

**An Evaluation of Inter-Local Government GIS Integration in British
Columbia, Canada**

M.Sc.

Kenneth R. Johansson

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Abstract

Geographic Information Systems (GIS) have evolved in the local government environment from departmentally based tools used to address an isolated problem or set of problems into a potentially enterprise based tool capable of integrating many other business systems and processes. The next logical step in the evolution of a GIS is to enable integration beyond the corporation of which it was initially implemented.

To this end, this research has examined the degree to which there is GIS integration among local governments in British Columbia, Canada, and has evaluated what the impacts of this integration might be. It has been found that this step requires both changes in the technology and changes in the way an organization operates.

Once the current level of GIS integration between local governments was determined, various alternatives were defined against an ideal inter-local government GIS integration environment. From this evaluation of integrated and non-integrated environments, it will be shown firstly, that it is possible to integrate local government bodies to achieve an ideal GIS environment and secondly, that it is a superior model to the current status.

Table of Contents

Abstract.....	ii
List of Figures.....	iv
List of Tables.....	iv
Declaration of Originality.....	v
1. Introduction.....	1
1.1. Efficiency Benefits.....	2
1.2. Effectiveness Benefits.....	3
1.3. Enterprise Benefits.....	3
1.4. Societal Benefits.....	4
1.5. Integration Barriers.....	4
1.6. Research Approach.....	6
1.7. Research Aim.....	6
1.8. Research Objectives.....	6
2. Literature Review.....	8
2.1. Integration Benefits.....	10
2.2. Integration Constraints.....	11
2.2.1. Technical Considerations.....	12
2.2.2. Organizational Considerations.....	14
2.3. Summary.....	18
3. Methodology.....	20
3.1. Research Methodology.....	20
3.2. Research Approach.....	24
3.3. Thesis Outline.....	26
4. Background.....	28
4.1. History and Function of Local Government in British Columbia.....	28
4.2. Local Government Overview.....	29
4.3. Organizations Effecting Local Government Integration.....	30
4.4. Summary.....	31
5. Research.....	33
5.1. Ideal Inter-Local Government Integrated GIS Requirements.....	34
5.1.1. Fitness for Purpose Test.....	34
5.2. Current Inter-Local Government Integrated GIS Environment.....	45
5.2.1. Fitness for Purpose Test Responses.....	47
5.3. Alternate Inter-Local Government Integrated GIS Environment.....	49
5.3.1. Development of an Alternate Integrated GIS Environment.....	49
5.3.1.1. Rules and Procedures Applied (Requirement Id Org2).....	52
i. AR cycle 1 (Create Data Sharing Opportunity).....	52
ii. AR cycle 2 (Automate Existing Data Sharing).....	53
iii. AR cycle 3 (Create Formal Agreement).....	55
5.3.1.2. Incentives for all Members (Requirement Id Org3).....	56
i. AR cycle 1 (Create Integration Opportunities).....	56
ii. AR cycle 2 (Delineate Integration Incentives).....	57
5.3.1.3. Limited Resource Scarcity (Requirement Id Org4).....	58
i. AR cycle 1 (Delineate Resource Inadequacies).....	58

ii. AR cycle 2 (Create Business Case)	59
5.3.1.4. Political Willingness of all Organizations (Requirement Id Org5)	61
i. AR cycle 1 (staff recommendation to integrate)	61
ii. AR cycle 2 (create public pressure to integrate).....	62
5.3.1.5. Accessibility to all Members (Requirement Id Ind1)	63
i. AR cycle 1 (create varied networking opportunities)	63
5.3.1.6. System of High Relative Quality (Requirement Id Tec1)	65
i. AR cycle 1 (create system comparison)	65
ii. AR cycle 2 (develop deficient system components)	66
5.3.1.7. Not Limited by Current Technology (Requirement Id Tec2).....	67
i. AR cycle 1 (apply appropriate technology)	67
6. Results and Conclusions	69
6.1. Results.....	69
6.2. Conclusions	72
6.2.1. Strengths and Weaknesses.....	74
6.3. Relevance to Other Environments.....	76
6.4. Other Areas of Research	76
Bibliography	78
Appendix 1 – Survey Results	86

List of Figures

Figure 3.1 Action Research Cycle.....	24
Figure 5.1 Information Sharing Framework.....	35

List of Tables

Table 4.1 British Columbia Local Government Statistics	30
Table 5.1 Fitness for Purpose Test Requirement Id's.....	36
Table 5.2 Survey Summary (by number)	48
Table 5.3 Survey Summary (by percentage)	48
Table 5.4 Current Environment Compliancy Summary.....	49
Table 6.1 Current and Alternate Environment Compliancy Summary	70

Declaration of Originality

The results presented in this thesis are based on my own research in the Department of Environmental and Geographical Sciences, Manchester Metropolitan University. All assistance received from other individuals and organizations has been acknowledged and full reference is made to all published and unpublished sources used.

This thesis has not been previously submitted for a degree at any institution.

This research is based solely on the researcher's work in this area. Appreciation is expressed to the local government organizations of British Columbia, specifically the District of North Saanich and the Capital Regional District for providing the environment within which this research has been performed.

Confirmation of researcher's own work:

David Hennigan

Senior Manger of Information

Technology & GIS Services

Capital Regional District

British Columbia, Canada

Date

The following people have assisted with this research by providing advice and draft reviews:

- Dr. Richard Armitage, Salford University, Salford, Greater Manchester, UK
- Mr. David Hennigan, Capital Regional District, British Columbia, Canada

Kenneth R. Johansson

Date: _____

1. Introduction

Historically, Geographic Information Systems (GIS) were implemented in local government environments to solve a specific operational task or problem, usually on a department by department basis (Nedovic-Budic and Pinto, 1999a) (Elliot, 2006). These departmentally-based implementations have resulted in *silos*¹ of geospatial information constrained to those respective departments. These systems were not organization wide and would not enable the overall information system environment beyond the specific departments in which they were intended to operate. “Such departmental focus limits the ability to act in unison to achieve a broader user base and shared applications” (Elliot, 2006, p.23).

Based on the researcher’s experience this type of isolated GIS architecture, although still largely present in the local government environment today, is beginning to be reduced. The reduction has come about through new business requirements, advancements and changes in technology, changes in workflow and sometimes changes in mandates from management and political leaders. This level of integration within local governments provides a background and basis from which to review and gain perspective on *inter-local government*² integration, specifically on how local governments integrate and collaborate with each other and other organizations.

¹ Information stored separately and more difficult to access and search as a result

² two or more separate local government organizations as opposed to intra-local government where this refers to departments within one organization

The majority of these local government services are in some way constrained by the organization's information technology infrastructure. To further expand on this point it has been widely estimated that over 80% of the data used by local governments has a spatial component (Nedovic-Budic and Pinto, 1999a). With spatial data being such a high percentage of the information stored and utilized by local governments, the use or potential use of GIS as an architecture to enable integration remains high. "Communities of people face important collective problems and participation to resolve those problems is a much more meaningful experience than participation as an end in itself. Participation has a specific purpose – to resolve common problems and provide desired services, to facilitate control over one's environment in cooperation with others" (Bish, 1990, pp.1-2). It can therefore be suggested that significant benefits may be realized through the integration of local government organizations, specifically regarding GIS (Obermeyer & Pinto, 2008, pp.187-223). These benefits are outlined below:

1.1. Efficiency Benefits

"Private sector firms innovate for competitive advantage while public agencies tend to seek efficiency improvements" Horiuchi (2006). There are many advantages and benefits, regarding efficiency, that may be seen through GIS integration in the local government environment. First, one of these benefits is in an increase in the efficiency of workflow. Benefits in efficiency may be realised through the automation of previously manual, repetitive processes thereby reducing production time or staff time to complete a task using GIS. "Typically, the larger the organization with manual or repetitive processes, the greater the benefit will be through the automation of those processes" (Dueker and Vrana, 1995, p.151).

1.2. Effectiveness Benefits

Secondly, are benefits related to effectiveness. In this context effectiveness benefits are derived from providing new products, services, and analyses to serve existing organizational mandates. In an inter-local government integration these benefits would be applied to more than just one organization and theoretically be of greater value to a wider audience. As a result, increased resources are brought to bear on problems, and better insight is gained into difficult decision making contexts (Dueker and Vrana, 1995, pp.151-152).

1.3. Enterprise Benefits

The third broad category of benefits to result from inter-local government integration are enterprise benefits. "Enterprise benefits consist of better information and communication throughout the organization and therefore result from, and provide greater opportunities for the integration of data and analytical systems" (Dueker and Vrana, 1995, p.152). The more that data and GIS resources are shared, the better process and standards are required. This increase in quality and completeness of process and standards ultimately produces a higher quality GIS (Fleming, 2005). Furthermore, improved data access from disparate units provides users with an appreciation for how their activity affects the entire agency. Related to this is another important enterprise benefit: the reputation of the organizations involved in the integration. In the end, the image and reputation of the organizations involved may be improved through this level of integration (Dueker and Vrana, 1995, p.153).

1.4. Societal Benefits

Finally, the value and social utility of geographic information comes from its use. Sharing of geographic information is important because the more it is shared, the more it is used, and the greater becomes society's ability to evaluate and address the wide range of pressing problems to which such information may be applied (Onsrud and Rushton, 1995, p.xiv) (Obermeyer and Pinto, 2008).

Furthermore, Masser and Campbell's (1995) study of GIS implementation in U.K. local government demonstrated that one of the most important perceived benefits of the GIS was its ability to improve information-processing facilities.

Another benefit of inter-local government GIS integration is the benefits to the individuals involved in creating and sustaining the integration. There are prestige and professional benefits that would result from creating such an integration. These benefits will be further explored in Chapter 5: *Research*.

1.5. Integration Barriers

Given the extent of the benefits derivable from the integration of local government geographic information systems it is appropriate to outline the barriers that may stand in the way of integration.

There are two broad barriers to achieving an integrated GIS architecture in the local government environment. First, are the technical aspects of GIS; geospatial data

architectures, distributed databases, data sharing and the like. Second, are a variety of organizational barriers to integration.

The first barrier has been somewhat reduced with advancements in technology for the application of GIS processes and architectures. The following statement was written in 1990 and shows how only a short time ago significant technological barriers existed: "On a technical level, an environment may soon exist where geographically distributed users from multiple organizations will be able to deal with spatial data elements relatively independent of concerns about the physical location of data or the host GIS software at that location" (1990, Meredith, 1995, p.8). However, as a result of this the focus has now shifted from the technical barriers, which have been somewhat resolved, to organizational barriers (Obermeyer and Pinto, 2008) (Gilfoyle and Thorpe, 2004).

The second main barrier to inter-local government GIS integration is related to organizational behaviour. Although there remain many problems associated with the technological aspect of GIS in local government environments, the more prevalent issues are related to the behavioural and organizational aspects (Obermeyer and Pinto 2008). One reason for this issue is that a GIS can represent a great deal of power in an organization. Obermeyer and Pinto (2008 p.115) state that "GIS is potentially a source of a large amount of information and is connected to many components of a local governments business and as a result this system can represent a great deal of power."

The results of research on behavioural and organizational issues that affect decision making in other fields promises to be useful in studying the sharing of geographic information and in developing strategies for optimising the use of geographic information (Onsrud and Rushton, 1995). It is for this reason that this research will focus on the

organizational barriers to GIS integration as well as addressing the remaining technical barriers.

1.6. Research Approach

This project will examine the current state of local government GIS integration in British Columbia, Canada. As well, this project will compare, using the Action Research methodology, various alternates to current levels of integration against a defined ideal level of local government GIS integration considering the general requirements of an integration environment. From this evaluation of integrated and non-integrated local government GIS environments it will be determined firstly, if it's possible to integrate local government bodies to achieve an ideal model and secondly, if it would be a superior model to the current status.

