the researcher's honesty and intelligence" (Becker and Geer, 1983, 240).

The two organisations that subsequently became case studies within this thesis initially approached Carleton University and the department of Geography with research initiatives. They were interested in obtaining help with certain projects within their organisations, and were not interested in having a student simply "observe" the implementation processes or their use of GIS technologies. I took the opportunity with both organisations to become involved in the GIS adoption process to the greatest extent

possible. The initiatives I became involved with allowed access to social systems and technical systems which crossed many levels of municipal government.

The Ramsay Township initiative required an evaluation of the desktop mapping system, its status within the bureaucracy and its long term future within the Township. The size of the Township bureaucracy meant that I became involved in data acquisition, data maintenance, training and rudimentary application development. The long term planning of the system required significant contact with councillors, management, staff and local volunteers on the planning committee. The Regional Municipality of Ottawa-Carleton (RMOC) initiative allowed participation in a small focused application (Window on the Region), my own application development process (with the economic development site), and allowed a glimpse of the inner-workings of a large scale GIS implementation process.

All of the activities listed above were steps in the process of understanding the organisational use of GIS. While I was interested in the success of the projects with which I was involved, it was the *process* of involvement that remained the focus of my Master's thesis research. Access to this world could not have been carried out using traditional forms of analysis given the resources at my disposal. Furthermore, the literature did not provide any entry points, as research in this field is minimal.

The delineation of concepts and terms may, in the future, allow for a more structured analysis of these issues. The sociological and psychological components of technological adoption, however, will forever limit the quantification of complex interrelationships which exist. The exploration of these issues will hopefully allow researchers to more fully comprehend the nature of these relationships and establish more

structured criteria within which to gauge effectiveness and use in order to more fully exploit GIS technology to the benefit of the organisation, be it public or private. While exploitation within private organisations is directed at improving the bottom line, the acceptance of the technology, and its proper use, will likely lead its acceptance, and subsequently the 'revolution' of which Dobson spoke more than 13 years ago (Dobson, 1983).

Conclusion

This chapter provides the appropriate methodological background with which to understand the following thematic analysis. Despite the dramatic scale and complexity differences between the two organisations in question, as will be illustrated, many of the same problems and issues arise. My participation in these organisations was obviously unique, and the interpretations are similarly distinctive. The lack of traditional material dictated, however, that this type of inquiry was required in order to begin to evaluate a problem which has had, and will continue to have, a dramatic impact upon GIS use in many different types of organisations.

CHAPTER 5: ANALYSIS

Introduction

The concepts delineated and discussed through the background chapters of this thesis form the basis for analysis within the following chapter specifically referring to both Ramsay Township and the Regional Municipality of Ottawa-Carleton (RMOC). Six primary areas of interest have been identified which are neither all-encompassing nor mutually exclusive. They include:

- Implementation Impetus;
- Software and Database Design;
- Software/Training;
- Management/ Political;
- Organisational Goals; and
- Simple Tasks.

While all of these issues are relevant within both organisations, and within all GIS implementation processes, Ramsay Township can be more easily discussed as it is smaller and many of the inter-relationships were much easier to read and interpret than those at the RMOC. The scope of the implementation process at RMOC and the limitations of my research in terms of both resources and time certainly limit my ability to comment on the organisation as a whole.

The following chapters compare and contrast the use of GIS technologies by these two groups with reference to the six sub-topics outlined above. Specifically, this chapter will first discuss Ramsay Township and emphasise the use of the technology to accomplish simple tasks in order to meet organisational goals.

RAMSAY TOWNSHIP

Background

Initial contact with the Corporation of Ramsay Township came in October, 1994 through the Centre for the Study of Training, Investment and Economic Restructuring (CSTIER), a research institute within the Faculty of Social Science at Carleton University. CSTIER attempts to negotiate and establish links between members of the faculty and interested organisations and individuals within both the public and private sector.

Townships are administrative units within the province of Ontario charged with carrying out most municipal functions within all areas not designated as either a town or city. As such, townships can vary considerably in size and take on an urban context (Kingston Township, for example, has over 35 000 people) or be inordinately small and characteristically rural (less than 500 people). Ramsay Township has a population of approximately 4000 people and surrounds the incorporated town of Almonte (approx. population: 4000). Ramsay Township is located approximately 50 kilometres west of Ottawa, just beyond the Regional Municipality of Ottawa-Carleton's boundary. Legislated Township responsibilities include the arrangement of police and fire services, garbage collection, planning decisions, building inspections, township road construction and maintenance, and all municipal tax collections. The 16 townships in Lanark County (of which Ramsay Township is one) share health care, education and social services provision, and participate jointly in the planning process.

A series of meetings and correspondence between myself, CSTIER and representatives from Ramsay Township between November 1994 and January 1995 established that there were many potential projects involving the desktop mapping system

and its future within the corporation. It took a great deal of time to determine which area should be addressed and the how the work should be undertaken. Initial dealings with staff, councillors and volunteers indicated that each individual had a specific agenda, which, in most cases, characterised my relationship with that individual throughout my involvement. In the end, all obstacles were adequately overcome and an agreement was reached between all parties which dictated that I attempt to help better integrate the desktop mapping system into the overall working environment at Ramsay Township.

The process of establishing a working relationship with Ramsay Township was iterative and slowly evolved into a workable project through discussions with councillors and staff. These difficulties help to emphasise both the political and organisational obstacles which had to be overcome before any technical advancements could take place. As will be illustrated, these issues became much more pertinent to the study in the case of the RMOC.

Briefly, GIS at Ramsay Township consisted of a desktop mapping package (SpansMap) installed on a PC in the Township office. Kelly McGregor, the full time tax clerk was additionally responsible for the in-house GIS with support from Harold Moorer at Gregory Geoscience. While adopted initially to aid in planning decisions through analyses of location, soil type, and flood plain analysis, there was an overall desire to more fully utilise the system which had previously been installed for environmental purposes. Once the computer, software and raw data were installed in early 1994, very little was done to expand its use, the abilities of the users, or the direction long-term development of the GIS would entail.

By conducting a user needs analysis (see Appendix I, p. 5) during February and March 1995, three primary areas were isolated, clearly affecting the use of the GIS at Ramsay Township: Training and Development, Data Requirements, and Long-Range Policy. Appendix I is the report submitted as the completion of the project at Ramsay Township and the fulfilment of the requirements of one half credit of my Master's course work. Table 5.1 contains excerpts from the Executive Summary (of Appendix I) which highlight problems encountered with SpansMap at Ramsay Township and the proposed plan of action to begin addressing these issues.

Table 5.1 Ramsay Township Focus Areas

1) Training and Development

Given the level of expertise in GIS related technologies within the Township office and the nature of the difficulties encountered by staff, even a relatively small increase in the formal knowledge base of staff members would lead to significant gains in almost all areas of GIS productivity.

Background knowledge would help staff overcome numerous real and potential problems, decrease Down-Time, reduce the likelihood of costly errors, and help considerably in the long-range development of GIS activities within the Township.

2) Data Requirements

Database maintenance and upkeep are important requirements that, while being technical, are important to the integrity of the GIS over the long term, and therefore, must be addressed.

1. The relationship with Gregory Geoscience in creating and maintaining complex data layers should be preserved. The maintenance of base layers should occur, at minimum, every two-three years, effective immediately, under the direction of Gregory Geoscience.

2. Through appropriate training, it should be required that one or more staff members acquire basic database management techniques in order to add and change basic non-geographical data which would increase efficiency and reduce cost.

3. The hard data from which information was collected for the various data layers on the GIS are not necessarily legally accurate, and should therefore not be utilised for legal

purposes. It is recommended that, at the very least, a legal disclaimer be placed on any such material to prevent misunderstandings, and possible litigious situations.

3) Long-Range Policy Development

At present, GIS development is reactive as opposed to pro-active, and is progressing inefficiently due to several factors. Coherent questions must be asked of those involved in order to develop appropriate GIS policy responses.

1. Every two-four months, a GIS steering committee should meet to discuss relevant GIS activities within the administration of the Township in order to direct GIS development, aid staff in choosing appropriate GIS activities, and ensure good communication between relevant parties.

2. A set of short policy and operational documents should be generated by GIS staff or other trained individuals regarding basic and more advanced GIS procedures to ensure clarity of operational procedures amongst all GIS users at the Township office.

(Appendix I, p. 2-3)

In isolating the three areas delineated and the proposed solutions, it was determined that development of the desktop mapping system in these areas would likely be beneficial. The analysis portion of this thesis (pertaining to Ramsay Township) will be derived from this report and the research used to generate it. Additionally, it should be noted that I was hired on a contract basis with Ramsay Township for 12 weeks during the summer of 1995 to carry out many of the recommendations incorporated in the report (Appendix I).

Implementation Impetus

The situation-bound nature of GIS implementation exists months, if not years, prior to the implementation process itself. The impetus for the use of GIS can emerge from any individual or group and spread within an organisation in many ways (Budic and Godschalk, 1994). The case of Ramsay Township is no different. The planning structure

at Ramsay Township consists of the Planning Committee, which is simply the Township's regular council with a specific councillor as chair, and traditionally decides the fate of severance application decisions once a month. Interestingly, they do not have a final say in any decision, but their decisions are rarely overturned at the County level. Beyond that, the committee agrees on an Official Plan in conjunction with a private consulting firm, which drafts the schedules and the final documents.

After the election in late 1991, however, the process of renewing the Official Plan was co-opted by the Economic Development Committee (EDC). A group of highly motivated councillors and volunteers, a couple of whom had been exposed to GIS and desktop mapping, decided better long-range planning was required. In the end, the fruits of the GIS sub-committee's work (under the EDC) were realised in early 1994 with the installation of the Desktop Mapping package on a dedicated PC platform (Appendix I, 5). The choice of software, the provision of data, and the final decisions concerning the installation which brought them to that point are all part of the implementation process.

The EDC, as well as councillors and staff, were initially introduced to GIS technologies through Harold Moorer of Gregory Geoscience. As an associate of an EDC member, Mr. Moorer provided a presentation to the committee and to council and subsequently obtained the contract to provide both the software and the data. Matching provincial funds were provided to help purchase the system under a grant dedicated to providing better ways to manage land, specifically for agricultural purposes (Appendix I, 5). It was clear through dealings with many councillors and staff that this money was of critical importance in the decision to purchase a system. Therefore, much of the impetus which brought GIS technology into the Township office was the prospect of better

environmental management and agricultural sustainability. It is also safe to say that none of the councillors (5), nor any of the office staff (5), had any GIS training whatsoever (Appendix I, 6-7).

Despite the limited understanding of GIS technologies at Ramsay Township, the purchase, development and installation of a desktop mapping system into an operating municipal bureaucracy was completed without the in-house knowledge to either fully utilise or maintain the system. While many councillors and staff members were keen on the system, others were not. Nevertheless, the provision of the system and the annual dedication of resources to the GIS had already been put in place. The formal disbandment of both the GIS sub-committee and the EDC by the end of 1994 prompted many to begin asking questions of the desktop mapping system's future within the organisation.

Diffusion of the technology might be categorised as 'lateral' according to Budic and Godschalk's (1994) definitions, as those involved would indicate that decisions were made in unison. It is more accurately defined, however, as 'top-down' (Budic and Godschalk, 1994, 288). Decisions made by the planning committee were, in effect, imposed directly on staff and office personnel. Fortunately, the staff member directly responsible for the system was enthusiastic. Had this not been the case, the implementation of GIS technologies into Ramsay Township would have undoubtedly been dramatically different.

As stated previously, the implementation of GIS technology does not really ever end (unless abandoned) — it only continues to evolve. The period at the end of 1994 was definitely a slow-down in the evolution of desktop mapping at Ramsay township.

Decisions concerning the choice of software and database design were made throughout this time period and will be discussed prior to examining ways in which Ramsay Township began to address some of their most pressing problems.

Software Design

One might argue that the design of the GIS or desktop mapping was a non-existent process at Ramsay Township as an 'off-the-shelf' desktop mapping software package was acquired. On the other hand, however, it is imperative that not only the right software package be chosen, but that database development and data storage be structured in a logical way.

Granted, the system at Ramsay Township was extremely limited by its budget, and decisions which were made often directly dictated subsequent actions. This does not mean, however, that decisions were easily made, or that broader questions were any less difficult. For example, it was clear from the start that a desktop mapping package was the most appropriate software package, and as most are fairly similar, any package would likely perform almost as well as the next. But if a desktop mapping package could not meet the requirements or goals of that organisation (which is actually the more important question), then the broader question becomes more critical - should the organisation be acquiring GIS technology at all? With a larger organisation, the question is no longer whether a system *will* be implemented or not, but which one, and in what way.

At present, desktop mapping packages have similar capabilities and are relatively refined tools used to carry out specific tasks at a reasonable price. This does not mean, however, that they can necessarily meet the GIS needs of every small organisation with

limited means. Products like MapInfo, ArcView and SpansMap have developed sophisticated 'front-ends' which are much more user-friendly than their technically more advanced counterparts — full blown GIS packages. They are, however, still crude in that they fail to interact seamlessly with non-geographical databases, they allow the user complete control over display functionality (without so much as a warning concerning possible error), prohibit metadata inclusion, and often require support from their full-blown GIS counterpart (i.e. ArcView/ArcInfo, SpansMap/SpansGIS).

While each new generation of Desktop Mapping software improves considerably, the basic model has been set as each package attempts to outperform the others. The model, however, has remained stagnant. While text on a page appears in fonts, phrases, sentences and paragraphs, the model has remained constant for many hundreds of years. There are, however, and will likely continue to be, many different ways to present spatial information (Sui, 1994; Gould, 1994). While there was not much to choose from between different desktop mapping packages for Ramsay Township, this should not preclude an understanding of the limitations of these packages. Moreover, it should not preclude a comparison of how these limitations might affect the system's ability to meet organisational goals through the tasks which can or can not be undertaken.

Database Design

Questions pertaining to data within a small organisation are, again, dictated by cost limitations. The only viable option is to obtain free or inexpensive secondary data gathered by external organisations, either public or private. Data will consequently not be collected expressly for the purposes of the organisation itself, the implications of which

must be recognised (Sheppard, 1993, 458; Curry, 1995, 75). Staff and council at Ramsay Township were often disappointed with the accuracy level within the system and often could not understand that data obtained through other sources (specifically the province) was not legally accurate. As a result, a primary recommendation, as mentioned in Table 5.1, is that the desktop mapping system not be used for external purposes, and that even internally, the system be regarded as possibly inaccurate.

When a system is not developed in-house (and potentially even when it is), users must recognise the limitations of the system to prevent misuse, and also to maximise use. Those familiar with GIS products can easily interpret the design philosophy, and hence the limitations of a desktop mapping package, as many are quite similar. However, an uninitiated user faces a much more complex challenge when utilising any system. Learning a few basic mouse commands will empower the user very little. When queried as to the validity of the results, novice users would likely not be able to respond accurately, if at all. Many of the ethical considerations pertaining to both data collection and error representation as defined by Sheppard (1993) and Curry (1994) should be much more important when implementing GIS technologies into organisational environments.

Management and Political Issues

For the purposes of the analysis pertaining to Ramsay Township, the themes of management and political issues will be dealt with together, for it was often the relationship between the politicians and management that dictated the advancement of the desktop mapping system. The provision of all of the resources required to facilitate GIS technology adoption is the responsibility of management and management practices (as

discussed by Obermeyer and Pinto, 1994, 3; Campbell, 1994, 310). The case of Ramsay Township is interesting in that many individuals were responsible for the management of the technology and its implementation. Council made decisions primarily based on research obtained through volunteers while the CAO signed the checks and decided how moneys would be spent. In some cases, all of these steps would be by-passed and volunteers would instruct the technician as to what should be carried out with reference to the GIS. Moreover, the Planning Committee also had it's own budget which could, if required, be devoted to GIS development, thus negating the role of the CAO. Finally, there was no individual responsible for the development and application of the desktop mapping system which meant that it could often be ignored, sometimes for weeks. This section explains the working relationship these individuals had with the desktop mapping system, how it was developed, and how it might be further developed in the future.

Staff and Bureaucracy

There certainly existed a fair amount of reluctance among the staff members towards the use and integration of the system. The deputy clerk and primary user of the system was enthusiastic and exhibited a great desire to use the system, but was nervous about engaging in the project too heavily given his lack of previous experience. It is certainly fair to say that in this situation the bureaucracy was somewhat resistant to change, which, according to Obermeyer and Pinto (1994), is critical. But perhaps more importantly, Obermeyer and Pinto (1994) argue that professionals are more likely to search out non-geographical information for solution generation (Obermeyer and Pinto,

1994, 72). While this tendency existed amongst staff, it also existed amongst other committee members and with management.

Management

Likely the single biggest difficulty Ramsay Township had with desktop mapping in general was the lack of knowledge and training (as described in Table 5.1). This was certainly the case in terms of daily operations, but was also apparent at the managerial and political levels. There was no internal source of information that could answer questions related to the use of the system on an ongoing and unconditional basis. External consultation was required at almost every stage.

My involvement with Ramsay Township, and my subsequent contact with Harold Moorer of Gregory Geoscience, only reinforced this idea. While it is technically correct that Mr. Moorer profited from the relationship as he developed the database, it quickly became clear that if it were not for his 'free' advice, Ramsay Township would not likely have even begun the implementation process at all. Interested in the long-range development of desktop mapping and GIS in local municipal organisations, Mr. Moorer continually answered the relatively simple questions which emerged. Even with his generous assistance, progress was often slow as contact was not constant.

From a managerial perspective, it was difficult to understand desktop mapping for both politicians and staff. Many questions between Mr. Moorer and staff (and myself and staff) consisted of straightening out ideas about what a desktop mapping system could actually do. Some potential projects could literally be completed in minutes, some might

take weeks, others were virtually impossible in that they would consume all of the Township's annual budget and take years to complete.

This is not to say that these intelligent individuals should be required to bring this knowledge to the table, but without an individual at the table who can provide these types of answers on an almost continual basis, progress will be slow, and resource maximisation will likely not take place. A person of this calibre was not available on a continual basis, and as such, development was often slow.

It should be noted that unlike other scenarios in which senior managers use the GIS by itself or possibly integrated with a MIS, this was not the case in Ramsay. The politicians were somewhat familiar with the system, but could not be classified as users. Moreover, the Chief Administrative Officer (CAO) was reluctant to utilise the system, and reluctant to devote a larger portion of the annual budget to it, as the finances of the Corporation were ultimately his responsibility. It was difficult to show the benefit of better planning on a yearly budget report (Ives et al., 1983, 786; Igbaria and Nachman, 1990), illustrating the difficulty in justifying GIS in a traditional cost/benefit analysis (utilised by Smith and Tomlinson, 1992). Moreover, on more than one occasion, the CAO wondered out loud as to the validity of the desktop mapping system in general. Given the state of the system at the time, as well as the prevailing economic climate, this is not an unexpected response. At no time did the CAO stand in the way of development per se - his ideas were understood by most on council and on staff. Despite his initial apprehension, however, he did express a desire to increase the effectiveness of the system once in place (more in terms of actions, than in words), because otherwise the entire

project might have been seen as a waste. This is a good example of how a system must continue to evolve if it is to be perceived as effective.

Organisation Wide

The third major focus area of Appendix I, which is associated with the problems described above, entitled "Long-Range Policy and Document Development" attempted to address the lack of guidance and direction that plagued the management of the desktop mapping system at Ramsay Township (Table 5.1). Those most devoted to its success were not necessarily permanent employees and their contact with the organisation was not consistent. Given that guidance, when provided, was often uninformed or based on incomplete knowledge, it is little wonder that the direction of GIS development was not consistent. As mentioned, the Deputy Clerk's enthusiasm was beneficial, but was often not sufficient to prioritise activities on behalf of the committees to whom he reported.

As to whether the organisational environment in general was stable enough to cope with the introduction of the new technology or was simply adaptive to change, is an interesting question (as discussed by Campbell, 1994, Obermeyer and Pinto, 1994). I would argue that the implementation process is not yet complete. Many other things could potentially be achieved through the use of the system. To argue that Ramsay Township's system has been fully implemented, or that any system has concluded the implementation process, is incorrect.

The Deputy Clerk was certainly receptive to change and potential future development, but the responsibility for further development falls heavily upon his shoulders. Sporadic external encouragement from volunteers does not foster an

environment which encourages future development, however. Greater maximisation of the system through its use in more routinised, structured tasks may have alleviated some of this concern and is the focus of the next section.

Organisational Goals and Simple Tasks

In much the same way that political implications and management issues were discussed in reference to Ramsay Township's desktop mapping system, this discussion will once again merge two themes. Although not readily apparent, organisational goals and simple, routine tasks can be discussed in unison. It will be argued that using the desktop mapping system to carry out routine, simple tasks efficiently and effectively, the system can more obviously meet organisational goals, thus justifying itself economically and by being of greater use to all involved.

Typically, when one discusses organisational goals one thinks of mission statements and the more qualitative aspects of organisational development, specifically within the public realm. Economic realities have helped to simplify the organisational goals within public institutions in much the same way they have always done for private institutions: maximise the bottom line. Unless a service, function or staff member can be rationalised economically, or the service is legislated from above, municipalities are making decisions in an economic climate not seen for the past half century.

In many institutions, GISs are acquired to aid in the planning function. As discussed previously, as critical as the planning process is to the long-term viability of a municipality or organisation of any kind, the results of investment are measured in tens of years, at minimum. Compound that with the numerous external factors which feed into a

municipality's development, and the process of measuring the impact of planning can make it an almost impossible task (Ives et al., 1983, 786; Obermeyer and Pinto, 1994, 86). In the case of GIS utilisation, even if one is able to measure the impact of planning (as attempted by Smith and Tomlinson, 1992), an attempt to disaggregate that marginal gain into the various components provided by each improvement in the planning process is almost futile. By no means is this an attempt to undermine the planning process, or remove it as an administrative function from any organisation. It is important to point out, however, that attempting to justify an Information System (which consumes large proportions of annual budgets) becomes a difficult task if the measurement of marginal improvements over tens of years is the system's only utilitarian justification.

Simply stated, providing new vehicles through which a GIS or desktop mapping system can help justify its existence, will only increase organisational support, morale and subsequent effectiveness and use of any system. With reference to the Ramsay Township case study, there were many opportunities for this to occur, many of which were not readily apparent.

The potential uses of desktop mapping or GIS in municipal governments are many and have been fairly well documented in the literature (as in Hunter and Goodchild, 1993, 57). Many of the functions which fall under the purview of a municipal government are geographical in nature. Taxpayers are clients, almost all of whom receive basic municipal services: police, fire, garbage collection, road access, schools (buses), health care (ambulances), etc. The location of these individuals is of prime importance as contact is required either continually or on an as-needed basis.

My involvement with Ramsay Township required me to meet and interact with almost all of the councillors and staff at Ramsay Township. Unlike a larger bureaucracy, these dozen or so individuals carried out almost every aspect of the Township's business. While my activities initially centered upon the use of the GIS for planning purposes, it was inevitable that discussions concerning all other aspects of Township business would enter into the dialogue. Moreover, I was being asked to review the entire desktop mapping system and look for ways to help it become more effective in any and every area. As each councillor, as well as the Clerk and Deputy Clerk, sat in on every standing committee meeting, each had a fairly strong grasp of the problems facing the Township in general.

At the time of my involvement, other than the Planning Committee, there were two other standing committees: Public Works and Finance, Policy, and Administration. With three councillors, each was chair to one committee and each committee met once a month. For a great deal of time, I was not aware of the breakdown in terms of resources allocated to each area of interest. Over time, it became clearer that of all expenses within the internal budget (i.e. moneys not passed on to other organisations), considerably more than 50% went towards the maintenance of Township roads. Given the difficulties encountered attempting to promote the use of the GIS within the Township, this revelation prompted me to reconsider the focus of the desktop mapping system. Of all the aspects of local government that the Township had to manage, roads were by far the single biggest expenditure. The Township could not control the amount of money required by the County for health and education, nor could it bargain extensively for police, fire and garbage services, all provided on a contract basis. Of the less than 50% spent on the internal budget, most was for office space and wages for the clerk, deputy

clerk and building inspector and the three support staff personnel, one of whom spent a lot of time keeping the books for the Roads Superintendent. Not to mention that road budget changed annually as some roads were continually being re-surfaced, and the amount of overtime spent plowing and salting roads each winter could dramatically affect reserve funds.

The purpose of the explanation above is to illustrate that the organisation's objectives (in terms of its annual operating budget) were threefold. First of all, each year or so council would have to negotiate new contracts with the garbage collection providers and for police and fire protection. Once settled, the issue would not arise until the next negotiation period. Secondly, municipal tax collection and transfers to both the County and the Province were required by law and are not under municipal control. And thirdly, obviously they manage the maintenance of roads. Utilise the desktop mapping system to better manage road maintenance and a valuable resource could pay for itself many times over and be an invaluable tool with immediate benefits. Perhaps more importantly, improvements in efficiency would be more readily discernible through traditional Cost/Benefit analysis, dramatically improving at least the perception of utility within the entire organisation of the desktop mapping system.

Searching out the ways in which road information was stored and analysed was the next step to thinking about potential application development. It quickly became clear that nearly all of the information pertaining to roads was stored in one place - the Road Superintendent's head. Many changes had occurred between the time the last road map was drawn and the present. The details of not only the paving which had taken place on a yearly basis, as well as the hundreds of culverts which had been installed, not to mention

vast amounts of miscellaneous local knowledge, was stored within one individual who had spent almost his entire life in the area. The loss of this individual would literally mean the departure of what is most likely the most valuable information system at Ramsay Township.

While it would potentially be problematic encoding all of this information, one important fact remains in the favour of the Township. Technically, the information is contained in-house. The previously digitised road sections could simply have a series of attributes associated with it, thus creating potentially the most valuable data layer the Township could ever own. This is an important consideration. Although it sounds simple, a project of this kind would not require any outside contractor, nor would it require any further primary data collection (which, in fact, has already been completed), and would potentially have the largest impact on meeting the organisational goals of the Township. Even more complex analyses could be carried out with road information quite easily. Modelling the effects of population growth on road deterioration could be projected, as could the effects of decreases in winter plowing, for example.