1.7. Research Aim

The aim of this research is to determine the degree to which there is GIS integration among local governments in British Columbia, Canada, and to evaluate what the impacts of this integration might be.

1.8. Research Objectives

1. To identify what characteristics an ideal inter-local government integrated GIS environment may have. This will be accomplished using a fitness for purpose test created in part from other researcher's requirements of an integrated environment.
2. To evaluate the current environment against an ideal environment.
3. To develop an alternate environment if necessary.
4. To compare an alternate environment to an ideal environment.

5. To present the results of the evaluations of the two environments; current and alternate.

A survey will be used to determine the current state of GIS integration between local governments. Collecting data in this manner will allow the researcher a current, broad view of the local government environment at the Provincial level in British Columbia, Canada.

Following this introductory chapter, chapter 2 outlines the literature reviewed in the areas of inter-organizational GIS integration and organizational theory.

Chapter 3 outlines the methodology used to perform this research.

Chapter 4 discusses the background of current local government environment and the survey used to perform this research.

Chapter 5 details the analysis used in this research.

Chapter 6 presents the results and conclusions of comparing both the current state of inter-local government GIS integration in British Columbia and an ideal environment against an alternate environment.

2. Literature Review

The primary focus of this research is to improve local government efficiency and effectiveness, specifically in regards to GIS and the use of geospatial data. To this end it is through the measurement and study of inter-local government GIS integration that this research may broaden the knowledge in this area.

This literature review has uncovered two key areas that impede inter-local government GIS integration. The first being the technical aspect of integration and the second being the organizational aspect (Nedovic-Budic and Pinto, 1999a). While there are currently technical issues that must be overcome, the larger and more complex of the two aspects is organizational (Masser and Campbell, 1995), (Obermeyer and Pinto, 2008).

Nedovic-Budic and Pinto (1999b, p.60) state that “the challenge of improving the efficiency and effectiveness of geographic information sharing rests firstly on our better understanding of the motivations and processes that are likely to influence such exchanges, either positively or negatively.” Furthermore, they go on to say “One common point raised by much of the work done to date suggests that resistance to data sharing, and subsequently GIS integration, is typically not related to technical issues; that is, incompatible systems or data structures. Rather, we continue to find that these challenges are first and foremost ‘people’ challenges; they represent the need to better isolate and address the human factors that are likely to impede free data sharing across organizational boundaries” (Nedovic-Budic and Pinto, 1999b, p.60).

Prior to the present day advancements in GIS and Information Systems in general, it was the technology itself that was the major barrier to inter-local government GIS

integration. Elliot (2006, pp.23-24) states that “Historically, local government has been slow to move toward integrated GIS for several reasons:

- GIS software wasn’t originally developed for enterprise use.
- Due at least partially to the software’s lack of enterprise capabilities, most localities implemented GIS on a departmental basis. Thus, GIS generally is focused on departmental objectives, with enterprise objectives being a secondary consideration. Such departmental focus limits the ability to act in unison to achieve a broader user base and shared applications.
- Enterprise architectures for sharing applications and data were time consuming and expensive to develop prior to the abundance of enterprise application-integration tools currently available.”

GIS didn’t typically evolve as a shared or enterprise system. That reality has hindered the focus on, and capability for, integration. Furthermore, as recently as the early 1990’s there was still a significant technical barrier to inter-local government GIS integration as indicated by O’Brien, qtd. in Meredith (1995, p.8), “On a technical level, an environment may soon exist where geographically distributed users from multiple organizations will be able to deal with spatial data elements relatively independent of concerns about host devices where they are stored, the physical location of data, or the host GIS software at that location”.

More recently however, in the area of inter-local government GIS integration, there have been substantial advancements in GIS and information system technology in general that have reduced the technological barrier to inter-local government systems integration. This advancement has led to new areas of research coming to the forefront

of inter-local government GIS integration. One of the most prevalent being organizational theory³ and behaviour to do with GIS intra and inter-local government integration.

2.1. Integration Benefits

There are a myriad of reasons to participate in an inter-local government integration, however one of the most fundamental of these is to increase the use of geographic data.

“The value and social utility of geographic information comes from its use. Sharing of geographic information is important because the more it is shared, the more it is used, and the greater becomes society’s ability to evaluate and address the wide range of pressing problems to which such information may be applied. Failure to share geographic information is also economically inefficient and wasteful. The expertise and time it takes to collect and maintain information about land creates a need to share that information” (Onsrud and Rushton, 1995, p.xiv).

Dueker and Vrana (1995, pp.151-152) (Nedovic-Budic and Pinto, 1999b) identify the following potential gains from an inter-local government GIS integration:

- Efficiency (existing operations performed at lower per-unit cost)
- Effectiveness (enhanced capabilities, new or better quality products)
- Enterprise benefits (new responsibilities, broader organizational mission)

Nedovic-Budic and Pinto (1999a, pp.185-186) state that some system benefits stem from the process of coordination itself. Coordination can offer a number of intangible benefits, such as:

³ the systematic study and careful application of knowledge about how people, as individuals and as groups, act within organization

- improved morale
- learning
- self-confidence
- confidence in others

Furthermore, Masser and Campbell's (1995) study of GIS implementation in U.K. local government demonstrated that one of the most important perceived benefits of GIS was its ability to improve information-processing facilities. Among the outcomes prized by their respondents was the GIS's ability to

- improve data integration
- speed of data provision
- access to information
- increased range of analytical and display facilities

2.2. Integration Constraints

Conversely, there are also some potential problems or issues that are associated with inter-local government integration such as the frustration of coordination, lower confidence in other participants, and the extra work created (Nedovic-Budic and Pinto, 1999b). There is also evidence to show that productivity, performance, and decision-making are all negatively related to greater resource interdependence (Nedovic-Budic and Pinto, 1999b).

As stated previously, there are a variety reasons for inter-local government integration. However, there are many factors that limit the ability of a local government to integrate

with another organization. The following 2 sections outline in detail the major issues hindering integration.

2.2.1. Technical Considerations

Technical constraints to inter-local government GIS integration over time have been reduced due to advances in technology, however a number of technical constraints still exist to varying degrees. Nedovic-Budic and Pinto (1999b, p.54) add that “There have been problems in coordinating system requirements; lacking common data definitions, formats, and models; differences in data quality; and networking costs. While those problems tend to cause less than desirable system performance, they have been gradually alleviated through technical solutions toward interoperability and open systems, distributed data processing in heterogeneous environments, integration of federated databases, and the use of World Wide Web for data distribution and viewing.” Furthermore, data confidentiality, liability, and pricing are additional constraints to inter-organizational GIS. (Nedovic-Budic and Pinto (1999b).

Dueker and Vrana (1995, pp.153-154) have put forth a taxonomy of systems integration that aids in putting the technical constraints of inter-local government integration into perspective with other aspects of the integrated computing environment as a whole:

- *Data Integration.* The ability to share access to data sources or access common databases. Various techniques for data modelling and view integration have been developed for this. Indeed, the database paradigm is built around the concept of integrated access to data in a non-redundant form to improve efficiency and consistency.

- *Applications Integration.* Bundling individual applications into larger modules. Two factors drive increasing integration of applications. First, increases in the performance of hardware and database systems over time enable more functionality to be built into existing applications. Second, market forces favour software competition on the basis of the functions a package can provide. In turn, vendor-supplied systems are employed in user applications by means of developing templates or writing macros.
- *Functionality Integration.* The integration of separate software and hardware systems for applications or products that combine many inputs. This is often what is meant with offhand references to “systems integration.” “Functionality integration” as a term, is offered in a narrow sense the explicit objective is to make different information or analytical systems work together to provide information products.
- *Organizational Integration.* The integration of various units within organizations to achieve a common objective function. The objective function can be expressed in terms of the organization’s mandate. Organizational integration can result from the needs of technological advances to achieve data, applications, and functionality integration.
- *Mission Integration.* The integration of organizations to achieve effective cooperation on programs and mandates. This last level lies principally in the political and societal realm, but certain enterprise benefits associated with other forms of integration can contribute to an environment that facilitates inter-agency coordination and contributes to an awareness of a common purpose.

The above taxonomy has aided in the researcher's overall understanding of inter-local government systems integration and put into perspective the technological constraints that are associated with this type of integration.

2.2.2. Organizational Considerations

This literature review has found that currently, the major constraint to inter-local government GIS integration has to do more with organizational factors rather than technical factors (Masser and Campbell, 1995) (Nedovic-Budic and Pinto, 1999a) (Obermeyer and Pinto, 2008). That being said, Evans and Ferreira (1995) argue that isolating technical from organizational issues risks missing many aspects of the problems of sharing spatial data. Furthermore, implementation of GIS and geographic data sharing is an organizational affair dominated by inter-organizational dynamics (Azad and Wiggins, 1995). The following quote from Obermeyer and Pinto (2008, p.114) gives a good synopsis of the current condition regarding inter-local government GIS integration.

“There is still far more to accomplish within the technical realms of GIS: algorithms, user interfaces, temporal databases, efficient storage schemes, better raster-vector integration and so on. Nevertheless, GIS technology continues to be acquired and put into use by a wide variety of organizations. Unfortunately, the technology implementation process in the organizational context remain riddled with problems leading to project slowdowns or outright discontinuance in many instances. This trend is usually attributed to a wide range of behavioural and organizational difficulties that tend to impede the more effective use of GIS in organizations.”

Further to this thought is that although anecdotal evidence and case histories abound that link politics to both GIS implementation success and failure, we lack a thorough understanding of the impact of corporate politics in the GIS implementation process (Obermeyer and Pinto, 2008, p.114). It is with this in mind that this research topic was chosen and will subsequently add to this area of study.

Historically, systems implementation did not take into account the larger picture of systems integration. They were built primarily around departmental needs without regard for inter-organizational implementation or even organization wide implementation. Consequently major duplications and redundancies resulted from those disjointed systems and database activities, particularly in organizations with the same jurisdictions (Nedovic-Budic and Pinto, 1999a).

Although some of these issues have now been resolved, there remain a myriad of activities that can effect inter-local government GIS collaboration either positively or negatively as identified by Croswell (1991):

1. Carry out an initial evaluation of organizational risk
2. Get commitment from management
3. Assign a GIS manager early in the project
4. Adopt a structured approach to system development
5. Involve users in the design
6. Formulate a goal-oriented plan and schedule
7. Develop a project organization that encourages cooperation and consensus
8. Allocate sufficient staff time

9. Keep users, manager, and constituents informed
10. Provide education and training at all implementation stages

Furthermore, Masser and Campbell (1995, p.232) suggest three additional conditions that must be met for successful GIS implementation.

- The existence of an overall information management strategy based on the needs of users in the agency and the resources at its disposal;
- The personal commitment of individuals at all levels in the organization with respect to overall leadership, general awareness and technical capabilities; and
- Organizational stability with respect to personnel, administrative structures and environmental considerations.

Further investigation into the above criteria introduce the following factors: The information strategies of each organization must take into account the needs of each type of user and the resources at the disposal of each organization. Furthermore, there must be a high degree of compatibility between the priorities of the participating organizations (Masser and Campbell, 1995).

It is important now to outline the differences between collaboration and integration as both terms are used in this research. "Collaborate" is defined in the Oxford English Dictionary as to work jointly on an activity or project. "Integrate" is defined as to combine or be combined to form a whole or, more appropriately in the context of this research, to bring or come into equal participation in an institution or body.

The following factors influencing the success of an integrated computing architecture that are put forth by Mattessich et al. (2001) in the book Collaboration: What Makes it Work.