Another project which was completed involved the use of 'in-house' information for planning analysis. Council had been approving severance applications since the process began in 1973, and each lot addition, easement or severance has been recorded. The important aspect again is that old records around the office and in the storerooms contain valuable pieces of information. Once entered on the computer, analyses were completed based on severance type (rural residential, commercial and agriculture), size, time periods, etc. Although not completely accurate, the trends within the results surprised many of those on council who had been monitoring the process for many years.

An area of the Township still considered to be essentially rural upon which many on council believed very little severance activity had occurred had been just as busy, if not busier, than many areas closer to Almonte, which councillors presumed had been busier.

One of Campbell's (1994) primary recommendations is that a GIS execute "simple applications producing information which is fundamental to the work of potential users" (Campbell, 1994, 309). At the time of analysis, Ramsay's desktop mapping system had accomplished the goals laid out for it by the GIS sub-committee, but found the results wanting. There had not been a direct analysis of ways in which it could infiltrate the other activities with the Township's administration. The questioning of the system is what ultimately led to my involvement and my subsequent work term at Ramsay Township. While many of the proposed activities listed in Appendix I (17) were not carried out, some were, and quite successfully. The installation of a desktop mapping system into an environment that literally has no resident champion is an interesting scenario, and the success that it has been able to achieve is quite remarkable.

Conclusion

The analysis of Ramsay Township with reference to the six topics outlined at the beginning of this chapter never explicitly addressed the issue of software training. Looking back on the three focus areas, however, it becomes clear that the lack of training or knowledge in general permeates all of the problems encountered at Ramsay Township. Without a resident expert, it was difficult for progress to take place. Simply being able to ask the right questions requires a solid understanding of the issues, the technology and the data, even before thinking about the steps one might undertake in order to acquire

solutions. Management of the system, by extension, suffered considerably, which, in turn, hindered the staff person's ability to carry out simple tasks which more fully met organisational goals. Without the ability to prioritise possible projects, not to mention the use of results in a coherent and ethical fashion, successful implementation and effective use of GIS technologies is jeopardised.

Ramsay Township's experience has been positive to date. Detractors could easily point out the obvious limitations of the system and question its continued existence. While their criticisms would be difficult to prove, the proponents of the system would face difficulties in attempting to defend it. The concept of the system awaiting impending doom is not attractive. Fortunately, opportunities exist though which application development could avoid system failure through the effective use of the technology to meet organisational goals through more routinised simple tasks.

REGIONAL MUNICIPALITY OF OTTAWA CARLETON

Introduction

The RMOC was formed by the amalgamation of eleven municipalities around and including Ottawa on the Ontario side of the Ottawa River and has a population of over 700 000. Primarily responsible for the regional provision of public transit, public health services, water and sewage, hydro, police services and now, garbage collection, the RMOC is a political and bureaucratic entity which operates in much the same manner as any Ontario municipal government. As a co-ordinating body which increasingly shares functions with the municipalities, the provision of GIS services and data was to be shared and co-ordinated within the Municipal Partnership struck between the municipalities and the RMOC.

The complexity of the Municipal Partnership itself, the specific interests of all participants, and the time frame of my project does not allow a detailed analysis of the Partnership. Rather than speculate about the motivation, management styles and organisational goals of each and every department and participant, the analysis will center around the two activities with which I was directly involved. This analysis follows the six sub-topics defined at the beginning of this chapter. The first section of this chapter outlines the background and implementation impetus behind the partnership, as well as the design of the RMOC's GIS-database and applications in general. To help delineate some of the managerial and political issues involved, the development of my working relationship will be described. To delineate how simple tasks and organisational goals

affect the use of GIS technologies in large and complicated public organisations, an in-depth analysis of the OSCAR applications in “Window on the Region” (WOTR) will be utilised. All of the six sub-topics will be used to analyse WOTR. As a small group of individuals who previously knew little or nothing about GIS or desktop mapping, many comparisons can be drawn between WOTR and Ramsay Township, specifically those pertaining to the transfer of the technology into an already operating organisational unit.

The Municipal Partnership: Background and Implementation Impetus

My thesis research initially focused on the use of GIS within small public organisations and was expected to progress along those lines. Concurrently, however, discussions were taking place between the Geography Department at Carleton University and members of the Municipal Partnership involving the Regional Municipality of Ottawa Carleton (RMOC), and these progressed throughout the summer of 1995. The eleven regional municipalities, RMOC itself, Systemhouse Limited (SHL), and the Carleton University Development Corporation were entering into a partnership in order to provide region-wide access to GIS data using software developed by Vision Solutions (a recently acquired division of SHL). Members of SHL approached the Geography Department at Carleton University, interested in forging a relationship that would see research being undertaken within the department which would aid in software development and training, potentially throughout the duration of the partnership. Applications for matching URIF funds from provincial government sources were submitted, and subsequently refused, but areas of mutual interest were identified in which work could be carried out.

It is out of these ongoing discussions that my involvement with the project began. David Vost, Municipal Applications Manager for Vision Solutions, had been the primary contact person and subsequently became my direct contact within the partnership. SHL's involvement at RMOC within the Municipal partnership was directly controlled by David Vost, whose technical guidance I followed throughout all of my projects within the Partnership.

Establishing the working relationship between myself and the partnership proved to be one of the most difficult aspects of my involvement. From SHL's perspective, it is safe to say that the primary objective in developing municipal applications was to be able to apply them within other municipal jurisdictions around the world. Many applications could have been developed, but the partnership dictated which particular applications were to be pursued.

By working on small projects within the Partnership — evaluating, commenting and participating — I would have insight into the organisational use of GIS, and the implementation process, that could not have been achieved otherwise. The projects themselves, in terms of my research, were not as important as the process of involvement itself and the access to the participants which they allowed. As an independent, I would be able to address some of the projects which couldn't necessarily be justified at the RMOC's expense, but could be perhaps pursued on a voluntary basis. This was the only opportunity I had to become involved in the Partnership. Strictly observing the process or monitoring meetings and interaction was not an option. My position within this relationship, however, guaranteed that I would become involved with many different individuals and groups within the Partnership. This is not to say that the work would be

undertaken only on behalf of SHL to the detriment of the RMOC, simply that priorities dictated certain projects be undertaken before others. Before describing my involvement, let us first examine the nature of GIS at RMOC.

The GIS division at RMOC is relatively autonomous, in that it is not associated with another traditional department (planning, public works, etc.). The development of the GIS, therefore, was responsible for meeting the GIS needs of every division. The four to five year period prior to the establishment of the Municipal Partnership was devoted primarily to data collection. Rather than simply meeting the internal GIS needs through extensive in-house application development, it was decided that the expensive process of application development could be shared among the municipalities within the region. This would benefit the municipalities through a data sharing process while reducing the costs to the region itself. SHL was willing to provide the underlying structural software but was to benefit from the development of many small municipal applications which would remain as SHL property. As the primary objective of the partnership was application development, which the case study of OSCAR II will illustrate, the municipal partnership can be seen as a response to the fact that the GIS environment was 'data rich' and 'application poor'.

The partnership was initially required to identify those areas in which applications should be developed. A series of workshops was held to determine appropriate application development working groups in early 1996. Working groups were determined based both on departmental affiliations and/or organisational size. For example, planners were grouped together from the larger municipalities, as were public works representatives, while all of the representatives from the smaller municipalities were grouped together. Each group was to generate priorities in order to provide software

developers with specifications for application development. Providing applications to municipal departments of different sizes, structure, technological advancement and focus would undoubtedly be a complex task. Broadly, the GIS needs for West Carleton Township for example (somewhat similar to those of Ramsay Township), would be considerably different than the Public Works department for City of Gloucester (pop. 110 000). More specifically, however, even differences between similar groups — planners at the City of Ottawa and planners at the City of Kanata, for example — would have been great as existing GIS application development would be at dramatically different levels within the two organisations. As an entry to the GIS program within the Partnership and the system itself, I became involved in two areas.

Fortunately, my involvement with the Municipal Partnership began just as it was formalised in late 1995. I was able to attend introductory meetings and workshops (as described above) where the project's scope, its structure and goals were presented to the various Partnership members. Having attended the same presentation on many occasions, the initial notion of 'data rich' and 'application poor' became more strongly established.

In addition, in order to gain a degree of familiarity with the existing system itself, I worked with staff at Window on the Region (WOTR) in their utilisation of the only operable GIS application in continual use at RMOC at the time. OSCAR I, a networked Windows 3.11 based application was used by operators at WOTR simply to identify an individual's garbage and recycling pick-up day. WOTR, it should be noted, is a catch-all department within Public Relations responsible for providing every type of information conceivable to telephone callers at RMOC. Telephone operators in this department had no prior GIS experience whatsoever. I was to evaluate the use of the OSCAR

applications in the working environment on an ongoing basis. I observed the telephone operators for four hour intervals during each time period during the day over the space of two weeks during mid-December 1995. I interviewed and interacted with the operators in an unstructured and informal way.

OSCAR I was text based and provided responses to queries in a text format. During the period of my involvement, OSCAR II was introduced. OSCAR II provided graphical responses (a map of the caller's neighbourhood) along with the textual data similar to that provided with OSCAR I. The look and feel of the two applications were quite different, with OSCAR II running in Xceed within Windows NT. Appendix II is the report developed as a result of my experiences observing and talking with operators at WOTR and will be used as a reference source for further analysis.

Initially, the work with telephone operators at WOTR was to act simply as an introduction to the project within which my primary project involvement would evolve. The process of developing my primary project involvement, however, did not evolve as originally planned. This process will be reviewed in terms of the management and political issues it raised. The design of applications in general and the database structure within the Municipal Partnership is critical to an understanding of the case study, and will be reviewed prior to the in-depth analyses which follow.

Design

The Municipal Partnership entered into by the municipalities within the region, RMOC and Systemhouse Limited was designed to utilise the massive digital database accrued by the RMOC over the last decade.

Systemhouse's "Vision" software is used within the partnership as both applications themselves and as a "language" in order to design and build applications. Vision is an interesting software system because it consists not of a compileable language nor of a turn-key GIS. Rather it is a series of mini-applications or toolboxes which can be grouped together into new and distinct applications depending on the user's required needs. While some users might use Vision's product called VisionInsight (which is comparable to a desktop mapping system), others would have custom designed front-ends which only contained the capabilities to perform certain tasks related to their jobs within the RMOC structure. The toolboxes, or mini-applications can be linked together in an infinite number of front-ends depending upon need.

The specific front-end a user is utilising notwithstanding, the application(s) would communicate with the Oracle-based data storage system. A powerful relational database, Oracle is able to control data models, allow multiple simultaneous access and maintain a high degree of data integrity. Moreover, Oracle more easily facilitates the use of data within other non-geographical applications, and can more easily customise data for geographically based applications. These capabilities are a vast improvement in power and flexibility over the proprietary database management systems utilised within many other high end GISs. As will be discussed, this is a trend that is beginning to pick up momentum (GIS World, 1995, 34) as many organisations have large databases which need a GIS as opposed to acquiring a GIS that needs a large database. As a result, it is a highly adaptive system which can be customised into literally any number of different uses. The fact, however, that it must be customised, necessitates that vast amounts of resources — time and money — must be devoted to application development.

As discussed, the first phases of the Municipal Partnership were aimed at determining the design requirements for the many different applications required by potential users. The subsequent stage would be to define the data model(s) which would subsequently be the basis of the GIS within all applications. Focus groups were undertaken with sub-groups (public works, planning, social services, etc.) of partnership members from every participating organisation.

My involvement with this component of the design process was as an external observer. Unfortunately, my involvement was relatively limited and was complicated by the fact that the data model design process was occurring concurrently with my activities at RMOC. In fact, the process was only just getting under way. I was not able to fully discern the assumptions that were made, nor do I understand enough about data model construction to be able to comment on these processes. The seminars I did attend, however, clearly illustrated to me that each group and sub-group not only had vastly different needs from one another, but that experience, both technical and organisational, with GIS technologies varied considerably, even amongst those who were considered experts.

As there were members from each organisation present, participants ranged from the City of Ottawa to those from the smaller townships. While the cities of Ottawa, Gloucester and Nepean were looking to enhance their existing systems, West Carleton and Cumberland Townships were looking to the partnership to provide the GIS technologies that they knew next to nothing about. It seems inconceivable that one set of data models would begin to approach the requirements of the many different users associated with municipal functions in all of the many different contexts which exist in the partners'

organisations. Nevertheless, this is the goal of the partnership. The concepts of software design within the Municipal Partnership will be discussed in more detail with reference to WOTR. Prior to the analysis of WOTR, however, I need to discuss the management and political issues I encountered throughout my involvement with the Municipal Partnership.