- History of collaboration or cooperation in the community
- Integrated group seen as a legitimate leader in the community
- Favourable political and social climate
- Mutual respect, understanding, and trust
- Appropriate cross section of members
- Members see collaboration as in their self-interest
- Ability to compromise
- Members share a stake in both process and outcome
- Multiple layers of participation
- Flexibility
- Development of clear roles and policy guidelines
- Adaptability
- Appropriate pace of development
- Open and frequent communication
- Establish informal relationships and communication links
- Concrete, attainable goals and objectives
- Shared vision
- Unique purpose
- Sufficient funds, staff materials, and time
- Skilled leadership

The above mentioned factors have aided in the creation of the fitness for purpose test used in this research. As well, these factors have increased the researcher's awareness of the need for further research in the area of the management of GIS in the context of inter-local government relationships.

2.3. Summary

Based on this literature review, there appears to be a lack of an overwhelming amount of material on the subject of inter-local government GIS integration. It is apparent that further research would be beneficial to fully understand the benefits of, and hinders to, inter-local government GIS integration. Authors, Nedovic-Budic and Pinto (1999b, p.53) state that: "Previous research provides only partial evidence about the trends in inter-organizational development and sharing of GIS and databases. Anecdotal evidence is provided primarily through user conference presentations, usually as a discussion of multi-participant or enterprise wide developments and data sharing issues. Those sources provide a foundation for initial recognition of the relevant issues, but they stop short of systematic examination of factors and processes that permeate the efforts in digital spatial data development and sharing."

Furthermore, implementation theory and research have for years known that the most prevalent implementation problems (such as lack of acceptance and use) are the result of poor development of an organization's human assets. Consequently, any discussion of the process by which a GIS is introduced and managed within an agency or organization must be predicated on developing a greater understanding of the organization as a social system (Obermeyer and Pinto, 2008, p.113).

Based on this review, it is apparent that there is no historic or current model to follow for inter-local government GIS integration to take place as viewed in the context of a social system.

3. Methodology

This research is an evaluation of inter-local government GIS integration. The aim is to determine the degree to which there is GIS integration among local governments in the province of British Columbia, Canada, and to evaluate what the impacts of integration may be. The Action Research approach will be utilized for this research. The appropriateness of this approach for this research comes from its iterative testing cycles and its applicability to the real world problem being studied. The potential weaknesses of this approach, as will be subsequently explained in section 6.2.1 *Strengths and Weaknesses*, are overshadowed by its appropriateness and advantages.

The data collection tool that will be used for this research will be the survey. The survey, although potentially limited in some aspects as stated in section 6.2.1 *Strengths and Weaknesses*, is the most appropriate tool to collect a, hopefully, representative sample of the current level of inter-local government GIS integration for the area of this study. This survey will be sent to the local government organizations in the province of British Columbia, Canada and will ideally provide a complete and broad perspective of the current level of GIS integration in the province. Additionally, Chapter 5: *Research*, describes the 5 step research process to create the dual comparison of an inter-local government GIS integration required for this research.

3.1. Research Methodology

Meyers (2008) states that “In Information Systems, there has been a general shift away from technological to managerial and organizational issues, hence an increasing interest

in the application of qualitative research methods.” Further to this, in order to align with the largely managerial and organizational issues to do with inter-local government GIS integration outlined in the literature review, the approach that will be used for this research will be largely qualitative.

By performing this research using the *action research* approach, new approaches to local government integration may be tested and refined through an iterative process in order to ideally produce an improved result. As a definition, action research aims to contribute both to the practical concerns of people in an immediate problematic situation, and add to the goals of social science by joint collaboration within a mutually acceptable ethical framework (Meyers, 2008). Another reason to review the application of action research to this research aim is that in Information Systems, the action research method has been largely ignored and may offer significant advantages and new perspectives (Meyers, 2008). This may be due to the fact that technological rather than organizational research in the Information Systems field has been more predominant in the past. This research will hopefully aid in the exposure of action research to the Information Systems field.

As identified by Bell (1999) an important feature of action research is that the task is not finished when the project ends; the researcher continues to review, evaluate and improve practice. As this is work based research, the researcher feels that the theories should not be validated independently and then applied to practice, but rather validated through practice. This researcher feels that this appropriately addresses the issue of scientific rigour in the use of action research in evaluating inter-local government GIS integration. Academic rigour in action research, according to Dick (2002), is achieved through:

- The involvement of all interested parties provides more information about the situation
- Critical reflection in each cycle provides many chances to correct errors. This is especially so when there are cycles within cycles within cycles, and where the critical reflection is characterised by a vigorous search for disconfirming evidence
- Within each cycle the assumptions underlying the plans are tested in action.

Further to this point, Dick (1993) goes on to say “It is, above all, a method for yielding simultaneous action and research outcomes. It is able to do this because it adapts to the situation. To achieve adequate rigour it does this within a reflective spiral. Each turn of the spiral integrates theory and practice, understanding and action, and informs the next turn.”

Bell (1999, p.9) outlines quite clearly how and why action research will be used for this project: “The research questions arise from an analysis of the problems of the practitioners in the situation and the immediate aim then becomes that of understanding those problems. The researcher/actor, at an early stage formulates speculative, tentative, general principles in relation to the problems that have been identified; from these principles, hypotheses may then be generated about what action is likely to lead to the desired improvements in practice. Such action will then be tried out and data collected on its effects; these data are used to revise earlier hypotheses and identify more appropriate action that reflects a modification of the general principles. Collection of data on the effects of this new action may then generate further hypotheses and modified principles, and so on as we move towards a greater understanding and improvement of practice. This implies a continuous process of research and the worth of

the work is judged by the understanding of, and desirable change in, the practice that is achieved.”

Additionally, Bell (1999, p.9) goes on to state and reaffirm the appropriateness of the action research method for this research: “The essentially practical, problem-solving nature of action research makes this approach attractive to practitioner-researchers who have identified a problem during the course of the work and see the merit of investigating it and, if possible, of improving practice.”

For this research, the action research method was chosen over other more conventional approaches as conventional research sacrifices responsiveness in the interests of achieving replicability. That is what often makes it unsuitable as a change technique. Action research values responsiveness over repeatability, because otherwise it is very difficult to achieve action as part of the research (Dick, 1993).

Ultimately, the aim of this research is to increase the efficiency and effectiveness of GIS in local governments and it appears the action research method is the most appropriate, given the discussion above. This researcher understands that the potential lack of repeatability is a potential drawback but feels the benefits of being able to institute change in the environment being studied far outweighs the disadvantages.

Dick (2002) elaborates on the action research model by stating the action research cycle consists of planning before action, and then critical review afterwards.

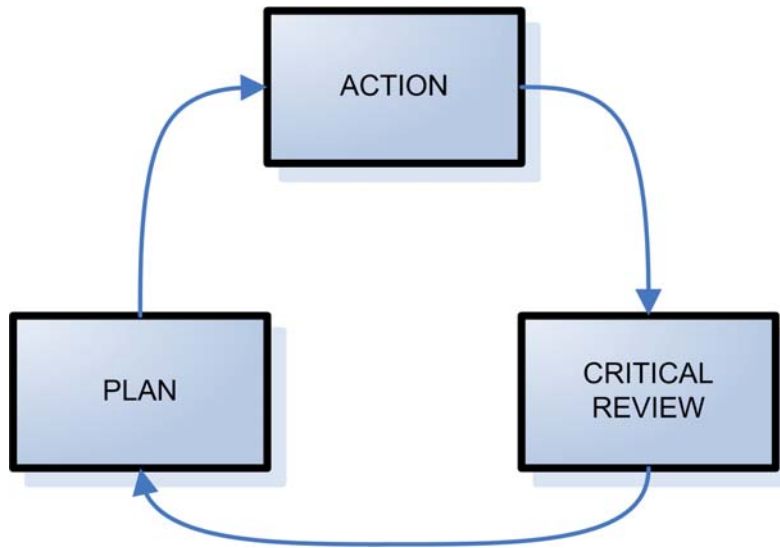


Figure 3.1 Action Research Cycle

Also, with respect to qualitative methods such as action research, Dick (1993) goes on to say that when practitioners use action research it has the potential to increase the amount they learn from their experience. “Furthermore, the action research cycle can be regarded as a learning cycle (see Kolb, 1984). The educator Schön (1983, 1987) argues strongly that systematic reflection, which is at the core of action research methodology, is an effective way for practitioners to learn. The new skills acquired through the research may be applied to the case study environment, and in part, completing the action research cycle” (Dick, 1993).

3.2. Research Approach

As mentioned above, the data collection tool for this research project will be a survey.

The survey is intended to serve three purposes for this project:

- Assist the researcher in determining the current state of integration and interoperability between local government bodies.
- Shed light on the current obstacles to potential integration.
- Help to determine the general requirements of a fully operational integrated environment.

The survey, as stated in the introduction to Chapter 3, is the most appropriate tool to collect a representative sample of the current level of inter-local government GIS integration for the area of this study. The survey will be sent to all 184 local governments in the Province of British Columbia, Canada. It will ideally provide a complete and broad perspective of the current level of GIS integration in the province.

The questions in the survey are designed to gather the most relevant information for this research. Questions range from the most broad, such as age and gender to GIS specific questions. Further along, the survey questions change to GIS implementation within the organization then to GIS integration with other local government organizations. Finally, are the questions designed to aid in the creation of the fitness for purpose test utilized in this research.

Prior to the dissemination of this survey a pilot survey was sent out to 5 local governments to determine the validity of each question. The responses were acceptable with no changes being required.

3.3. Thesis Outline

This thesis has been designed around the qualitative action research method for reasons discussed above. As such, the thesis outline has deviated from the outline suggested by Manchester Metropolitan University in order to better facilitate the methodology mentioned.

The process that will be followed to complete this research is:

1. Firstly, to identify what characterizes an ideal inter-local government GIS integrated environment. This will be done through the creation of a fitness for purpose test. This test will be designed using requirements for such an environment, in part, determined from other researcher's work in the field of organizational theory and GIS integration.
2. Second, will be to evaluate the results of the survey to determine a base line for the current level of inter-local government integration. This evaluation will take place against the ideal integrated environment mentioned above.
3. Thirdly, dependent on the results of the evaluation from the second step above, will be to develop an alternate integrated environment that satisfies the user requirements of an inter-local government GIS integration environment.
4. Fourthly, the alternate integrated GIS environment from step 3 will be evaluated against the current level of GIS integration from step 2 to determine the differentiating factors.

5. Lastly, the difference between the existing environment and the alternate environment will be presented and discussed.

4. Background

In order to effectively study the field of inter-local government GIS integration it is necessary to explain and subsequently understand the environment in which this study was undertaken. Geographically, the province of British Columbia is Canada's Western most province, stretching from the Pacific Ocean on the West to the Alberta border on the East and from the state of Washington in the South to the Yukon Territory and the state of Alaska in the North.

4.1. History and Function of Local Government in British Columbia

In British Columbia, the local government system is comprised primarily of *municipalities* and *regional districts*. Municipalities are a “general purpose local government which provide a wide range of services and regulate a variety of activities” (Bish, 1990, p.3). Municipalities are still being created today when a community desires a way to provide and develop its own services. The second type of local government is the Regional District. Regional districts were formed in the late 1960s to perform three functions. They provide a way to deliver local services to areas outside of local governments, a way for local governments and the rural areas to jointly fund services which are of a benefit to the region, and a means for providing services to the region as a whole. There are 27 Regional districts in British Columbia. Regional districts are the general purpose local government for unincorporated areas and also perform some functions for both unincorporated and municipal areas within the district (Bish, 1990).