Management and Political Issues

As part of my continuing involvement with the RMOC and the Municipal Partnership, meetings were held in January of 1995 with two potential user groups whom I could aid in developing a framework for application development. While neither group would receive an application within the initial phase of the Municipal Partnership, both Public Affairs and councillor's assistants were identified as longer-term potential user groups. Involvement with either group would hopefully raise the awareness of the GIS initiative within the RMOC, which was a priority for the Partnership in general. The product itself, again, was not as important to my research as the vehicle it provided into the inner-workings of the Municipal Partnership itself. The decision, in the end, was to focus upon Public Affairs. The rationale for this decision is listed in Appendix III, a report submitted to David Vost on January 24th, 1996.

The process of reaching this decision is indicative of the managerial and political motivations amongst the users. The councillor's assistants were extremely enthusiastic about the use of the technology. They could see a lot of potential with a GIS. Being responsible for their councillor's daily activities, application ideas ranged from mapping contacts to policy analysis (crime, poverty, education, etc..) to electoral voting patterns. The problem was, there was too much potential, and it became clear that no system would

adequately meet their diverse demands. Moreover, the political implication of being perceived to help one councillor's assistant over another were potentially disruptive, not to mention there being concerns over data.

...there exists very real political implications in terms of access and availability to data which directly affect my role within the project. While there are many very interesting dynamics at play between the executive/legislative arm and the administrative arm of the organisation, positioning myself between them might not be the best move I could make.
(Appendix III, 1996, 1)

My work would have been experimental and prototyping a system would likely have involved working directly with one or two councillor's assistants. In the competitive world of political power, even being perceived as having given one councillor's assistant the upper hand over another could have been problematic.

Alternatively, it is the role of the Public Relations division to regulate the outflow of information. Disseminating information through this division would, in essence, help to guarantee responsible use as decisions concerning data access would be taken on by a larger group of individuals. As my relationship was relatively tenuous within the Municipal Partnership as it was, it was decided that the Public Relations division was a more stable environment within which to work. As will be discussed, my situation, and subsequently, my work, still became hampered by political factors, despite the perceived stability of working through Public Relations.

It was decided that an Economic Development Information Site for External Users would become the focus of my project involvement (proposal number 2 in Appendix III). This system would be a way to allow access to some of the data and information contained in the GIS to the widest possible user group: the general public. Better

representing geographical data in an intuitive, easily negotiated environment would increase use as well as promote the database, SHL, and the RMOC. As the level of detail within the system, and the content of data contained therein, had yet to be determined, further research was required. Moreover, this process allowed access to a larger, more diverse, group of participants, thus extending my ability to 'participate' within the Municipal Partnership.

As the head of Public Affairs, Rob Dolan was an active participant in the Marketing Council, a group of individuals drawn from local economic development agencies with an interest in jointly promoting the region. Mr. Dolan provided me with the contact person(s) at each of the organisations involved, including the Ottawa Carleton Board of Trade (OCBT), the Ottawa Carleton Economic Development Corporation (OCEDCO), and the Ottawa Carleton Research Institute (OCRI). While each of these organisations is individually responsible for promoting the region, the Marketing Council was developed to co-ordinate their activities. The largest joint initiative was the development of a cohesive web site as the internet is increasingly becoming a place to publicise prospective business opportunities. One would assume that members of a committee interested in promoting the region would encourage a system similar to the one which I was proposing.

In contacting and meeting with these contact persons, I attempted to develop an understanding of what types of information would be most beneficial within an Economic Development web site. During February and March of 1996, informal meetings were organised between myself and members of local economic development offices. The Ottawa Carleton Economic Development Corporation (OCEDCO), Ottawa Carleton

Research Institute (OCRI), Ottawa Tourism and Convention Authority (OTCA) and the Public Affairs department at RMOC all provided information which indicated what types of requests are received and what information is typically provided in responding to those requests. Moreover, a system which provided these answers concisely could cut down staff time devoted to routine queries.

My analysis revealed that *very* basic information, similar to the information provided in Economic Profile: Metro Ottawa, a publication produced by OCEDCO (1995) was the standard information type thought to be required by most people outside the region. The document is an enhanced brochure at 26 pages in length and contains many tables and graphs outlining the demographic profile, retail, office, industrial and residential sectors, etc.. As the graphical elements of the conventional publication were poor, re-packaging this data in a more legible, easily understood web site was eventually seen as an appropriate project.

The report in Appendix III, is the proposal submitted May 10, 1996 and is the basis for the digital component of this thesis. Unfortunately, the end product was considerably less sophisticated than previously envisaged. In fact, it has not yet been implemented and was all but abandoned during the final phases of my research. For reasons beyond my control, it was never adopted and is not a substantive component of this thesis. There are no definitive answers as to why this occurred. The participants and their relationship with both the project and with each other are all part of the social, bureaucratic and managerial systems which exist within and between these organisations. The processes which brought about this failure, however, are not uncommon and offer insight into the obstacles faced by those attempting to implement new technologies. The

actual product acted simply as a vehicle to develop a greater understanding of these difficulties.

Support in principle was offered by most of the individuals contacted with reference to the proposed Economic Development Searchable Web Site. The actual reaction I received, however, was one of reserved enthusiasm. While my proposal sounded good to these individuals in theory, they expressed reservations about further development. They seemed reluctant and often queried me as to what type of resources I required. Upon informing them that no monetary or physical resources were required, but information and access to economic development resources would be beneficial, they seemed sceptical. In addition, I took great pains to explain that my actions were solely for the purposes of my own research, which was separate from the work I was completing. My "compensation" was the opportunity to learn about organisational aspects of GIS adoption by being given "real world" tasks, data and access. In explaining this fact to the contact persons, it again seemed as if they were expecting me to ask for more in the way of compensation.

On no occasion, however, did any of these individuals respond with genuine enthusiasm or offer ways in which I could better understand the process of promoting the economic development of a regional municipality (which was obviously their area of expertise, not mine). Representatives politely answered most of my questions, but did not offer anything substantial that was not contained in the brief documents published by these organisations which are either distributed at conferences or mailed out to prospective entrepreneurs or investors. As mentioned, the most comprehensive of these documents is entitled Metro Ottawa, published by OCEDCO (1995). As a result, the content of the

system is a digital representation of most of the graphical information presented in this document. It was the only solid information source available to me at the time.

The inability to garner support for this system is attributable to many things. None of the explanations, however, are conclusive, nor do any encapsulate all of the problems encountered. Undoubtedly, my position as researcher and student did not lend the credibility to the endeavour that someone in a more prestigious position might have had. Even with the RMOC Public Affairs division, the GIS division and the Municipal Partnership behind me in terms of support, more questions were often directed at me than towards my subjects (concerning my position, affiliations, etc.). Moreover, my personality and that of the participating individuals could have played a role. I often felt as though I was 'selling' a concept. The method of delivery may have impacted upon my success significantly. It became obvious that the inter-personal nature of these negotiations can dramatically affect their outcomes.

Conversely, the position of the representatives undoubtedly played a role in the negotiations. While the buzz words of the day now are 'internet' and 'web sites', the world wide web was still relatively unfamiliar territory in 1995. In addition, the perception that I 'wanted' something from them seemed to permeate our discussions which almost automatically placed the individual in a defensive mode. This attitude may have been a function of the many demands they faced in their work. My project may have been perceived as 'extra work', and minimising the amount of 'extra work' may have been a priority.

My involvement with the RMOC was initially designed to undertake tasks which, although seen as socially and intellectually important, could not be given high priority

within the project. Despite the desire to investigate these 'asides', when activity within the Municipal Partnership increased and deadlines became imminent, the priority of my project dropped off the scale. At present, I have delivered a digital prototype of the system and am awaiting a response. The process illustrates, again, the non-technical components and obstacles which have to be overcome in an area dominated by the technology.

There is no doubt that the exploratory process embarked upon in my research uncovers more questions than are answered. The direction of my work was often serendipitous and took me along a different path at each junction. The process could not be replicated exactly by anyone else or by myself. The complex social systems described above are not closed systems. These systems could not have been researched in their entirety within the scope of this thesis (if at all). As a result, holes exist within the work itself. Each implementation process evolves differently and does not often adhere to either schedules or budgets. Given the amount of research available, however, immersing one's self into the process is required to begin to identify actors and the influence they yield. It is important to note that all of these obstacles were encountered prior to the *technical* exercise of developing the web site. The non-technical components of this process dominated the technical ones. To focus on the technical components of an implementation process, or a GIS is to look at only one aspect which limits an understanding of these systems and process as a whole.

Prior to the exercise involving the economic development application, however, I observed the use of the *only* operable GIS application located in WOTR. The six sub-topics utilised throughout the analysis portion of this thesis can be applied to this division,

and as such, will be reviewed. While the implications of the economic development application could not be analysed in terms of organisational goals and simple tasks as it was not completed, the WOTR example illustrates these concepts quite well.

WOTR

The telephone operators at Window on the Region (WOTR), a division of the Public Relations division at RMOC, are employed to answer calls and provide informed responses to public queries concerning the delivery of regional services to taxpayers throughout the RMOC. If an operator could not provide an answer or connect the caller directly to someone with the potential to provide an answer, the objective was to provide the caller with a direct phone number (possibly in another organisation) to someone who could help. The WOTR phone number was becoming very popular as an answer service for an increasing variety of questions dealing with the RMOC and beyond. It was accepted, however, that the public service benefit and the good public relations function it performed justified this role.

As mentioned, the OSCAR I and OSCAR II applications were developed by the IS and GIS divisions of the RMOC to meet the needs of telephone operators at WOTR for responding to queries concerning garbage collections dates. OSCAR II was the only operable GIS application actively being used on a continual basis outside the GIS division within the Regional Municipality of Ottawa Carleton at the time of my involvement. Operators at Window on the Region (WOTR) used the system to answer calls about garbage collection dates, but knew or cared little about what a GIS did or how it worked. Their sole mission is to answer phones 24 hours a day and provide any and all relevant

information to callers. Any system that could help them provide answers quickly and correctly was seen as beneficial, while additional information was useless.

The document listed as Appendix II is the report submitted to the RMOC GIS division and was presented informally to the working group responsible for the maintenance of the WOTR application. It is brief and acts as an Executive Summary which forms the basis for analysis of the use of GIS technologies at WOTR. The problems outlined by both the operators at WOTR and those observed through my involvement were outlined at this time. The following section discusses the inter-relationships between WOTR and the GIS division along the lines of the six sub-themes previously outlined.

Implementation Impetus

On June 1, 1995, the Region took over responsibility for managing the garbage collection contracts for nearly all of the municipalities in the region. Moreover, the RMOC was in the process of negotiating one large contract for the entire Region after all of the other municipalities' contracts came up for renewal. Not surprisingly, the number of phone calls directed towards garbage collection was growing substantially. The impetus for an associated information system was clear. Providing the operators with a system which offered information related to any caller's garbage collection date and their blue box recycling collection date was critical. Operators received thousands of calls each year from people who simply wanted to know: "When is my garbage being picked up this week?" or "When can I put my Christmas tree out?" The internal design of the (G)IS

application developed to answer those questions was not of much importance to the operators.

Initially, the IS solution was the development of a traditional database application using FoxPro based on street names and garbage pick-up dates (OSCAR I). While not utilising traditional “GIS technologies”, it was a geographic information system. While it did not utilise a graphical display, street names were the geographical identifier which were cross-referenced against other attributes (in this case, garbage collection dates).

One could construe the decision to go with a traditional database application as an inability among professionals to recognise GIS capabilities (as discussed in Obermeyer and Pinto, 1994, 72). As will be discussed, however, the introduction of more traditional GIS technologies into this particular application does not support this claim. It can be argued, in fact, that the addition of graphical information into OSCAR II only served to complicate the task carried out by operators at WOTR.

Implementation in this case can be defined as lateral (according to Budic and Godschalk's, 1994, 288). Despite continual interactions between WOTR and the IS division, the decisions and implementation strategies were dependent almost entirely upon the IS division. Inexperience in the area of application development and implementation processes amongst staff and management at WOTR undoubtedly defined this relationship. Initially, fully-fledged GIS technologies were not involved (OSCAR I), but were applied under the direction of the IS division in OSCAR II. Prior to an analysis of the implementation process, its management, and its political implications, a discussion of the design parameters and limitations of both OSCAR I and II is needed.

Software Design

An analysis of system design is difficult as my involvement began after all software development had taken place. Moreover, the way in which the system worked was not clear as Oscar II was built on proprietary Vision software which I am not trained to use. I was able, however, to observe the operators for extended periods on a number of occasions using both software packages.

Oscar I

OSCAR I was built in-house and utilised a database package called FoxPro to be used with networked Windows 3.11 PCs. When a telephone query came in, an operator entered the individual's street address and was then required to determine the closest cross street. The system could not even be referenced an individual's numeric municipal address. Each street section was also accompanied by a code, so if it was unclear to the operator exactly which block the client lived on (or which side of the block in some cases), it could be searched through a set of paper maps. Cases which required the use of the paper maps often took longer to decipher than ideally desired, but the occurrence of complex cases was relatively rare.

OSCAR I was not a networked application. The software and database themselves were located on each PC's hard drive, and were therefore static in terms of data updates but were not prone to network errors. Moreover, processing time was relatively quick, as network traffic did not affect performance.

The design considerations behind the OSCAR I application were considered before my involvement with the project and were outside of the GIS division's Municipal

Partnership mandate. Addressing the operator's needs through a traditional commercial database offered WOTR an application which had the same 'look and feel' as most Windows applications and did not require any significant additional training. Moreover, the limitations of the system were fairly well understood. The fact that there could be confusion as to which block (or side of a block) had different garbage pick-up dates, without the ability to reference the response by municipal addresses, compromised the system. While complaints were minimal, it was obvious improvements could be made. The limitations of the OSCAR I system were seen as considerable by those in the IS division, and specifically, the GIS division. They were considerable enough, in fact to be the impetus for OSCAR II. OSCAR II's design characteristics are discussed in the next section.

Oscar II

Oscar II was built using Vision technology and was networked into a 'live' database which was the most current database available to the GIS division. Searches could be completed through more fields than with Oscar I (i.e. address, etc.) but more dialogue boxes were required to get to the specific search menus. Instead of the text responses of Oscar I, each and every search query (which required several field entries in multiple dialogue boxes) built and displayed a map of the corresponding area which was colour-coded. This in turn required a comparison with the legend (opening another dialogue box), or clicking on the road itself (which opened another dialogue box) to determine the pick-up dates.

OSCAR II required the user to keep the network connection open and operating system running as it has to be accessed at a moment's notice. The operating system is Unix based and utilises Xceed as a Graphical User Interface (GUI) to run the Vision modules. Not only was this system unfamiliar to the users in principle, but it consumed system resources. Search times could be quick, but network traffic dictated access times and would often cause the system to hang. During my observation period, users experimented with Oscar II, but often had to switch to another machine to answer real calls as the processing time of Oscar II rendered the original workstation useless. Perhaps the most frustrating aspect users encountered was that often the processing of a query would commence and continue indefinitely without informing the user what was occurring. During my observation periods, no operator used OSCAR II in 'real time' to answer calls as it was not perceived as a quality information system. Conversely, OSCAR I would provide an error message quickly, allowing the operator to search out the answer through other means. In addition, network failures that occurred after normal working hours definitely did not receive appropriate attention because WOTR answers calls 24 hours a day.

Internal support for the system was obviously not overwhelming. Most operators at WOTR admitted that Oscar II showed promise, but in its current guise would not hold up to the rigorous work environment at Window on the Region. As a whole, they were told that OSCAR II was *supposed* to be better, and it was fairly obvious that it *could* be better (search queries based on municipal addresses and the possibility of graphical maps). But in reality, it was *not* better. Follow-up did not formally occur, and the fact that OSCAR I was being utilised continuously meant that complaints never really filtered back

to the GIS division. Complaints that were made were based on the fact that responses were not being generated quickly enough (if at all). The response from the GIS department was that their computers were probably not quick enough and network traffic was too great. Simply the fact that OSCAR I was still available to the operators leads one to question the internal communication paths between the WOTR and the GIS division. The important fact is, however, that OSCAR II was not being used within the everyday working environment. Within this scenario, design considerations are tied much more closely to management and political issues as communication is much more important to the successful implementation of potential applications.

Management and Political Issues

The management of application development in this case was not controlled as effectively as it might have been. After initial contact between the managers in both the IS division and WOTR, contact was maintained primarily through staff, i.e. operators and application developers. Beyond that, once application development was completed, it was my impression that managers within both departments were relatively satisfied. One meeting which was held on January 4, 1996 (after my observation period) was attended by managers from WOTR, the IS division, one telephone operator from WOTR, a couple of the developers and myself. Only one full-time member of the GIS division made a brief appearance. The report listed as Appendix II was available to all of those present on that date, but neither my opinions, nor those of the telephone operator were solicited. Both the operator and myself expressed our dissatisfaction with OSCAR II, but, again, the problems were ascribed to network and hardware configurations. The problem was,

WOTR was still answering calls (primarily with Oscar I) while the GIS division had provided what they believed was an operable system which could act as a base for future application development. From management's perspective, there was no need for drastic action, only some minor "tweaking".

From the GIS division's perspective, the development of Oscar II had very different implications than the limitations encountered by the operators at WOTR. Oscar I was seen by the developers as an archaic, static system with very few possibilities for improvement. The fact that it could not be networked and incorporated continually into the GIS database was seen as problematic. Oscar II on the other hand, had great potential and was seen as much more sophisticated. In many ways, it was seen as a prototype for many different applications which were to be used within many departments within the RMOC. Delays in terms of seconds and minutes were overlooked because of its potential future within the Municipal Partnership. This became clear working with the application developers within the GIS division.

Demonstrations of OSCAR II that I witnessed within the GIS division during my involvement took on a much different context than those experienced at WOTR. The user in the GIS division had a much more powerful PC with which to work, and was not only much more familiar with the application itself, but also with the Xceed operating system within which it worked. Unfortunately, this expertise was still not enough to keep the system from hanging. The operator in the GIS division was, however, able to re-establish the connection and get it up and running much more quickly than a WOTR operator, as it was often difficult to determine whether or not the system was hanging or the application was just processing on a very busy network.

One of the interesting things often touted by the GIS division was the monitoring capabilities Oscar II offered system administrators. The GIS division developer showed me log file after log file of backups documenting activities on Oscar II, most of which he declared illustrated its effectiveness. There was not, however, any categorical analysis of these log files monitoring performance on any sort of temporal basis, even though the information did exist. In this case, an analysis of system usage would have clearly revealed that the levels of use between OSCAR I and OSCAR II were dramatically different. It was my interpretation that these files would be used in an emergency situation to determine what, in fact, had gone wrong. In reality, however, no emergency situation would ever arise as operators, upon encountering a problem with Oscar II, simply switched back over to Oscar I.

The GIS division's enthusiasm towards Oscar II is not completely unjustified, as the preceding illustration suggests. The up-side that the GIS division sees is that the application (OSCAR II), although perhaps crude, could actually be the basis for a series of potential applications fulfilling the needs of many individuals and departments both within their own organisation and the Municipal Partnership in general. The philosophy of database design, as discussed previously, appears to be solid, yet the application in this scenario needs some retooling.

Follow-up on the application's success in this case was my role. It likely would never have been done had I not volunteered my services. Despite the grumblings on the part of the operators and myself, future revisions and bugs would be worked out of Oscar II, but wholesale change was not seen as required. Probably the most ironic aspect was that all Municipal Partnership presentations I attended lauded Oscar II as the most

advanced working application that had emerged to that point. My experience with the project illustrated to me that it was in fact the most advanced application, further reinforcing the notion that RMOC at the time was data-rich and application-poor.

Simple Tasks and Organisational Goals

The two departments in question view organisational goals in two very different ways. The GIS division, despite attempts to define short-term goals, measures its effectiveness in terms of data and application development in months or years. WOTR, on the other hand, measures its effectiveness in terms of the numbers of seconds required to correctly answer a taxpayer's call. Both groups use similar systems and identical data structures and models which are only configured in different ways. WOTR has a simple task (in terms of OSCAR I and II) and has simple organisational goals. It is a task, however, that has to be repeated many of thousands of times throughout a year and its goals are considered to be important by the Public Relations division at the RMOC. Calls to WOTR are often the only direct contact a client or taxpayer has with the RMOC and almost every call to the RMOC goes through WOTR.

In this case the technology required to meet the organisational goals was not complex. It appears, in fact, that the less technically complex solution better met the organisational goals through the simple tasks which it could carry out effectively. Management failed to recognise this in their implementation of the two systems in question, although it has not yet jeopardised service or the system.

An interesting concept that kept recurring to me during the analysis of WOTR and the OSCAR systems is that the telephone only offers one mode of communication, and

one which is limited at that. Over the phone, one cannot communicate graphics, tables or diagrams. Having this type of information is of little use unless it can be expressed in terms of verbal statements.

A good example of this is another task the operators of WOTR undertake. RMOC public works crews call WOTR via a two way radio located in the office to find out where water posts are located on any property in the region. In the many years of communicating this type of information to trained regional employees, the most effective communication model is still relatively crude. The operator provides the crew with an "L" measurement which consists of two numbers. The first is the distance from the front left corner of the house (x in figure 5.1) (when looking from the street) towards the street, and the second is the distance is from the end of first line towards the middle of the house (on a 90 degree angle) to where the water post is located (y in figure 5.1).

Figure 5.1

Although it sounds straight forward enough, corner lots, oversized lots, odd shaped houses, semi-detached garages, and a myriad of other problems render this system highly inaccurate. Until work crews are allocated fax machines or video display units or Global Positions Systems in their vehicles, however, this is the best system available.

Accomplishing the routine operations efficiently and effectively to meet organisational goals is not an easy task. The graphical displays which appear on the WOTR operator's

screen after an OSCAR II query is of little value to the client/taxpayer if the operator is incapable of communicating the information over the telephone. Even when the technology seems simple, it can often remain out of reach for any number of reasons.

Conclusion

The analysis of the WOTR application was not utilised in order to evaluate the entire GIS division at RMOC or the Municipal Partnership. It is similar to the Ramsay Township example as it emphasises the difficulties encountered when attempts are made to transfer GIS technology into organisational environments. As illustrated, many of the difficulties appear to be management oriented, or politically motivated. Changing standard bureaucratic procedures to accommodate the technology can be either beneficial or a recipe for disaster. The constant seems to be that disruption and change will inevitably occur. Much of the shift towards automation within organisations has been caused by this phenomenon. It appears that the reason why some GISs and desktop mapping systems have encountered more problems than others is that the technology was not originally designed for routine tasks, and implementations have been slow to illustrate how these systems can better meet organisational goals.

CHAPTER 6: CONCLUSION

In the introduction to this thesis, it was mentioned that some researchers are wary of case study research because of its inability to produce conclusions that apply to all implementation processes. The second chapter discussed the desire among researchers to devise common criteria with which one could analyse the implementation process and the effectiveness of GIS technology in general. Each organisation, and each sub-unit of every organisation, however, is characterised by its own social context into which technology must integrate. Hirschheim's conception, which defines ISs as "... social systems which rely to an increasing extent on information technology for their function" (from Campbell, 1991, 262), underlines the conclusions of this thesis. These organisational social systems, I would argue, would not have been put in place if they were not designed to help meet organisational goals. If the introduced technology fails to integrate into the social system, organisational goals will subsequently not be met, thus negating the value of the technology and the social system within which it works.

The process of organisational involvement undertaken within this thesis engaged many individuals and groups in order to explore the many aspects of GIS implementation and use within public institutions. The size of the administration at Ramsay Township allowed involvement in the evaluation, training, database development, data acquisition and application development of the system and with all of the participants therein. The Municipal Partnership allowed an analysis of the inner-workings of a large GIS development process as well as involvement with a focused application (WOTR).

Moreover, I was able to begin the process of application development itself. The experiences and subsequent knowledge generated through participation in these activities were far greater than any survey or questionnaire could have revealed. Although many questions were generated through this work and the social systems which were exposed could not be explained in their entirety, the research goals were achieved. The plethora of non-technical components involved in GIS implementation processes may be more generally suited to research within business studies. They do, however, impact greatly upon the use of technologies developed from within the discipline of geography, and eventually, will affect the use of the technology within the discipline as GIS products change to meet organisational demands. The inter-relationships between researchers who use GISs, the departments that teach GIS courses, the corporate GIS community and organisations that use GISs are greater than any one of these factions would probably like to believe. This thesis argues the least understood of all these areas is that of organisational GIS use. Organisational GIS use has, however, the greatest ability to impact on all of the other aspects of GIS use and development given the potential market.

Even a cursory analysis of the potential differences between public organisations, their legislated responsibilities, the division of functions between sub-units, and the size, scale and scope of the implementation processes that introduce GIS technologies would lead one to question the validity of generalisations made concerning any implementation process. The question then becomes: how can we better understand these systems within organisations and facilitate the transition of GIS technologies into organisational environments?

Further Research

It is concluded that user satisfaction as a correlate for GIS success is likely the most accurate form of analysis available for "system success" evaluation. Documented in the field of IS more than a decade ago (Ives et al., 1983), the use of user satisfaction, however, does not easily lend itself to statistical analysis. Moreover, as an inherently qualitative research method, it may never receive full support in the scientific community. Certainly a number of assumptions must be made when using a perception as an indicator within any analysis. One must assume that the user is aware that the GIS is making a discernible difference in either the quality or efficiency of the work she or he undertakes. Additionally, one must assume that the user is capable of understanding her or his role within the organisation, and either his or her position's objective or the goals of the organisation.

The process of differentiating a successful system from an unsuccessful system, however, does not even isolate, much less explain, the causal factors that differentiate them. If one cannot differentiate factors that explain success, can organisations afford to implement multi-million dollar GISs, evaluate their levels of "success", and then start all over if it is "unsuccessful"?

The difficulties encountered by researchers in this field (outlined in chapter 2) are reflected in the case study work carried out in this thesis. The traditional literature fails to address the differences in GIS use amongst end users. This thesis delineates these differences more clearly. The use of GIS technologies amongst IS technicians or trained planners and engineers, for example, is dramatically different than its use amongst those who are trained in other areas (clerks, administrators, accountants, politicians, etc.).