4.2. Local Government Overview

A local government can either be known as a village (Village of Lumby), a town (Town of Ladysmith), a city (City of Victoria), or as a district local government (District Local Government of Kitimat). Classification is based on the community's size at the time of incorporation:

Villages - less than 2,500 population

Towns - 2,500 to 5,000 population

Cities - over 5,000 population

Regional Districts - large geographic areas with lower population densities

Today there are 157 municipalities, and 27 regional districts that are home to 4.2 million people (McConnell, 2007):

Classification	Number	Population
Cities	49	2,672,231
District Municipalities (including Regional Districts)	48	791,363
Towns	15	76,043
Villages	42	43,565
Indian Govt. District	1	844
Island Municipalities	1	3,362
Resort Municipalities	1	9,248
Other areas including Indian Reserves		516,831
British Columbia Total Population		4,113,487

Table 4.1 British Columbia Local Government Statistics

4.3. Organizations Effecting Local Government Integration

There are 2 other organizations that impact local government integration, to varying degrees, in the province of British Columbia, Canada.

The first organization is GIS Innovations, this is a private company that collects street centreline data province wide. This data is leased to local governments where it is used

for emergency 911 dispatch⁴ in Regional Districts specifically and for many other reasons such as geocoding⁵ and route finding in local governments. When new streets are added or changed by the local government there is a change management process that is undertaken between the local government and GIS Innovations to ensure the data is current. This relationship creates a type of integration where data is created by one local government then information such as address ranges is added by a private company. The data is then fed back into the original local government who created the data and also other local governments who require that information.

Secondly, is a not-for-profit organization called the Integrated Cadastral Information Society (ICIS). The primary objective of ICIS is to share and integrate spatial data, specifically cadastral⁶ data. Local governments provide their cadastral data to ICIS in a specified format and at regular, typically monthly, intervals. Once this data is in a central repository any ICIS member, typically local governments, utility companies etc., can download any data that is required. In regards to local governments this is typically data for areas adjacent to their jurisdiction.

4.4. Summary

The data collection tool for this research will be a province wide survey disseminated to the local government organizations in British Columbia. The survey will provide a holistic

⁴ 911 dispatch is the organization responsible and the process for dispatching appropriate services in an emergency situation

⁵ Geocoding is the process of assigning geographic identifiers (e.g., codes or geographic coordinates expressed as latitude-longitude) to map features and other data records, such as street addresses.

⁶ Cadastral or Legal surveying deals mainly with the establishment or relocation of land boundaries.

view of the interactions between local government bodies and a detailed view of local government GIS integration efforts, projects and approaches to integration.

5. Research

This research will consist of a five step process outlined below:

1. Firstly, to identify what characterizes an ideal inter-local government GIS integrated environment. This will be done through the creation of a fitness for purpose test. This test will be designed using requirements for such an environment, in part, determined from other researchers work in the field of organizational theory and GIS integration.
2. Second, will be to evaluate the results of the survey to determine a base line for the current level of inter-local government integration. This evaluation will take place against the ideal integrated environment mentioned above.
3. Thirdly, dependent on the results of the evaluation from the second step above, an alternate integrated environment will be developed that satisfies the user requirements of a truly integrated inter-local government GIS environment.
4. Fourthly, the alternate integrated GIS environment from step 3 will be evaluated against the current level of GIS integration from step 2 to determine the differentiating factors.
5. Lastly, the difference between the existing environment and the alternate environment will be presented and discussed.

5.1. Ideal Inter-Local Government Integrated GIS Requirements

This section identifies what characterizes an ideal inter-local government GIS integrated environment. Furthermore, the fitness for purpose test will be designed using requirements for such an environment, in part, determined from other researcher's work in the field of organizational theory and GIS integration.

5.1.1. Fitness for Purpose Test

The fitness for purpose test is included in this research in order to create a baseline from which to measure both the current and an alternate integrated inter-local government GIS. This test will outline an "ideal" integrated inter-local government GIS model based in part on other research in the field.

There are two broad areas that comprise the requirements for this fitness for purpose test. The first are organizational requirements that must be satisfied for an ideal integrated model to exist, and the second are the technical requirements that are required. The two requirements however are not equally weighted, Obermeyer & Pinto, (2008, p.81) state that:

"The primary problems that underlie most implementation concerns are usually organizational rather than technical. That is to say, in contrast to technical problems accompanying the introduction of new innovations or Information Systems technologies (which are usually quickly surmounted), organizational problems of implementation refer to the human aspects that can inhibit or limit the potential acceptance and use of new system innovations."

Although the technical barriers to integration will be addressed in this fitness for purpose test, organizational barriers, which are the greater issue according to the above quote and the literature review in general, will be the primary focus.

The following framework, proposed by Obermeyer and Pinto (2008, p.187), shows the antecedents and consequences of information sharing and will be used in part for this fitness for purpose test to help in the design of an ideal model for an integrated inter-local government GIS.

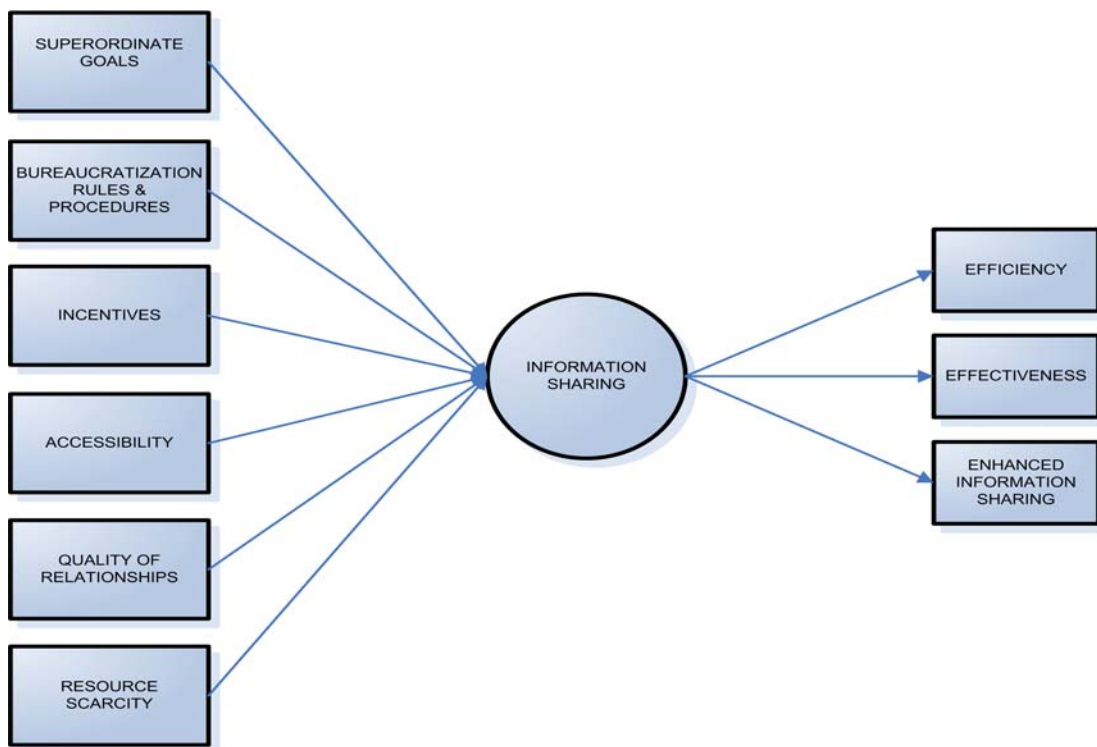


Figure 5.1 Information Sharing Framework

This fitness for purpose test is comprised of 11 requirements each falling within 3 broad categories. The categories include organizational, individual and technological; 2 of the 3 have been addressed above. The third, individual, has been added as the items within this category may be addressed at the individual level within the organizations that may integrate.

The 11 requirements for this fitness for purpose test are derived from the literature review and others' research in both the fields of GIS and organizational theory and are presented as requirement Id's in Table 5.1 below:

Org = organizational
 Ind = individual
 Tec = Technological

Requirement Id	Description
Org1	Superordinate goals identified
Org2	Rules and procedures applied
Org3	Incentives for all members
Org4	Limited resource scarcity
Org5	Political willingness of all organizations
Org6	Benefits outweigh disadvantages
Ind1	Accessibility to all members
Ind2	High quality of relationships
Ind3	Informal communication
Tec1	System of high relative quality
Tec2	Not limited by current technology

Table 5.1 Fitness for Purpose Test Requirement Id's

The following section outlines in detail each requirement and the reasoning for using each of the criteria for this fitness for purpose test.

Org1 - Superordinate goals⁷

Survey question: Is your collaboration based on common goals which all parties have agreed to aim?

Most local governments in British Columbia perform similar functions and as a result should be driven by similar goals. It is through these common goals that integration may successfully occur. This idea is put forth by Obermeyer & Pinto (2008, pp.198-199) "In theory, different organizations performing similar or complementary functions should possess complementary goals that are derived from a set of general, cross-organization objectives." Mattessich et. al. (2001, p.4) outlines a definition of collaboration that includes the importance of common goals as a means for inter-organizational collaboration: "Collaboration is a mutually beneficial and well-defined relationship entered into by two or more organizations to achieve common goals."

Based on the premise of an overall unifying goal to promote integration is the idea of a superordinate goal. Superordinate goals are described as "urgent and compelling for all groups involved, but whose attainment require the resources and efforts of more than one group" (Pinto and Onsrud, 1995, pp.51-54).

Furthermore, "The acceptance of superordinate goals by team members should transcend and mitigate the role of individual factors" (Obermeyer & Pinto, 2008,

⁷ Superordinate goals, are goals that are achieved by the contribution and co-operation of two or more people, with individual goals that are normally in opposition to each other, working together.

pp.198-200). In addition, they are assumed to lead to enhanced data sharing which, in turn, is expected to result in an improvement in an organization's efficiency, effectiveness, and decision making.

Org2 - Rules and procedures

Survey question: Does your organization have appropriate rules and procedures in place which allow the collaborative to function appropriately?

A formal definition of this measurement component is offered by Obermeyer & Pinto (2008, pp.200-202) "rules and procedures refer to the degree to which activities or tasks on a project team are mandated or controlled."

Rules and procedures offer a systematic and formal framework for inter-local government GIS integrated projects; as well they offer a mechanism for integrating and coordinating the activities in such projects. Another important characteristic of implementing rules and procedures is to help reduce the occurrence of conflicts between organizations.

One potential caveat to using rules and procedures as a method to measure inter-local government GIS integration is that as an organization's complexity increases, the use of rules and procedures as a method to integrate decreases. "The degree of rules and procedures is related to the degree of formalization in an organization" Obermeyer & Pinto (2008, p.201). However, as most of the local governments in British Columbia function in a similar manner (Bish, 1990), it is reasonable to believe that the level of complexity is similar and subsequently offer a good baseline comparison.

This component of the fitness for purpose test will aid in the determination of the level of formalization that exists in an ideal inter-local government integrated model. The validity of this measurement is supported by Obermeyer & Pinto, (2008) who found that written or formalized rules and procedures have a significant positive relation to the perceived effectiveness of inter-departmental relations.

To summarize, implementation and adoption of organizational rules and procedures and the subsequent formalization between departments, should produce a more harmonious climate. Therefore, it appears that rules and procedures should have a direct influence on the development of inter-organizational cooperation and information sharing (Pinto and Onsrud, 1995).

Org3 Incentives

Survey question: Are there are incentives in place that require or allow you to collaborate with other agencies?

Incentives are typically the initial driver of an integrated initiative and help to answer the questions: why do we want to collaborate and what's in it for me? Obermeyer & Pinto (2008) and Pinto & Onsrud (1995) have both shown that incentives suggest that an organization, or its key members, must perceive a payoff arising from the act of cooperating in an information exchange relationship. Such a payoff may be in the form of creating a future bond of obligation or gaining some form of strategic or monetary advantage over rival (or perceived rival) organizations or agencies. The integration must be seen by all

members as a benefit to either themselves or their organization. Furthermore, there should be measurable and definable incentives for each organization in the integration project or relationship (Mattessich, et al., 2001).

Org4 Limited Resource Scarcity

Survey question: Is there an abundance of resources available to you to participate in your inter-local government integration initiative?

In the local government environment, as in most other business areas, organizations must make due with a limited amount of resources. “Resources” may be technological personnel, money, time etc. Furthermore, this information may be viewed as a form of power, the agency that possesses needed information is less likely to share it with another party for fear of losing influence in the exchange relationship.

Conversely, the environmental condition of munificence offers an increased likelihood of information exchange (Obermeyer & Pinto, 2008). When conditions of relative munificence operate, there is less emphasis placed on hoarding resources, either material or informational. Thus, the environmental condition of munificence offers an increased likelihood of information exchange, while perceived resource scarcity is likely to create the opposite effect, in which parties possessing information are not as inclined to make it readily available to other organizations (Rushton & Onsrud, 1995).

Org5 Political Willingness of All Organizations

Survey question: Is there political willingness of all organizations to support inter-municipal integration?

The knowledge and information that is found in an organizations GIS naturally represents a significant source of power and therefore may provoke a variety of political behaviours (Obermeyer & Pinto, 2008). Therefore, the political willingness of an organization to collaborate may have a significant impact on the likelihood of a successful integration project. Often, a positive political and social climate within an organization acts as a positive motivator to integration. For example, policy makers may encourage collaborations as a way of tackling issues affecting organizations (Mattessich, et al., 2001). If the appropriate political climate does not currently exist then strategies or tactics may be used to change the political climate or alternately wait for an opportunity for a more appropriate political climate to come about.

Org6 Benefits Outweigh Disadvantages

Survey question: Do the members of the collaborative believe benefits outweigh the disadvantages?

If organizations choose to collaborate then they, individually, must believe that the benefits to integration outweigh the disadvantages (Mattessich, et al., 2001). Furthermore, the timeline of the benefits must be taken into consideration: There may be initial disadvantages to integration but over time the advantages must be seen to prevail.

Ind1 Accessibility to All Members

Survey question: Are all members of the partner organizations accessible to all other members?

The accessibility of individuals within an organization is an important determining factor in the likelihood of inter-local government GIS integration (Pinto and Onsrud, 1995). For example, organizations that permit their GIS departments to associate with individuals from other organizations at their locations and modify their work schedules to meet the demands of the project represent a different type of culture than those organizations that do not permit the same degree of latitude (Obermeyer & Pinto, 2008). Further to this point, the more individuals within an organization that interact with individuals from other organizations the greater the level of trust between organizations. Specifically, Zaltman and Moorman qtd in (Pinto and Onsrud, 1995) found that “interactions between organizational members enhance trust and trust in turn enhances the potential of collaboration.”

Ind2 High Quality of Relationships

Survey question: Is the quality of your relationship with those organizations with which you collaborate, specifically to do with satisfaction, trust and minimal opportunism, of high quality?

With respect to evaluating the quality of an exchange relationship there are three main components that need to be addressed. First, member satisfaction includes all characteristics of the relationship that the focal organization finds rewarding, profitable, instrumental, frustrating, problematic, or inhibiting. Second, trust refers

to a party's expectations that another desires coordination, will fulfil obligations, and will "pull its weight" in the relationship. "Finally, opportunism is exemplified by distortion of information, failure to fulfil promises, and unwillingness to share what may be considered proprietary information" (Obermeyer & Pinto, 2008, p.204).

As indicators of high quality relationships: exchange relationships that are characterized by satisfaction, trust, and minimal opportunism will have a positive and significant direct effect on geographic information exchange (Pinto and Onsrud, 1995). This is also reiterated in a more current publication by Obermeyer & Pinto (2008, p.197): "the quality of exchange relationships argues that high levels of trust and minimal opportunism mark positive inter-organization relationships".

Ind3 Informal Communication

Survey question: Do members of each organization communicate at an informal level?

In a collaborative environment informal communication between individuals in each organization is an important factor in the success of the project. Evidence supports the contention that often the "real work" of establishing coordination protocols takes place in informal settings rather than in structured settings (Obermeyer & Pinto, 2008). Furthermore, collaborative group members should interact often, update one another, discuss issues openly, and convey all necessary information to one another and to people outside the group (Mattessich, et al., 2001). Finally, members should establish informal lines of

communication in order to facilitate an increased chance of success for the common project (Mattessich, et al., 2001).

Tec1 System of High Relative Quality

Survey question: Is your organizations GIS and subsequent information of high relative quality compared to those of the organizations with whom you collaborate?

Obermeyer and Pinto (2008, p.144) indicate that the quality of the GIS systems of the members of an inter-local government integration project refer to the quality of information generated compared to that of the organizations that are part of the project. Where appropriate, this also refers to the quality of the actual system itself, as the quality of the system would have an effect on the various components of an integrated computing / GIS environment.

Some of the more obvious measures of system quality, particularly within the context of GIS would include system response time, ease of online use, and reliability of the computerized system (absence of consistent downtime). These all represent some of the more common and well accepted determinants of a GIS's technical quality. Furthermore, Obermeyer and Pinto (2008, p.84) give the following criteria as a measure of a systems quality:

- Data currency
- Turnaround time
- Completeness

- System flexibility
- Ease of use
- Ease of interpretation
- Reliability
- Convenience

Tec2 Not Limited by Current Technology

Survey question: Is your organization limited by lack of current technology that would allow for inter-municipal collaboration?

In many organizations GIS is implemented to apply to a certain task and each organization chooses the technology that is appropriate to its task (Craig, 1995). Further to this, “The technology is available to do everything that is needed, but organizations each choose a more limited technology, thereby limiting themselves from extraordinary use of data” (Craig, 1995, p.112).

5.2. Current Inter-Local Government Integrated GIS Environment

This section describes, by way of the survey, the current level of inter-local government GIS integration in the province of British Columbia, Canada.

The survey was sent to 184 local governments in the Province of British Columbia, Canada in September of 2008. Forty surveys returned, or 21.7% of the number of surveys sent out.

The following is an overview of the information provided by the respondents. Of the surveys returned, 82% of the respondents were male and 18% female. 35% were between the ages of 31 – 40 and 28% were between the ages of 41 – 50. The highest level of education was undergraduate degree at 38% and college degree / diploma at 32%. Of the number of years that the respondents have worked in the GIS field: 38% from 11 – 20 years, 22% from 6 – 10 years and 32% less than 5 years. Regarding the level of expertise in GIS of the respondents 41% rated themselves at high, 28% as average and 21% as very high.

From an organizational perspective: 60% of the respondents are non-managers and 40% are managers. Of the number of years worked at the current organization, 56% have been there less than 5 years, 22% from 11 – 20 years, and 20% from 6 – 10 years. 35% of the respondents are from Regional Districts, 25% from Cities, and 22% are from Districts. Population wise, 28% of the respondents were from organizations with less than 10,000 people, 22% with 20,001 – 50,000, 22% population with more than 100,000, 15% with 50,001 – 100,000 and 12% with 10,000 – 20,000. The average number of mayor and councillors for the responding organizations is 10.1.

From a GIS specific perspective: 85% of the respondents reported having GIS at their organization, 15% reported that they do not have GIS. 67% of the respondents that do not have a GIS reported that they plan on implementing one. 61% reported that their GIS was an enterprise GIS implementation, while 31% said that theirs was departmentally based. The respondents that have an enterprise GIS have had GIS for an average of 5.8 years.

Lastly, from an integration perspective: 73% reported that they collaborate with other organizations to a significant degree. Of the organizations that currently do not collaborate, 85% said they plan to in the future. 41% of the respondents see the barriers to collaboration as being organizational, and 28% see it as being technical. The main categories of collaboration are data at 97%, knowledge at 76%, and web mapping (delivery of GIS data to staff and public) at 61%. 94% of the respondents see the benefits to collaboration as tangible, 45% as political, 30% as personal. and 27% as altruistic.

5.2.1. Fitness for Purpose Test Responses

For the fitness for purpose test component of the survey there were between 32 and 34 responses. These responses determine the overall compliance for each requirement Id. as discussed in Chapter 3: *Methodology*. This information will be used as a baseline from where the current level of inter-local government integration will be determined and a new, practical integrated model will be developed and presented.

Requirement Id	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Org1 - Superordinate goals identified	4	24	4	0	0
Org2 - Rules and procedures applied	1	8	18	6	0
Org3 - Incentives for all members	2	6	17	8	0
Org4 - Limited resource scarcity	0	5	12	14	2
Org5 - Political willingness of all organizations	2	9	14	7	1
Org6 - Benefits outweigh disadvantages	9	20	5	0	0
Ind1 - Accessibility to all members	1	15	13	5	0
Ind2 - High quality of relationships	7	21	5	1	0
Ind3 - Informal communications	9	20	4	1	0
Tec1 - System of high relative quality	5	13	13	2	1
Tec2 - Not limited by current technology	5	17	5	5	2

Table 5.2 Survey Summary (by number)

Requirement Id	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Org1 - Superordinate goals identified	12	75	12	0	0
Org2 - Rules and procedures applied	3	24	55	18	0
Org3 - Incentives for all members	6	18	52	24	0
Org4 - Limited resource scarcity	0	15	36	42	6
Org5 - Political willingness of all organizations	6	27	42	21	3
Org6 - Benefits outweigh disadvantages	26	59	15	0	0
Ind1 - Accessibility to all members	3	44	38	15	0
Ind2 - High quality of relationships	21	62	15	3	0
Ind3 - Informal communications	26	59	12	3	0
Tec1 - System of high relative quality	15	38	38	6	3
Tec2 - Not limited by current technology	15	50	15	15	6

Table 5.3 Survey Summary (by percentage)

The following table outlines the level of compliancy for each requirement Id as determined by the survey results above. The requirements that will be considered fully compliant are where a combination of “agree” and “strongly agree” are greater than 75% of the response percentage regarding compliancy. In order to ensure that all of the

necessary requirements for an inter-local government GIS integration are addressed in this research, and not dismissed by using a mid-range percentage, the researcher has consciously chosen a high threshold.

Requirement Id	Description	Compliance
Org1	Superordinate goals identified	fully compliant
Org2	Rules and procedures applied	partially compliant
Org3	Incentives for all members	partially compliant
Org4	Limited resource scarcity	partially compliant
Org5	Political willingness of all organizations	partially compliant
Org6	Benefits outweigh disadvantages	fully compliant
Ind1	Accessibility to all members	partially compliant
Ind2	High quality of relationships	fully compliant
Ind3	Informal communication	fully compliant
Tec1	System of high relative quality	partially compliant
Tec2	Not limited by current technology	partially compliant

Table 5.4 Current Environment Compliance Summary

5.3. Alternate Inter-Local Government Integrated GIS Environment

This section describes the development of a practical inter-local government integrated environment, drawing from the results of the survey discussed above and providing a new, ideally improved integration framework. This section will address the partially compliant requirement Id's and, using the Action Research approach outlined in Chapter 3: *Methodology*, attempt to bring these requirement Id's into compliance creating an alternate integrated inter-local government GIS environment.