Focusing on specialised groups of users within an organisation is obviously critical to a greater understanding of the use of GIS technologies in general. Fortunately, future studies in this area are possible. Through participant observation and through more structured methods (longitudinal studies involving structured surveys and/or informal interviews), the study of the use of GIS technologies in achieving simple tasks is quite feasible. The process of involvement undertaken within this thesis with both Ramsay Township and WOTR are examples of this type of work.

The other broad area discussed within this thesis pertains to management and political issues. Gaining insight into the processes that drive large scale implementations will, in the long run, prove to be more difficult. While attempts have been made to gain access to this world (Campbell, 1994; Campbell and Masser, 1995), fully understanding the processes within these social systems is an enormous task. Even if one were able to design questionnaires, surveys and interview questions which could fully capture the many processes, working in a 'live' environment does not guarantee accurate disclosure from the participants who obviously have a stake in the project at hand. Furthermore, simply gaining access to all the participants would likely prove to be a challenging task. While I would have liked to have sat in on the high level meetings between RMOC administrators and executives from SHL, it was simply not possible. However, developing frameworks that allow researchers to participate in and observe these processes can be accomplished. Issues relating to levels of access, anonymity and researcher independence would become increasingly important, and would have to be more fully defined prior to further research activities.

The Future of GIS and Organisations

In terms of design, traditional GIS software vendors have potentially missed their opportunity to capture the available market. Waters (1993) argues that the refinement of commercial GIS technologies lags many years behind those in other areas of software development (Waters, 1993, 63). Part of the problem may have been the lack of focus on the niche markets that exist within the broad spectrum of GIS technologies. Given limited competition, GIS software vendors in the past have advertised that they can be all things to all people. In one "turn-key" system, they postulate that a GIS can combine complex spatial analysis techniques required by a small number of users with the user-friendliness and functionality required by the masses. In the retail sector, however, the two GIS software success stories are focused efforts that do not attempt to be all things to all people. Arc/Info by ESRI is successful and popular despite its high retail price because it has distinguished itself as one of the best tools for complex spatial analysis. The demand for trained Arc/Info programmers illustrates both its popularity and its difficulty of use.

At the other end of the spectrum, MapInfo has grown to dominate the desktop mapping market because of its user-friendliness and likely because it does not proclaim to be something that it is not — a full-blown GIS. Neither of these products, however, were designed specifically for organisational use. The strong analytical and display capabilities these packages contain, however, have been co-opted into hybrid systems for organisational use. No one software vendor has been able to capture what many perceive to be the middle ground between the two extremes. It is argued that it is not the middle ground, but territory that lies outside the traditional domain of what most consider to be

GIS technologies, that will allow GIS technologies to be most productive. Software that links mission critical data and their spatial entities with basic GIS functionalities which more closely approximate the needs of the average user (and subsequently organisational goals), could not only capture existing market share, but expand the market. It is concluded that this unmarked territory, defined by the simple tasks that meet organisational goals, is perhaps the most important component in the long-term success of GIS technologies within public and private organisations.

The failure of traditional GIS software manufacturers to seize this opportunity has left the door open. Large companies like Oracle, Illustra, Ingres, Informix, IBM and even Microsoft are considering entering, or have begun to enter, the field of spatially enabled Data Base Management Systems (DBMSs) (GIS World, 1996, 34-5). In an article entitled "Outlook '97: Industry Visionaries Examine High-Profile Issues" in GIS World (December, 1996, 34), the first question asked of the "visionaries" pertains to the increasing presence of these large companies in the GIS marketplace. As can be expected, most had a positive outlook for 1997 with reference to the GIS market and specifically, their own products. Some of the comments, however, are interesting. "My view is that this interest isn't really focused on the GIS market. It's primarily directed to adding the spatial dimension to enterprise data (i.e. simple spatial data types and simple spatial query functions)..." — Jack Dangermond, President, Environmental Systems Research Institute Inc. (GIS World, 1996, 35); "They may excel in specific technical products that improve GIS functionality..." — Jerry Dobson, Oak Ridge Laboratory (GIS World, 1996, 35). While many of the respondents encourage what one of them called "co-optetition" (co-operation and competition) between the two groups of companies, there were dissenting

opinions. Alison Brown, President of Navsys Corp., states: "I would expect this trend to continue, with more of the market share being captured by the larger players and only the most competitive smaller products remaining." (GIS World, 1996, 35), while Donald F. Cooke, President, Geographic Data Technology Inc., argues that the presence of Oracle and others "will make it technically easier and organizationally 'safer' for the pragmatic majority of data processing managers to adopt GIS technology. This should keep revenues growing even as software and data prices drop" (GIS World, 1996, 35).

The criticisms of GIS design in Chapter 3 were not directed at the tasks that GIS programs are designed to carry out. It was argued, however, that technical advancements in GIS have been achieved at the expense of usability. Has the corporate GIS community conceded part of what was its clientele over to the traditional IS companies? Has the corporate GIS community accepted that research and advanced applications are their only domains? To speculate on the future of organisational use of GIS under the control of the large IS companies is not within the scope of this thesis. A question which can be asked, however, is this: If error representation and the ethical use of spatial data is difficult when developed by geographers, can database specialists improve, or invent, these capabilities?

The comparison of the case study research illustrated that the use of these technologies to reach organisational goals (primarily through the proper execution of simple tasks) would better position the technology within an organisation in terms of its long-term success. Both Ramsay Township and WOTR have fairly clear organisational goals, yet the technology, in both cases, was not directed specifically towards those goals. In the case of Ramsay Township, the technology was not being applied to the Roads

department which consumed more than 50% of the annual budget. Within WOTR, goals can be measured in terms of the number of seconds required to provide a client with an answer. OSCAR II failed in this respect. The technology existed within the Municipal Partnership to improve this situation, even within WOTR in the OSCAR I application.

Although GIS technologies have existed within the discipline of Geography and some organisations for many years, the collective understanding of their uses, benefits and drawbacks is still quite limited. My research and the process with which I was involved exposed me to many individuals who were not trained in GIS technologies, from the roads crew at Ramsay Township to Regional Councillors, department heads and directors of organisations. Every conversation and unstructured interview involved the explanation of the technology at some level. GIS technology remains a highly specialised field. While users and managers bring different levels of experience with GIS and IS (what Danziger and Kraemer, 1986, 10 call 'sociotechnical interface'), the overall level of competence and understanding brought to GIS use must increase substantially. The research illustrates that the lack of information and knowledge amongst individuals caused great difficulty. Neither staff, managers, nor councillors were able to determine the long-range goals of the desktop mapping system at Ramsay Township because they were simply not capable of determining what the system could and could not do. Telephone operators at the RMOC were aware that OSCAR II could be better but were unable to communicate this to members of the GIS division. The lack of enthusiasm towards the economic development initiative was partially driven by ignorance towards both the internet and GIS technologies in general.

There is no question that the use of spatial information analysis techniques is increasing within small and large organisations. This requires that more and more individuals become spatially literate. Developing and utilising methods that understand both the technological systems and the social systems driving these uses is imperative. This thesis illustrates that many problems exist with both the technology and our understanding of the social systems within which they operate. Additionally, there are many difficulties with the methods through which we can better understand these problems.

A greater awareness of these obstacles amongst all users is required to improve the situation. We should not expect, however, that an increase in awareness will be forced upon us by GIS software developers. Software sales pitches rarely include sections entitled: What this system cannot do; Why you don't necessarily need a GIS; New staff required to maintain system; Likelihood of failure. While this will not (or should not) ever happen, it is important because many institutions, especially smaller ones, are often entirely informed by software vendors or commercial information.

While the regulation of the use of the tools is not a requirement within the discipline of geography, the promotion of a greater understanding of GIS technologies should be encouraged. Many geography departments within North America are promoting the training and application of GIS technologies in an effort to bolster enrolments and remain viable. It is unrealistic to believe that all of these individuals will use their skills in either research or advanced applications. There is every reason to believe, however, that their skills will be required in many organisations that use, but are not dependent on, spatial information.

APPENDIX I — Ramsay Township's GIS: Analysis and Recommendations

**RAMSAY TOWNSHIP'S
GEOGRAPHIC INFORMATION SYSTEM:
ANALYSIS AND RECOMMENDATIONS**

April 24, 1995

prepared by:
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and submitted to:

**Ramsay Township
Planning and Development
Committee**

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EXECUTIVE SUMMARY

The objectives outlined by the Geographic Information System (GIS) sub-committee of Ramsay Township were fully realized by the time the sub-committee disbanded in the fall of 1994. However, little attention focused upon the long-range objectives the GIS was to achieve, and the manner in which they were to be carried out.

A valuable resource presently exists within the Township office. Achieving the greatest degree of productivity through the use of the system is imperative if it is to obtain long term support from both staff and council.

Presently, the greatest barrier to improved productivity through the GIS lies not within the system itself, but with the use of the system as a tool. The human component, rather than the technical component, therefore, is of greater concern to the study in question.

Three areas of concern were identified:

- 1) Training and Development
- 2) Data Requirements
- 3) Long-Range Policy Development

RECOMMENDATIONS

1) Training and Development

Given the level of expertise in GIS related technologies within the Township office and the nature of the difficulties encountered by staff, even a relatively small increase in the formal knowledge base of staff members would lead to significant gains in almost all areas of GIS productivity.

Background knowledge would help staff overcome numerous real and potential problems, decrease Down-Time, reduce the likelihood of costly errors, and help considerably in the long-range development of GIS activities within the Township.

One of the following four training strategies should, therefore, be pursued.

1. Formal Training through Intera-Tydac® on SPANS Map® software.

Staff member would attend one or more of the workshops provided by Intera-Tydac(see Appendix 1) and work in a group setting.

2. Formal Training through Gregory Geoscience and Mr. Harold Moorer.

Staff member would work directly (one on one) with individuals at Gregory Geoscience possibly working with Ramsay Township data.

3. Informal Training with the assistance of Mr. Harold Moorer.

Staff member would experiment and work through SPANSMap© applications independently one half day per week, meeting with Mr. Moorer monthly to discuss problems and set up new challenges.

4. Formal/Informal Training through a summer student employee with the assistance of Mr. Harold Moorer.

Staff member would work directly and continuously with a student employee with a GIS background in order to guide study of the GIS and develop more GIS applications.

2) Data Requirements

Database maintenance and upkeep are important requirements that, while being technical, are important to the integrity of the GIS over the long term, and therefore, must be addressed.

1. The relationship with Gregory Geoscience in creating and maintaining complex data layers should be preserved. The maintenance of base layers should occur, at minimum, every two-three years, effective immediately, under the direction of Gregory Geoscience.

2. Through appropriate training, it should be required that one or more staff members acquire basic database management techniques in order to add and change basic non-geographical data which would increase efficiency and reduce cost.

3. The hard data from which information was collected for the various data layers on the GIS are not necessarily legally accurate, and should therefore not be utilized for legal purposes. It is recommended that, at the very least, a legal disclaimer be placed on any such material to prevent misunderstandings, and possible libellous situations.

3) Long-Range Policy Development

At present, GIS development is reactive as opposed to pro-active, and is progressing inefficiently due to several factors. Coherent questions must be asked of those involved in order to develop appropriate GIS policy responses.

1. Every two-four months, a GIS steering committee should meet to discuss relevant GIS activities within the administration of the Township in order to direct GIS development, aid staff in choosing appropriate GIS activities, and ensure good communication between relevant parties.

2. A set of short policy and operational documents should be generated by GIS staff or other trained individuals regarding basic and more advanced GIS procedures to ensure clarity of operational procedures amongst all GIS users at the Township office.

2. INTRODUCTION AND BACKGROUND

Ramsay Township identified Geographic Information Systems (GIS) as a spatial tool as early as 1991 through the GIS sub-committee, under the direction of the EDC. Agricultural monitoring was identified as the first key variable, and the GIS was subsequently developed along these lines. The objectives of the GIS sub-committee were met with the introduction of the stand alone SPANSMap© package on the 486/33 platform dedicated to GIS use in early 1994. The choice of SPANSMap© software was based upon the intended use of the system (agricultural monitoring) and the potential for support services through Gregory Geoscience and Mr. Harold Moorer. It should be recognized that this decision was not based upon the GIS choices of other governmental agencies, and was not chosen based on service provision requirements.

The provision of an in-house system which would provide staff with the ability to generate maps on the basis of many data layers (provided externally) was effectively met and presently exists. A valuable resource now sits within the Township office, but the manner in which this system is actually used has not been fully explored, much less, exploited. Initial hardware difficulties have limited the use of the system, data has not been updated, and integration into the office environment has been slow. The GIS sub-committee disbanded at the end of the previous council's term (Nov. 1994), and after having implemented the system, any subsequent progress has been realized slowly.

The solicitation of outside help in addressing these problems has come through the Center for the Study of Training, Investment and Economic Restructuring (CSTIER) at Carleton University, and has manifested itself in this report. In analyzing the present status of the GIS and possible short term and long term solutions, this report is designed to act as both a reality check and as a springboard towards future action.

A valuable resource now sits within the Township office, but the manner in which this system is actually used has not been fully explored, much less, exploited.

3. METHODOLOGY

As mentioned, the GIS system conceived of by, and developed through, the GIS sub-committee presently exists within the Township office and is available for use. It was decided, therefore, that looking towards expanding the system at this time was not a useful exercise, as the potential that exists within the present system was not being used to its fullest capacity. It was necessary, therefore, to look towards the human components which directed and utilized the in-house GIS in order to understand the difficulties in terms of acceptance and use which the GIS faced.

A series of interviews provided the basis from which this study took place. Key persons were identified who were both directly responsible for the GIS, as well as those who oversaw its use within the Township as a whole. While the questions varied in terms of their technical content, they were designed to flesh out several key themes:

- What was the individual's conception of both a GIS specifically, and the way in which it could help Ramsay Township?
- What products have been produced through the GIS, and how have they been received, both by the individual themselves and those around them?
- How would the individual rate the acceptance of the GIS and its integration into the everyday working environment of the Township?
- How would the individual rate both his/her own morale, and that of both staff and Council, as it pertains to the support of the GIS and its use?
- What support networks exist (both formal and informal) for the GIS itself and its users?
- What possible future applications could the individual identify as even possibly being related to the GIS?

It was quickly identified that, in general, morale towards the system was quite positive, but that there were definite concerns and a certain degree of residual scepticism which had not yet been entirely overcome. Furthermore, while the tendency still existed among individuals to discuss the broad, long range objectives of the GIS, it became obvious that if the GIS was to be considered a success and obtain a long term commitment on behalf of both staff and council, tangible progress must occur within the working environment of the Township office.

It was necessary to look towards the human components which directed and utilized the in-house GIS in order to understand the difficulties in terms of acceptance and use which the GIS faced.

4. RESULTS AND RECOMMENDATIONS: 3 FOCUS AREAS

4.1 Training and Development: Immediate and Future Needs

The effectiveness of the GIS as a tool is directly related to the ability of the user to exploit the characteristics available within both the system and data sets which are available. Not only must one learn the commands, syntax and intricacies of the user interface, but one must also have a rudimentary understanding of the way in which a GIS operates in order to understand the system's capabilities, and its accuracy, and even to understand the on-line help and hard-copy documentation provided. If this is not the case, the original capital outlay on hardware, software, and data is effectively nullified.

While contracted formal support in terms of data capture and even technical expertise is necessary upon start-up, the training of users is imperative if the relationship is to grow, and productivity is to expand. Outside technical expertise is not capable of overcoming everyday hardware and software glitches, nor is it able to intuitively understand the requirements of the Township unless an individual is able to express those needs in a clear and coherent manner.

4.1.1 STATUS

At this stage of GIS development in Ramsay Township, even the most minor problems effectively nullify the GIS and its effectiveness until it can be resolved by an outside agent. As it stands, there is no formal, ongoing relationship with any outside agency, and subsequently, no direct GIS support. Printer and Operating System difficulties have occurred, disrupting the use of the GIS which technically have little to do with the GIS software itself.

Other problems include:

- The present GIS user, Kelly McGregor has received one (1) day of formal training.
- No other staff member has any formal or informal training on the system
- Previous difficulties have resulted in reservations experimenting with the GIS.
- There is a great deal of uncertainty as to which applications should be directed towards the GIS.

4.1.2 BENEFITS OF TRAINING:

A more rudimentary understanding of the GIS and its operating environment would aid a staff member to:

- recognize and identify problems (real or potential).
- recognize the source of any problem:
 - hardware
 - GIS software
 - operating environment
 - difficulties with data
- overcome simple problems: printer difficulties, file management, etc.
- reduce the likelihood that costly errors will occur:
 - data loss, file corruption,-hardware failure, etc.

These would help increase the daily efficiency of the GIS itself and dramatically reduce Down-Time

- develop some conceptions as to the accuracy and reliability of output
- determine whether the GIS is most efficient for certain tasks, and whether they should be pursued, if appropriate.
- determine which sources should be consulted to pursue certain initiatives, and more importantly, to be able to express those concerns in the most appropriate manner possible.

These would help in furthering the long-range objectives of the Township.

It should be noted that at present, none of the functions listed above are being carried out within the Township Office and that even a small increase in the knowledge base of the staff would lead to significant gains in almost all of these areas.

Greater integration, acceptance and use can only occur if at least one staff member is able to conceptualize and understand the abilities and realities which the GIS offers. Not only will that staff member begin to think of the possibilities the GIS affords, but in simply using the machine and experimenting, comfort levels will grow, results will begin to be realized and, by definition, integration, acceptance and use will occur.

4.1.3 RECOMMENDATIONS (TRAINING)

Increasing the GIS autonomy of the Township staff is the primary recommendation offered by this report. Staff training should be seen as imperative in order to increase the efficiency of staff by allowing them greater access to the potential tool contained within the system which already exists. Increasing GIS literacy allows for communication between both the user and the system to increase, as well as between the user and potential sources of support. There are four primary ways in which effective training can be achieved.

4.1.3.1. Formal Training through Intera-Tydac© on SPANSMap© software.

Staff member would attend one or more of the workshops provided by Intera-Tydac (see Appendix 1) and work in a group setting.

- + obtain knowledge of SPANSMap© software quickly and efficiently.
- only two - one day courses offered, one of which Mr. McGregor has attended
- inability to work directly with Ramsay Township data and applications
- cost- very expensive

4.1.3.2. Formal Training through Gregory Geoscience and Mr. Harold Moorer.

Staff member would work directly (one on one) with individuals at Gregory Geoscience possibly working with Ramsay Township data.

- + obtain advanced knowledge of SPANSMap© software quickly and efficiently.
- + possibility of working directly with Ramsay Township data and applications.
- advanced knowledge may not be required at this time
- cost- very expensive

4.1.3.3. Informal Training with the assistance of Mr. Harold Moorer.

Staff member would experiment and work through SPANSMap© applications independently one half day per week, meeting with Mr. Moorer monthly to discuss problems and set up new challenges.

- + ability to work directly with Ramsay Township data and applications.
- + very inexpensive
- knowledge base would grow more slowly
- fundamentals of GIS may never be obtained
- possible that mistakes or errors could have a detrimental effect - less guided.

...cont'd

4.1.3.4. Formal/Informal Training through a summer student employee with the assistance of Mr. Harold Moorer.

Staff member would work directly and continuously with a student employee with a GIS background in order to guide study of the GIS and develop more GIS applications.

- + ability to use actual Ramsay Township data and applications.
- + less expensive than one on one tutoring by a 'GIS expert'
- + new applications may develop more quickly with the help of a summer student, knowledge would increase more quickly than with self-guided study, and errors would be less likely to occur.
- + during training period, a GIS trained individual will already be in place.
- could be expensive based on term of contract and the other duties assigned to the summer student.
- depending upon abilities of summer student, accumulated knowledge base could be less than using a 'GIS expert'.

4. 2. Data Requirements

Of the three focus areas, the data requirements of the Township is perhaps the most easily overcome, but its importance should not be understated. Quality information within the system is imperative, and is an area which has not been ignored by those who have developed the GIS. There are, however, ways in which data collection and use may be carried out in a more efficient manner, and are the focus of this portion of the analysis.

4.2.1. STATUS

Gregory Geoscience, through Harold Moorer, have organised and implemented a series of data layers based on information available to Ramsay Township. These data layers have not been updated since they have been installed on the machine, and obviously, should be, if the GIS is to be utilized to its fullest potential. If the Township is truly dedicated to the long term use and effectiveness of the GIS, clearly, all efforts should be made to maintain the database.

The relationship between Ramsay Township and Gregory Geoscience has been profitable, in that there now exists a number of data layers which are of great value if

utilized correctly and properly maintained. Preserving this relationship is important, and is necessary for the maintenance of the more complex aspects of the database and perhaps for more advanced GIS analysis and assistance.

- A base set of data layers presently exists within the system.
- The land registry information has not been updated in almost two years.
- The accuracy of each data layer is not clearly understood by staff users.
- Staff are unable to manipulate or update the database in any way.

4.2.2. BENEFITS OF MAINTAINING AND UPGRADING THE DATABASE

The benefits of maintaining the basic information contained within the GIS should be self-evident. Without an accurate base, the information which is obtained through the system becomes less and less valuable.

The layers and the database information within the GIS exist on many levels, however. While some information is very complex and requires the formal knowledge of a GIS expert, the addition of lower level data is not intrinsically difficult. In determining which layers, or portions of layers, could be maintained in-house by staff when their schedule's allowed for it, not only would the accuracy of the GIS be increased more quickly, but the costs of database maintenance would dramatically decrease. It is simply not worth contracting out expensive data layers simply for the purposes of data entry. For example, it was suggested that the years of building construction could be added in order to determine the rate of strip development. This *may* simply involve the addition of a database field and a few labour hours of data-entry.

4.2.3. RECOMMENDATIONS (DATA REQUIREMENTS)

4.2.3.1. The relationship with Gregory Geoscience in creating and maintaining complex data layers should be preserved. The maintenance of base layers should occur, at minimum, every two-three years, effective immediately, under the direction of Gregory Geoscience.

4.2.3.2. Through the training of the staff member(s), it should be required that one or more staff member acquire basic database management techniques in order to add and change basic non-graphical data which would increase efficiency and reduce cost.

4.2.4. DATA ACCURACY AND LEGAL RESPONSIBILITIES.

Another related issue that is linked with data maintenance is that of data accuracy. The hard data from which information was collected for the various data layers on the GIS are not necessarily legally accurate, and should therefore not be utilized for legal purposes. It should be well understood that, for the most part, the GIS is a graphical representation that is in no way more accurate than the least accurate component which was used in its design, if not more so, due to error propagation.

Perhaps a review of the way in which the output is to be used is necessary, before further developing public services based on the GIS. If released to the public or outside government or non-government agencies, the data, and accuracy thereof, is the responsibility of the Township, and should be represented as such. I would recommend, that at the very least, a legal disclaimer be placed on any such material in the future in order to prevent misunderstandings, and possibly libellous situations. Moreover, a staff member more properly versed in the collection and manipulation of the data contained

within the GIS would be better able to express the degree of confidence with which the data contained on the GIS was suitable and appropriate.

The hard data from which information was collected for the various data layers on the GIS are not necessarily legally accurate, and should therefore not be utilized for legal purposes. It is recommended that, at the very least, a legal disclaimer be placed on any such material to prevent misunderstandings, and possibly litigious situations.

4.3. Long-Range Policy and Document Development

The GIS sub-committee established under the EDC during the previous council term introduced and developed the GIS into Ramsay Township administration under certain guidelines and objectives. Those objectives have clearly been reached. The GIS is now in place, the data layers, for the most part, exist, and a great deal of potential has now been placed in the hands of those who must now utilize it. The danger is to see this as the end of the process. GIS development is new, and must be developed pro-actively as opposed to haphazardly. There is a need to continuously address those issues which are relevant to the GIS and work towards slowly achieving greater efficiencies and productive information through the GIS.

4.3.1. STATUS

As it stands, the system and the staff are behaving in a re-active manner, only dealing with those issues it comes across, achieving little, because of the lack of formal networks to obtain the correct answers. Moreover, the questions which are being asked are not being asked in a coherent manner. At the same time, those functions which the GIS has adopted are done so informally, and are not documented in any way shape or form. There is a need, therefore, to generate some positive policy initiatives that can evolve over time to improve the use of the GIS as a tool, and concurrently, entrench the GIS into the everyday working environment of the Township.

4.3.2. BENEFITS OF DEVELOPING LONG-RANGE POLICY

- allow GIS development to be pro-active than re-active
- advise GIS staff on directions towards which GIS development might take place
- aid GIS staff in deciding upon which functions are appropriate for the GIS
- maintain communication between staff, Mr. Moorer, and Ramsay Township
- help entrench the GIS within the working environment of the Township office

4.3.3. RECOMMENDATIONS (LONG-RANGE POLICY)

Bringing together certain key individuals on a regular basis to discuss the continual development of the GIS would be an appropriate way to generate continual discussion over the many relevant issues. Even if every three months, the staff member in charge of the GIS were to meet with Mr. Moorer from Gregory Geoscience, perhaps a member of the Planning Committee, and other interested parties (Don Duncan, Jim Cochrane, etc.) to discuss the achievements to date and future developments pertaining to the GIS, the exercise would be fruitful in that the staff member could then work with that information throughout the following three month period. Simply developing a clear set of coherent questions which concretely relate to the use of the GIS would be an excellent way to ensure pro-active development of the GIS over time.

4.3.3.1. Every two-four months, a GIS steering committee meet to discuss relevant GIS activities within the administration of the Township in order to direct GIS development, aid staff in choosing appropriate GIS activities, and ensure good communication between relevant parties.

4.3.3.2. A set of short policy and operational documents be generated by GIS staff or other trained individuals regarding basic and more advanced GIS procedures to ensure clarity of operational procedures amongst all GIS users at the Township office.

5. CONCLUSION

Difficulties in adopting GIS technology into any environment often occur in the areas of training and data acquisition. Hardware and software costs often represent only a fraction of the total cost of GIS development.