5.3.1. Development of an Alternate Integrated GIS Environment

Throughout the development process of the new design for the inter-local government GIS integration model, each alternative will be evaluated in terms of which requirements

are not sufficiently met. Subsequent design options will attempt to provide a solution to address the non-satisfied requirements. The methodology used for this analysis is Action Research:

Step 1

- Plan: evaluate a problem
- Action: suggest a solution and what that would entail
- Critical Review: evaluate advantages and disadvantages of suggested action

Step 2

- Evaluate a new issue as determined from the previous step / Critical Review
- Once all subsequent options have been discussed as a result of subsequent Plan / Action / Critical Review phases then go on to address a new issue from the survey

The survey, which is reasonably representative of the current state of inter-local government integration, as described in *section 5.2.1* will be used as a baseline from which this redesign effort is focused. The current environment will be iteratively modified, conceptually speaking, in an attempt to design an environment that can achieve the requirements as defined by the fitness for purpose test in *section 5.1.1*.

The intention is to begin this action research process by beginning to redesign the current environment in a broad manner first, then through subsequent iterative cycles, further refine and focus the design as believed desirable and as a result of the Critical Review(s). The current environment only partially complies when compared against

most of the organizational requirements and all of the technical requirements outlined by the fitness for purpose test. It is felt that by focusing on the organizational requirements then the technical requirements that the most benefits will be found. In order to do this it is felt appropriate to begin with an identification and summary of all the current and potential goals of an inter-local government integration.

To summarize, the requirements not fully satisfied by the fitness for purpose test that were found from the survey are as follows:

- Org2 Rules and procedures applied
- Org3 Incentives for all members
- Org4 Limited resource scarcity
- Org5 Political willingness of all organizations
- Ind1 Accessibility to all members
- Tec1 System of high relative quality
- Tec2 Not limited by current technology

5.3.1.1. Rules and Procedures Applied (Requirement Id Org2)

Survey question: Does your organization have appropriate rules and procedures in place which allow the collaborative to function appropriately?

i. AR⁸ cycle 1 (Create Data Sharing Opportunity)

Planning:

As stated in *section 5.1.1* there are many important advantages in applying rules and procedures to local government GIS integration projects. They offer a systematic and formal framework as well as a mechanism for integrating and coordinating activities. In order for an inter-local government GIS integration to be successful it is appropriate to apply certain rules and procedures that should increase its success.

Only 27% of the respondents to the survey either agree or strongly agree that rules and procedures have been applied at their organization to aid in inter-local government GIS integration. As this is one of the most important aspects to inter-local government GIS integration it will be the first issue addressed in the development of an alternate environment.

Action:

The first action that will be attempted in this Action Research cycle in order to attempt to bring the requirement Id (rules and procedures applied) into compliance will be the creation of a data sharing opportunity. The main reason for choosing this action is that of the 80% of the survey respondents who indicated that they currently collaborate with other organizations, 97% of those indicated that they share data. Data was the most

⁸ Action Research

commonly exchanged item of the local governments surveyed; next being the exchange of knowledge at 76%.

In order to create a data sharing opportunity between two or more local governments a great deal of formality is not required, at least initially. Once the data becomes part of a greater workflow or is relied upon in some other way, then the level of formalization will increase. It is at this point, when the data becomes more important to the receiving organization, that this action may help in bringing this requirement Id (rules and procedures applied) into compliance.

Critical Review:

The creation of a data sharing opportunity in order to apply rules and procedures to an inter-local government integration is really just a first step. This action in and of itself will not will allow rules and procedures to be applied. It does however, give the local government organizations an opportunity to “test the water” prior to committing to any further form of integration. To summarize, the action of creating a data sharing opportunity, will not bring the requirement Id (rules and procedures applied) into compliance.

ii. AR cycle 2 (Automate Existing Data Sharing)

Planning:

Given that the above action, “create data sharing opportunity” did not bring the requirement Id (rules and procedures applied) into compliance it is now appropriate to create a new Action Research cycle which will hopefully do so. In order to expand upon the previous action in *section 5.3.1.1.i* a new action will be tested that will add a degree

of formality to the data sharing process in hopes of bringing the requirement Id (rules and procedures applied) into compliance.

Action:

Once the creation of a data sharing opportunity is completed, the next action: automation of an existing data sharing scenario, will be created. This automation will entail the technical requirements to exchange data between two or more local governments in an automated fashion. The data exchanged will be uploaded or downloaded, depending on the local government, in an agreed upon format and schedule.

Critical Review:

The objective of creating an automation of data sharing was to bring the requirement Id (rules and procedures applied) into compliance. Theoretically speaking, it was hoped that through this process that certain rules and procedures would have to be agreed upon by the local governments involved in the integration. Although this is the case, it is not plausible that through the automation of existing data sharing alone that the rules and procedures required for this process would significantly increase the likelihood of supporting an inter-local government GIS integration.

iii. AR cycle 3 (Create Formal Agreement)

Planning:

Given that the above action, “automate existing data sharing” did not bring the requirement Id (rules and procedures applied) into compliance it is now appropriate to create a another Action Research cycle in hopes of doing so. In order to bring the requirement Id (rules and procedures applied) into compliance, the next solution that will be employed, in order to add a further degree of formality to the above action, will be the creation of a formal agreement.

Action:

A formal agreement will be created between the participating organizations; it will outline the varying levels of involvement and contribution by each organization. This will provide a systematic and formal framework for the various organizations to work together and reduce unnecessary conflicts. Furthermore, the responsibilities of each organization and each individual will be outlined with the appropriate timeframe around the goals to be achieved through the inter-local government integration.

Critical Review:

Once this agreement is put in place and agreed to by all the member organizations it is reasonable to believe that the requirement Id: application of rules and procedures would become compliant. In creating this agreement the various rules and procedures that are at the core of the agreement can be expanded upon to create a goal oriented integration with minimal conflict as suggested by Obermeyer and Pinto (2008) and Nedovic-Budic and Pinto (1999a).

5.3.1.2. Incentives for all Members (Requirement Id Org3)

Survey question: Are there are incentives in place that require or allow you to collaborate with other agencies?

i. AR cycle 1 (Create Integration Opportunities)

Planning:

One of the fundamental reasons that two or more organizations choose to integrate is that there is one or more benefits to do so. There must be incentives for all members, either individually or organizationally, in order for an inter-local government GIS integration to occur and be successful. As indicated by the survey only 24% of organizations indicate that incentives have been delineated for inter-local government GIS integration.

Action:

The first action that will be attempted in this Action Research cycle in order to attempt to bring the requirement Id (Incentives for all Members) into compliance will be the creation of integration opportunities. This action will entail researching and outlining what data, systems and human resource functions can be potentially integrated between two or more local government organizations. By going through this process in a thorough and systematic fashion, a series of integration opportunities will be exposed.

Critical Review:

The creation of integration opportunities for each local government organization is an important step in bringing the requirement Id (Incentives for all Members) into

compliance. However, this action by itself would likely not make this inter-local government GIS integration requirement Id compliant.

ii. AR cycle 2 (Delineate Integration Incentives)

Planning:

Given that the above action, “create integration opportunities” did not bring the requirement Id (incentives for all members) into compliance it is now appropriate to create a new Action Research cycle which will hopefully do so. In order to expand upon the previous action in *section 5.3.1.2.i* a new action will be tested in hopes of bringing the requirement Id (incentives for all members) into compliance. This action will reveal the potential incentives for integrating.

Action:

This action will be to delineate integration incentives to inter-local government GIS integration. Each organization participating or potentially participating in the integration will be canvassed based on the information gathered from the previous action in *section 5.3.1.2.i*. The information derived from this process will theoretically be a complete set of incentives to integration for each local government.

Critical Review:

The incentives give the members of the integration as a whole the ability to plan how to move forward to achieve their goals. This also reduces conflict by digressing to other areas of perceived opportunity that arise during the course of the project. Furthermore, by having each organizations incentives made clear it gives the group the opportunity to

be flexible enough to change course throughout the project if necessary. For example if a new opportunity arises that was not available or achievable at the outset of the project then the group can make an informed decision to pursue the new opportunity that would benefit its members. Finally, the delineation of incentives gives the members clear goals on which to deploy resources both currently and in the future. With the incentives being clearly delineated to all members and included in a formal agreement, it is likely that the requirement Id: incentives for all members, will become compliant.

5.3.1.3. Limited Resource Scarcity (Requirement Id Org4)

Survey question: Is there an abundance of resources available to you to participate in your inter-local government integration initiative?

i. AR cycle 1 (Delineate Resource Inadequacies)

Planning:

Only 15% of the respondents to the survey indicate that they agree or strongly agree there are sufficient resources in their organizations to integrate with other local governments. This is an important issue affecting local government GIS integration. As stated earlier, the environmental condition of munificence offers an increased likelihood of information exchange, while perceived resource scarcity is likely to create the opposite effect, in which parties possessing information are not as inclined to make it readily available to other organizations.

Action:

The first action that will be attempted in this Action Research cycle in order to attempt to bring the requirement Id (limited resource scarcity) into compliance will be to delineate resource inadequacies. In order to address the main issue of resource scarcity and ensure that adequate resources are in place to create and maintain an inter-local government GIS integration, an assessment of all of the potential areas of resource limitation will be conducted.

Critical Review:

The delineation of resource inadequacies in order to ensure there are adequate resources to create and maintain an inter-local government integration is really just a first step. This action in and of itself will not will allow the necessary resources to be secured. It does however, give the local governments involved in the integration a starting point to “take stock” of their current state. This action by itself does not make this inter-local government GIS integration requirement Id compliant.

ii. AR cycle 2 (Create Business Case)

Planning:

Given that the above action, “delineate resource inadequacies” did not bring the requirement Id (limited resource scarcity) into compliance, it is now appropriate to create a new Action Research cycle which will hopefully do so. Once the delineation of resource inadequacies is completed, the next action will be to create a business case in hopes of bringing the requirement Id limited resource scarcity into compliance.

Action:

In order to expand upon the previous action, delineate resource inadequacies in *section 5.3.1.3.i*, a new action will be tested that will formalize the process of acquiring the necessary resources to create and maintain an inter-local government GIS integration.

The business case will address each inadequate resource, revealed in the previous Action Research cycle, individually and outline a process to bring each one up to the required level in order to support an inter-local government GIS integration. For example, if one of the limited resources was computer hardware necessary to support an inter-local government GIS integration the business case would outline why this resource is currently inadequate as well as an approach to obtaining the necessary hardware to make this resource adequate.

Critical Review:

Creating a business case to address each limited resource item by item would very likely bring this requirement into compliance. Arguably this step could be eliminated and the necessary resources could just be obtained on an adhoc basis, however by creating a structured approach to obtaining the required resources a greater level of validity is given to the process which may prove beneficial in the resource acquisition process.

5.3.1.4. Political Willingness of all Organizations (Requirement Id Org5)

Survey question: Is there political willingness of all organizations to support inter-municipal integration?

i. AR cycle 1 (staff recommendation to integrate)

Planning:

Only 33% of the respondents to the survey indicated that they either agree or strongly agree that there is political willingness of all organizations to support inter-local government GIS integration. This is an important issue affecting local government GIS integration as the political willingness of an organization to integrate may have a significant impact on the likelihood of a successful integration project.

Action:

It is important to gain the political willingness of all organizations that wish to be involved in an inter-local government GIS integration. To do this it is first necessary to outline the potential benefits and reasons for integration to the people responsible for the direction of the local government. The process to transmit the value of these benefits and the reasons for inter-local government integration, as well as the costs of not integrating, is to come as recommendations from senior staff members of the local government to the politicians in office.

Critical Review:

A recommendation from staff to the political leaders of a local government (mayor and council) to participate in an inter-local government GIS integration, although a very important step, will not guarantee political willingness to integrate. Political leaders may

choose either to adopt the recommendations from staff or not depending on many factors. The importance of this step is that in recommending a certain action to council the staff will have to create a “report to council”. This report to council should systematically address the various components that would be required to participate in an integration as well as the potential advantages and disadvantages.

ii. AR cycle 2 (create public pressure to integrate)

Planning:

Given that the above action, “staff recommendation to integrate” did not bring the requirement 1d (political willingness of all organizations) into compliance, it is now appropriate to create a new Action Research cycle which will hopefully do so. Political leaders are influenced not only by local government staff but to a much larger degree by the public who they represent.