In Ramsay Township, data requirements were not initially overlooked, and while they are now in need of updating, this process should be relatively simple given that it has already taken place in the past. It is important to remember, however, that the quality of data is not perfect and should not be represented as such.

The greatest obstacle lies within the GIS related knowledge of staff members and their ability to effectively communicate with both those who desire GIS related output and the technical expertise which will allow them to generate useful material. Coherency amongst all these groups is imperative. Without solid grounds upon which communication can take place, development cannot occur and acceptance and use will be slow. Moreover, without an end product, constituents, council and staff may become disillusioned in terms of the system. If this occurs, unfortunately, it will probably be for the wrong reasons.

Township council has indicated support for the system through the initial capital outlay, and through continuing financial support. Plainly speaking, it is the responsibility of those who are directing its use to spend those dollars in the most appropriate manner possible in order to allow this project a legitimate shot at success. Situating the system within the township office may actually have been the easiest step. Directing and guiding its use in the most appropriate manner is the challenge which all those involved now face.

6. APPENDIX 1:

Intera-Tydac SPANSMap© Training Schedule

In consulting Ms. Lisa Andrews of Tydac Technologies located in Nepean, Ontario, the only commercially available training courses which are directly related to SPANS Map, include:

Desktop Mapping with SPANS Map

(Thursday, February 9 and Wednesday, March 8, 1995 •cost: \$330*)

This one-day course will allow you to discover hidden worlds in your data using SPANS Map as a visualization and query tool. You will learn how to:

- *link map, chart and spreadsheet data,*
- *produce reports by querying the database*
- *create maps and charts, and*
- *print and plot paper maps*

and

Map Output: Principles and Practice

(Friday, February 10 and Thursday, March 9, 1995 • cost: \$330*)

This one-day workshop combines the principles of cartography with hands-on experience using the map composition and printing capabilities of SPANS Map. You will:

- *learn the most effective choropleth/ shading choices for maximum impact,*
- *integrate required cartographic elements with mapping information to produce powerful results and*
- *discuss the role of serial and parallel communications with associated trouble-shooting, tweaking and maximising results.*

* appropriate taxes are extra

(information obtained by fax from Tydac Technologies on April 20, 1995)

7. APPENDIX 2:

FUTURE RAMSAY TOWNSHIP GIS APPLICATIONS: IDEAS

An integral component of the many interviews undertaken for this project and a primary underlying theme was the future potential applications to which the GIS could be dedicated in order to improve efficiency. While the recommendations contained within this report are more concerned with the creation of an environment in which these concerns can most efficiently be addressed, it is appropriate to list some possible applications. There has been no formal evaluation of any of these potential applications at this time, however. The components of these applications involve varying degrees of complexity, and hence, cost. These ideas should, therefore, be seen as a working list as opposed to a concrete schedule of activities.

Activities can be divided into two separate areas:

MONITORING APPLICATIONS

- With new planning regulations and (Ont.) Bill 163 emphasizing environmental monitoring, the GIS offers unique opportunities to utilize the functions which were the basis for its choice as a hardware/software platform. Informing residents of environmental implications not only by distance from site, but through other factors, such as watersheds or flood plains, for example, could be beneficial. Moreover, the 1994 Draft Official Plan also recognizes maintaining land inventories as necessary, to which this function is appropriate.

- Monitoring the assessment ratio of the Township (% commercial/industrial vs. residential) is possible, including the potential modelling of proposed changes.

- Monitoring strip development is possible given the inclusion in the database of dates upon which buildings were built through development permits in the Township over the last 20 years or longer. Modelling future development is possible, but would seem to be much more difficult, with accompanying costs.

SERVICING APPLICATIONS

- Organisations providing municipal services are often very much interested in improving efficiency of service delivery within their jurisdictions. For the most part, these services are provided along routes. Road networks, power lines, garbage pick-up, school bus routes, police and fire accessibility, and possibly, sewer networks. The choice of a raster based (SPANS Map) GIS does not inherently lend itself to these sorts of applications, and for this reason, has not been the choice of many other.

- A rural, agricultural base is more appropriate for raster-based GIS, and software increasingly is more able to handle different types of information (SPANS Explorer, for example). While this is more of a long range goal, this should not preclude efforts to advance in any of the areas listed above.

8. APPENDIX 3: STUDY ANALYSIS

As this project was the first connection between Ramsay Township, CSTIER and the Geography Dept at Carleton University, this brief analysis outlines the way in which I undertook the project, as well as its benefits and drawbacks. It is hoped that this might provide some insight for future students attempting such projects in order to achieve the best possible outcome for all parties.

December, 1994/ January, 1995: Through a great deal of discussion between myself, Ramsay Township and CSTIER, it was decided that a project of some kind could be developed. Narrowing down to a specific focus, however, was much more difficult. While it was eventually decided that the GIS would be an appropriate project, many ideas were considered; some very broad and policy oriented, while others were very specific.

As a student looking for experience, I was willing to help in any way possible, and fortuitously, the people at Ramsay Township were adamant that my work for them relate to my academic work. For this reason, however, the process became somewhat drawn out.

It became somewhat evident through this process, however, that pursuing a personal interest of mine would be most beneficial, as interest on my part would necessarily imply a greater stake in the project, and better results in the end.

February, March, 1995: During this period I was undertaking interviews and research. All the individuals approached were more than willing to help. While the interviews were fairly informal, they went smoothly, and a great deal of information was obtained. Time restrictions prevented me from interviewing all those I would have liked to have contacted, but a sufficient amount of data was obtained, in my opinion. Additionally, more exposure to the SPANS Map system would have been appreciated, but as my report indicates, this was not necessarily required.

April, 1995: Writing the final report was challenging in that it was not an academic research paper, but was designed to fulfill the needs of many different individuals. Tailoring the report to suit all needs, however, is not possible, and approaching the best possible compromise was difficult. I found that aiming for simplicity and clarity, while lacking intense detail, was the best approach to communicate the three or four primary concepts which I felt were most important to the study in question.

The process was incredibly instructive and allowed me to obtain a great deal of experience. While I would encourage any student to undertake such a project, I would also recommend that they should not be shy about pursuing her/his own interests and to ensure for themselves that their schedule conforms with that of the outside organisation.

APPENDIX II — WOTR REPORT

WOTR REPORT

January 3, 1996

Goal and Objective

- To help improve the efficiency of WOTR's Waste Management Application
- In analysing the operational context of the application within WOTR, to suggest ways in which the application might be refined in order to improve client service

Today's Situation

Two programs (Oscar 1&2) have been introduced in WOTR:

Oscar 1 is simple, efficient and is being used regularly:

text driven

locally accessed

direct hits yield pertinent information quickly and efficiently

low level of detail, and requires some user knowledge of streets

Oscar 2 is more cumbersome, less efficient and used sporadically, yet it is more powerful and up-to-date:

network access (slower but more up-to-date)

graphics included on each request

higher level of detail, better problem-solving abilities, more powerful querying capabilities

Susceptible to many processing difficulties: hanging or rejecting users

Discussion

The Waste Management Application fits the operational environment of WOTR adequately. Oscar 2, however, is not used on a regular basis as it is prone to hanging, processing time is far too long, and the user is occasionally rejected from the system. Much of the waiting time seems to be devoted to querying graphics off the network. Although graphical information is useful, it is not required by the operator in most situations. Allowing operators the option of searching graphics only when required would not only be less confusing to the operator, but would likely reduce processing time.

Moreover, the accuracy level required does not necessitate downloading information in real-time. A weekly (or perhaps even monthly) update of the system would allow it to operate independently of network processing demands.

Finally, encouraging operators to use the SEARCH/ADDRESS query function in Oscar 2 will undoubtedly reduce confusion and search times, while improving service immensely. As address range coverage increases, this will become the only search method requiring little or no operator knowledge of streets. This function will allow the system to take on a broader role within WOTR in addition to its waste management application.

Recommendations

The next step in the Waste Management Application appears to be the development of a hybrid application which uses Vision software technology but works in much the same fashion as Oscar 2. Within this context, certain modifications to the program could be of great value:

The overall stability of the program must be enhanced to improve the processing time and to decrease program failure. Isolating the system from the network with periodic updates would likely reduce processing time and increase program integrity. An increase in the coverage of address range data is necessary in order to allow for direct searches of municipal addresses. Direct hits (through either municipal addresses or by entire street) should lead directly to the data table with the option to call on graphics if necessary.

APPENDIX III — PROJECT IDEAS/RATIONALE**PROJECT IDEAS/RATIONALE**

January 26, 1996

Areas of Focus within RMOC project and my work

Project does not have specific mandate to address potential external users at any level.

This gives me a fairly wide range within which to work and allows me to work at my own schedule/pace. It does mean, however, that I will be the largest proponent of work in this area (and must convince others to devote resources to it) while it also places more responsibility on my shoulders.

The main idea is to create new and better ways of disseminating (re-packaging) geographic information for use by a wider range of non-specialist users. The challenges faced by this project are, for the most part, not technical:

Primarily, I would argue that a useable product must be intuitive and fairly basic while providing the user with a fair amount of information. There is a base of literature which illustrates this problem and outlines more user-defined methods of product/application development.

Secondly, however, there exists very real political implications in terms of access and availability to data which directly affect my role within the project. While there are many very interesting dynamics at play between the executive/legislative arm and the administrative arm of the organisation, positioning myself between them might not be the best move I could make.

This was discovered fairly clearly through a meeting with the councillor's assistants and the project co-ordinators in mid-January. Information needs amongst this group of non-specialist users is great, while the working environment is quite complex. A certain degree of clarity was shed upon the nature of information at the RMOC by Rob Dolan, head of Public Affairs, in a meeting soon thereafter.

As the Public Affairs group, Mr. Dolan's unit is to act as the gatekeeper of outgoing information from the region. In doing so, they must negotiate the dynamic between departments and councillors on a continual basis. Moreover, the goals outlined by Mr. Dolan seem to be more in

keeping with my work. There are, therefore, several arguments as to why I should work within this unit:

- 1) The goal (outlined above) which describes the desire to serve the public more effectively can more easily be achieved. This also makes justifying the project at a larger scale more feasible.
- 2) Public Affairs is already involved with information delivery methods which may become pertinent to the study in question (WWW pages, etc.).
- 3) The question of politicized information is less significant due to the structure of the project. Public Affairs would not only act in an advisory role, but also act as a buffer to other interest which could monopolise the project.
- 4) The tasks of the Public Affairs Unit are more focused and cohesive than previously defined groups.

POTENTIAL PROJECTS WITHIN PUBLIC AFFAIRS

Two potential applications could be developed

1) NAVIGATIONAL BROWSER FOR INTERNAL PURPOSES

Providing Public Affairs staff with a navigational GIS browser which allows them access to as many data layers as feasible in a user-friendly computer environment. This project would focus around determining which layers are most important, and how much analytical capability should be woven into the system. While being a non-specialist user group, this would undoubtedly require some training of staff, in order to be able to extract the types of information required.

This project would tend not to be very politically sensitive in terms of information provision in the developmental stage. Once established, the onus would fall onto the users within Public Affairs to use the information at their own discretion. Whether the information is used directly (published, etc.) or as background information would be their responsibility.

Special efforts would be made to ensure that print copies could be made from digital productions. One must remember, however, that information used by Public Affairs will likely, at some point, enter the public domain, and may face the scrutiny of outside observers in terms of error. As non-specialist users, it may be unclear to this unit which layers are of credible accuracy.

2) ECONOMIC DEVELOPMENT INFORMATION SITE FOR EXTERNAL USERS

In order to more fully recognise the goal of serving external non-specialist users, the establishment of an externally accessed site which provides information as to development possibilities in the RMOC could benefit many groups of users, and, at least upon first glance, would have few detractors.

Mr. Dolan indicated one of Public Affairs' roles is to provide detailed information to potential investors in the Region. While this project would potentially integrate more sensitive information, it would be done in conjunction with Public Affairs, and within their jurisdiction. It would be affiliated with the other WWW pages already produced by public affairs. While it may not exist specifically as a WWW page, the idea would be similar, in that interested parties could get into a directory or browser which allows access to various types of information at different scales.

Graphical information would illustrate transportation routes and potentially available land, development restrictions and charges, as well as community profiles. The level of detail must be considered more objectively and will undoubtedly evolve.

Probably the most attractive aspect of such a project is the desirability of such a system on the part of many different groups. The GIS/ISD group as well as SHL will have a public stage upon which to illustrate their technical capabilities, the business community (OCEDCO) will receive publicity and could contribute information and resources, while Public Affairs and the Regional Council will receive greater attention and awareness.

While it could be argued that the groups which will benefit the least are community groups which desire information to regulate their own environments, I would contend that this system would provide a base from which such a system could eventually be developed. Moreover, despite its auspices, such a system which contained cursory demographic information (such as community profiles) and information related to development could be beneficial.

It is my opinion that the latter proposed project would more fully fulfil the goals outlined as well as the wishes of other groups involved with the RMOC's GIS project. Discussions will continue with the interested parties to determine its feasibility and the desire to follow through on such a project.

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