Action:

The next solution that will be attempted is to create public pressure in order to influence political leaders into exploring inter-local government GIS integration. There are a variety of ways to make this happen such as outlining what similar services adjacent local governments are providing and the potential efficiencies that may be gained through integration. Another option is to outline and expose other successful integration projects that have taken place between similar local governments.

Critical Review:

By exposing this type of information to the population of a local government it is likely that the pressure to explore inter-local government GIS integration would be created. If,

the option of integration is explored and supported by the public it would be reasonable to expect that the political willingness to participate in an inter-local government GIS integration would be present.

5.3.1.5. Accessibility to all Members (Requirement Id Ind1)

Survey question: Are all members of the partner organizations accessible to all other members?

i. AR cycle 1 (create varied networking opportunities)

Planning:

In an inter-local government GIS integration a high level of trust and communication between the member organizations significantly adds to the potential success of the project. In order for a high level of trust and communication to be either created or maintained between organizations, frequent and quality accessibility to all members of the integration is necessary. Only 47% of the respondents to the survey indicated that they either agree or strongly agree that all members of the partner organizations are accessible to all other members in order to support inter-local government GIS integration.

Action:

In order to bring requirement Id Ind1 “accessibility to all members” into compliance the creation of varied networking opportunities will be developed. Following are a series of forms of networking that will be explored that are likely to create greater accessibility to all members of an inter-local government GIS integration:

- Face to face meetings
- User group list serves
- Instant messaging
- Social networking applications, such as Facebook and Twitter
- Conference presentations
- Employee training

Regarding face to face meetings, greater flexibility around meeting times will be permitted in order to facilitate more frequent meetings. As well, having meetings outside of normal business hours creates a higher level of informality for meetings which has been shown to be effective as outlined in the literature search section of this paper.

Another form of communication is through a list serve. The inter-local government GIS integration participants can use a list serve to communicate with each other in a slightly more formal way than a face to face meeting. This allows messages to be tracked and is more suited to a larger audience than instant messaging, which is discussed next.

Finally is instant messaging, this is another tool that will be employed to create greater accessibility between participants in the integration. This type of communication is more “real time” than email and allows for less formality than email. Social networking sites such as Facebook and Twitter work along the same lines and provide a similar form and type of communication as instant messaging.

Critical Review:

It is reasonable to think that by altering the currency of meetings and the methods in which the participants in the inter-local government GIS integration project communicate that there will be an increase in the accessibility to all members of the group.

Subsequently, this action would bring the requirement Id Ind1 “accessibility to all members” into compliance. There are however, some potential disadvantages to increased communication between the groups involved. The foremost being the accidental dissemination of confidential information or information that would compromise the integration in some way.

5.3.1.6. System of High Relative Quality (Requirement Id Tec1)

Survey question: Is your organization’s GIS and subsequent information of high relative quality compared to those of the organizations with whom you collaborate?

i. AR cycle 1 (create system comparison)

Planning:

Only 53% of the respondents to the survey indicated that they either agree or strongly agree that their system is of high relative quality compared to their partner organizations. This is a significant impediment to inter-local government GIS integration in that by not having similar quality systems the ability to integrate is compromised.

Action:

The action that will be taken in order to bring the requirement Id Tec1 “system of high relative quality” into compliance will be to create a system comparison. This comparison will be in the form of a matrix for each local government. The matrix, once completed,

will quantify the quality of each component of the GIS for each individual local government. Once this step is completed, the matrices will be compared against each other to determine where each local government is deficient in comparison to other local governments.

Critical Review:

This is a necessary step in order to bring each local government's GIS to high relative quality with other participants in the inter-local government GIS integration. This action, by itself however does not bring the requirement Id Tec1 "system of high relative quality" into compliance. This action will only compare systems, not actually change them in any way.

ii. AR cycle 2 (develop deficient system components)

Planning:

As discussed previously the action "create system comparison did not bring the requirement Id Tec1 "system of high relative quality" into compliance. Therefore a new action will be tested that will hopefully do so. Correcting current gaps in system components that hinder inter-local government GIS integration is the next logical step.

Action:

The next action that will be tested will be the development of the deficient system components that were uncovered in section 5.3.1.6.i. In order to bring all members of the inter-local government GIS integration to systems of high relative quality, the deficient components of each local government's systems will be addressed. Once addressed,

each deficient component will be developed to an appropriate level to ensure high relative quality.

Critical Review:

Once the individual components of each systems are developed it is reasonable to expect that the requirement Id Tec1 “system of high relative quality” will be brought into compliance. A potential caveat to this action is that a system’s quality can be somewhat subjective, so in order to compensate for this problem the matrices will have to be agreed to by the group at the beginning of the process to ensure support for the action.

5.3.1.7. Not Limited by Current Technology (Requirement Id Tec2)

Survey question: Is your organization limited by lack of current technology that would allow for inter-municipal collaboration?

i. AR cycle 1 (apply appropriate technology)

Planning:

65% of the respondents to the survey indicated that they either agree or strongly agree that their organization is limited by the lack of current technology that would allow for inter-local government integration. This can be a significant obstacle for inter-local government GIS integration, however as stated in the literature review it is not as significant an obstacle as some organizational barriers.

Action:

In order to bring the requirement Id Tec2 “not limited by current technology” into compliance the action “apply appropriate technology” will be applied. For each local

government member of the potential integration, the appropriate technology will be put in place to ensure that a successful inter-local government GIS integration would not be compromised by the technology required.

Critical Review:

By applying the appropriate technology to ensure that an inter-local government GIS integration would be not hindered by technology it is reasonable that the requirement Id Tec2 “not limited by current technology” would become compliant. Clearly, a requirement for this action is that the necessary resources would have to be acquired to make this action viable.

6. Results and Conclusions

As indicated in Chapter 1. *Introduction*, the aim of this research is to firstly determine the degree to which there is GIS integration among local governments in British Columbia. The second part of the research aim is to evaluate what the impacts of this integration might be. In addition, the feasibility of integration is addressed as are the relevant issues in creating this level of integration. The results and conclusions derived from this research are outlined below.

6.1. Results

As per the research design outlined in Chapter 3. *Methodology*, the results are presented below in terms of comparisons of inter-local government GIS integration environments against a set of ideal integration factors derived from the fitness for purpose test. However, it is not enough to evaluate the requirements compliance for the newly designed *alternate* environment against the *ideal* requirements, it is also necessary to evaluate compliance of the *alternate* environment requirements against that of the current environment. This dual comparison, as shown below in Table 6.1, provides a secondary validation of the research results to ensure that a positive requirements compliance for the integration environment alternative is also an improvement over the existing current environment. After all, it is in theory possible to develop an alternate environment that satisfies a defined set of requirements, however is of no real improvement over the current environment.

Shown below in Table 6.1, is an indication of the compliance differences between the current level of inter-local government GIS integration and the alternate integration

environment as derived through the action research cycles outlined in Chapter 5:

Research.

Requirement Id	Description	Current	Alternate
Org1	Superordinate goals identified	Compliant	Compliant
Org2	Rules and procedures applied	Partially compliant	Compliant
Org3	Incentives for all members	Partially compliant	Compliant
Org4	Limited resource scarcity	Partially compliant	Compliant
Org5	Political willingness of all organizations	Partially compliant	Compliant
Org6	Benefits outweigh disadvantages	Compliant	Compliant
Ind1	Accessibility to all members	Partially compliant	Compliant
Ind2	High quality of relationships	Compliant	Compliant
Ind3	Informal communication	Compliant	Compliant
Tec1	System of high relative quality	Partially compliant	Compliant
Tec2	Not limited by current technology	Partially compliant	Compliant

Table 6.1 Current and Alternate Environment Compliancy Summary

As can be seen in this table, and detailed in Chapter 5, *Research*, the alternate environment matches the current environment for Requirement Id's Org1, Org6, Ind2 and Ind3; Superordinate goals identified, Benefits outweigh disadvantages, High quality of relationships and Informal communication, respectively. Furthermore, the alternate environment improves on the capacity for an inter-local government GIS integration for requirement Id's Org2, Org3, Org4, Org5, Ind1, Tec1 and Tec2; Rules and procedures applied, Incentives for all members, Limited resource scarcity, Political willingness of all organizations, Accessibility to all members, System of high relative quality and Not limited by current technology, respectively. In addition, all the ideal requirements as derived from the fitness for purpose test as specified are satisfied by the alternate design environment.

Outlined below are key changes required in current local government GIS environments to support an inter-local government GIS integration:

- Creation of formal agreements between the local governments that plan to participate in an inter-local government GIS integration to ensure that appropriate rules and procedures are applied.
- Delineation of integration incentives so that participating local governments are aware of the reasons and benefits to integration.
- Creation of a business case in order to gain support for the acquisition of necessary resources to support an integration.
- Creation of public pressure to assist in the political support for integration.
- Creation of varied networking opportunities in order to ensure a high level of accessibility to all members of the integration.
- Development of deficient system components to ensure that all systems are of high relative quality.
- Application of appropriate technology in all organizations in order to support integration.

6.2. Conclusions

This research has examined the current state of local government GIS integration in British Columbia, Canada. Furthermore, this research has compared various alternatives to current levels of integration against an ideal level of inter-local government GIS integration derived from a fitness for purpose test. Finally, this research has provided an evaluation of what the impacts of this level of integration may be.

The integration requirements that are now possible as a result of this research are summarized in Table 6.1. This table shows the current state of inter-local government GIS integration compared with the alternative integrated environment.

As stated earlier in Chapter 3 *Methodology*, action research was the method used to perform this research. The action research approach has worked well in the case of this research as it based on a real world environment where the results can be readily applied. In fact, the findings of this research are currently being applied in the researcher's place of work and neighbouring local governments.

Furthermore, to apply, test and review these impacts in a real-world environment was the core reason in utilizing the Action Research methodology for this research. Additionally it provides a way to validate this research on an ongoing basis through practise, not just one time.

Through the use of the action research approach, the following have been allowed:

- Direct research to be applied to a real world local government GIS environment.
- The inclusion of considerations in the design of the integrated environment such that the actions are considered through the critical review of environment alternatives as a result of being compared against the ideal environment.
- Consideration of alternative approaches to the integrated environment through iterative reductions of the actions that were deemed not to be viable solutions.

This research has also confirmed that the requirements required to support an inter-local government GIS integration environment are more extensive than for the current environment:

- More time and effort required to administer the integration
- Increased software costs
- Increased time spent communicating among all members
- Increased time / effort adhering to specified standards
- More time and effort spent on creation of and adhering to formal agreements
- Potential maintenance of additional or more complex software
- Increased time spent on project planning (more formal)

The key impacts to the users of the GIS information as a result of an inter-local government GIS integration are:

- Efficiency gain in workflow both within and between integrated local government organizations.
- Reduction in staff time to complete manual tasks.
- Improvement of service delivery; new or better service.
- Increased information dissemination.
- Easier access to information
- Access to more standardized and usable information.
- Increased use of data.
- Increased level and quality of communication both within and between local government organizations as well as the public.
- Increased local government transparency.

This research contributes to the greater body of knowledge in GIS research through the evaluation of inter-local government GIS integration from a predominantly organizational theory point of view. The majority of research done in the GIS field to date has been on a technical level and has been somewhat lacking from an organizational perspective.

Although this research does evaluate the technical factors in inter-local government GIS integration it focuses mainly on organizational factors.

6.2.1. Strengths and Weaknesses

The key strength to the methodology used in this research (action research methodology) is that it provides iterative testing and validity checking of each action

presented. In addition, the iterative development of actions based on the test results against a theoretical environment allow for flexibility and adaptability of the research to the environment being studied. As stated by Bell (1999, p.9) in action research 'theories' are not validated independently and then applied to practice. They are validated through practice. In addition, another key strength is that it is an ongoing process that may be applied to a real world environment continually.

Conversely, a weakness in this approach is that what action research gains in responsiveness it lacks in repeatability. Furthermore, as action research, and specifically this research, has been performed close to the researchers work in local government in the province of British Columbia, Canada, there is a potential for bias to enter the study. Therefore, to the degree possible biases and preconceived ideas have consciously been avoided wherever possible, however, this cannot be guaranteed.

Additionally, the use of the survey in this research introduces some potential weaknesses as well. First, is whether or not the survey is answered truthfully by the respondents. It is possible that the respondents believe that they should be integrating with other organizations but might not be and as a result may not answer 100% truthfully. Secondly, is that knowledge of the study being conducted may to some degree influence the actions of the organization being studied. As well, is the representativeness of the survey of the population being studied. Of the 2 broad categories of local government in British Columbia, the municipal response rate was 16.5% and the regional district response rate was 51.8%. One possible reason for the higher response rate from regional districts is that they have a stronger mandate to collaborate with their member local governments than do the individual municipalities. This discrepancy in responses may have introduced some bias in the survey results.

Finally, is the fitness for purpose test compliancy threshold. This threshold was chosen in order to ensure that all of the necessary requirements for an inter-local government GIS integration were addressed in this research, and not dismissed by using a mid-range percentage; the researcher has consciously chosen a high (75%) compliancy threshold.

6.3. Relevance to Other Environments

The results of this research may prove to be relevant to a wider local government jurisdiction or complementary organization. The results however, should be used with caution in areas where the functions of local government are not similar to the study area. For the application of the results of this research in other areas, further study is required. Furthermore, the results of this research may not apply to a private or competitive environment where collaboration is considered to be discouraged.

6.4. Other Areas of Research

This research is foundation research in field of GIS integration as it applies to the local government environment. As previously stated this research may apply to other environments as well. Another area of research that should be explored using this as a base are the results of other collaborations or integrations that have been tried but have been disappointing or have failed. Additionally, as increased communication was one of the major findings of this research, as newer forms of communication such as social networking become more mainstream they should be explored as well.

The critical review process that is a fundamental component of action research is based on the comparison of the current environment against an ideal inter-local government integrated GIS environment. This is just one approach, as devised by the researcher, as a way to test the appropriateness of an alternative environment. Other approaches are likely to be as valid or better than the one introduced here, further research should be conducted to reveal them.

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Appendix 1 – Survey Results

SelectSurveyAS™



Survey Results -- Overview



BC Municipal GIS Collaboration Survey

Respondents: 40 displayed, 40 total

Status: Open

Launched Date: 07/21/2008

Closed Date: N/A

Display:

Manage Filters 0 filters


Share Results Disabled

1. What is your gender

		Response Total	Response Percent
male		31	82%
female		7	18%
Total Respondents		38	
(skipped this question)			2

2. What is your age?

		Response Total	Response Percent
<20		0	0%
20 - 30		6	15%
31 - 40		14	35%

41 - 50		11	28%
51 - 60		8	20%
>60		1	2%
Total Respondents		40	

3. What is your highest level of education

		Response Total	Response Percent
High school Diploma		1	2%
College Degree / Diploma		13	32%
Undergraduate Degree		15	38%
Post Graduate Certification		5	12%
Master's Degree		6	15%
Doctorate Degree		0	0%
Total Respondents		40	

4. How many years have you worked in the GIS field

		Response Total	Response Percent
<5		12	32%
6 - 10		8	22%
11 - 20		14	38%
20 - 34		2	5%
>35		1	3%
Total Respondents		37	
(skipped this question)		3	

5. How would you rate your level of expertise in the GIS field

		Response Total	Response Percent
Very High		8	21%
High		16	41%
Average		11	28%
Low		3	8%

Very Low



1 3%

Total Respondents 39

(skipped this question) 1

6. What is your position within your organization

Manager



16 40%

Non-manager



24 60%

Total Respondents 40

7. How many years have you worked at your current organization?

<5



23 56%

6 - 10



8 20%

11 - 20



9 22%

21 - 30



1 2%

>30

0 0%

Total Respondents 41

8. What type of organization is yours?

Village



2 5%

Town



3 8%

Township



1 2%

District



9 22%

City



10 25%

Regional District



14 35%

First Nation Community

0 0%

Resort Municipality



1 2%

Total Respondents 40

9. What is the population in your organizations area?

		Response Total	Response Percent
<10,000		11	28%
10,000-20,000		5	12%
20,001-50,000		9	22%
50,001-100,000		6	15%
>100,000		9	22%
		Total Respondents	40

10. How many full time employees are there in your organization?

		Response Total	Response Percent
<25		11	28%
25-50		9	22%
51-100		8	20%
101-250		4	10%
>250		8	20%
		Total Respondents	40

11. How many councillors (including the Mayor) are there at your organization?

	Response Average
View responses to this question view	10.1
Total Respondents	39
(skipped this question)	1

12. Does your organization have a GIS?

		Response Total	Response Percent
Yes		34	85%
No		6	15%
		Total Respondents	40

13. If your organization does not have a GIS, why not?

View responses to this question [view](#)

Total Respondents	6
(skipped this question)	34

14. If your organization does not have a GIS, do you plan on implementing one?

		Response Total	Response Percent
Yes		4	67%
No		2	33%
		Total Respondents	6
		(skipped this question)	34

15. How does GIS fit into your organizational structure?

		Response Total	Response Percent
CAO (Chief Administrative Officer) – IT – GIS		6	19%
CAO – Finance – IT – GIS		4	12%
CAO – Engineering – GIS		12	38%
Other, please specify view		10	31%
		Total Respondents	32
		(skipped this question)	8

16. Is your GIS an enterprise GIS or is it strictly department based?

		Response Total	Response Percent
Enterprise		22	61%
Department based		11	31%
Other, please specify view		3	8%
		Total Respondents	36
		(skipped this question)	4





17. How many years have you had an enterprise GIS if at all?

	Response Average
View responses to this question view	5.8
Total Respondents	28
(skipped this question)	12

18. Why was an enterprise approach adopted?

View responses to this question view	
Total Respondents	23
(skipped this question)	17

19. With what other processes is your GIS integrated?

		Response Total	Response Percent
Financials		13	38%
Permitting		12	35%
Asset management		12	35%
Work order management		5	15%
Property management		23	68%
Recreation booking		0	0%
Computer aided design		15	44%
Traffic management		8	24%
Utility network modelling		11	32%
Emergency dispatch		18	53%
Document management		2	6%
None		4	12%
Other, please specify view		4	12%
		Total Respondents	34
		(skipped this question)	6

20. Do you collaborate with other organizations to a significant degree?

		Response Total	Response Percent
Yes		27	73%
No		10	27%
		Total Respondents	37
		(skipped this question)	3

21. If not, why?

View responses to this question [view](#)

Total Respondents	8
(skipped this question)	32

22. If not, do you plan to collaborate in the future?

		Response Total	Response Percent
Yes		11	85%
No		2	15%
		Total Respondents	13
		(skipped this question)	27

23. Do you see the barrier(s) to collaborating or collaborating to a larger degree as:













		Response Total	Response Percent
Organizational		13	41%
Technical		9	28%
Other, please specify view		10	31%
		Total Respondents	32
		(skipped this question)	8

24. Please elaborate on the above question

View responses to this question [view](#)

Total Respondents	22
(skipped this question)	18

25. If you collaborate, with what type of organizations do you collaborate?

		Response Total	Response Percent
Village		10	30%
Town		14	42%
City		22	67%
Private Company		12	36%
District		16	48%
Indian Government District		2	6%
Regional District		29	88%
Provincial Government		18	55%
Federal Government		5	15%
First Nation Community		7	21%
Township		4	12%
Resort Municipality		1	3%
		Total Respondents	33
		(skipped this question)	7

26. What best describes the type of collaboration that you do?

		Response Total	Response Percent
Data		32	97%
People (the secondment of staff for various purposes)		8	24%
Knowledge		25	76%
Software		14	42%
Hardware		6	18%
Data structures / data models		13	39%
Adhoc standards		5	15%
Metadata (data about data)		5	15%
GIS data workflows		9	27%
Quality Assurance / Quality Control methods		3	9%
Cadastral maintenance		15	45%

methods

Models		6	18%
Database replication methods		3	9%
Analytical techniques		5	15%
Web mapping (delivery of GIS data to staff and public)		20	61%
Don't currently collaborate		1	3%
Other, please specify view		1	3%
Total Respondents		33	
(skipped this question)		7	

27. Do you see the benefits to collaboration as:

		Response Total	Response Percent
Tangible		31	94%
Political		15	45%
Personal		10	30%
Altruistic		9	27%
Other, please specify		0	0%
Total Respondents		33	
(skipped this question)		7	

28. Please elaborate on your response to the above question

View responses to this question [view](#)

Total Respondents	16
(skipped this question)	24

29. Org1

		Response Total	Response Percent
Strongly Agree		4	12%

Agree		24	75%
Neutral		4	12%
Disagree		0	0%
Strongly Disagree		0	0%
		Total Respondents	32
		(skipped this question)	8

30. Org2

		Response Total	Response Percent
Strongly Agree		1	3%
Agree		8	24%
Neutral		18	55%
Disagree		6	18%
Strongly Disagree		0	0%
		Total Respondents	33
		(skipped this question)	7

31. Org3

		Response Total	Response Percent
Strongly Agree		2	6%
Agree		6	18%
Neutral		17	52%
Disagree		8	24%
Strongly Disagree		0	0%
		Total Respondents	33
		(skipped this question)	7

32. Org4

		Response Total	Response Percent
Strongly Agree		0	0%
Agree		5	15%

Neutral		12	36%
Disagree		14	42%
Strongly Disagree		2	6%
		Total Respondents	33
		(skipped this question)	7

33. Org5

		Response Total	Response Percent
Strongly Agree		2	6%
Agree		9	27%
Neutral		14	42%
Disagree		7	21%
Strongly Disagree		1	3%
		Total Respondents	33
		(skipped this question)	7

34. Org6

		Response Total	Response Percent
Strongly Agree		9	26%
Agree		20	59%
Neutral		5	15%
Disagree		0	0%
Strongly Disagree		0	0%
		Total Respondents	34
		(skipped this question)	6

35. Ind1

		Response Total	Response Percent
Strongly Agree		1	3%
Agree		15	44%
Neutral		13	38%

Disagree		5	15%
Strongly Disagree		0	0%
		Total Respondents	34
		(skipped this question)	6

36. Ind2

		Response Total	Response Percent
Strongly Agree		7	21%
Agree		21	62%
Neutral		5	15%
Disagree		1	3%
Strongly Disagree		0	0%
		Total Respondents	34
		(skipped this question)	6

37. Ind3

		Response Total	Response Percent
Strongly Agree		9	26%
Agree		20	59%
Neutral		4	12%
Disagree		1	3%
Strongly Disagree		0	0%
		Total Respondents	34
		(skipped this question)	6

38. Tec1

		Response Total	Response Percent
Strongly Agree		5	15%
Agree		13	38%
Neutral		13	38%
Disagree		2	6%

Strongly Disagree



1 3%

Total Respondents 34

(skipped this question) 6

39. Tec2

Strongly Agree



5 15%

Agree



17 50%

Neutral



5 15%

Disagree



5 15%

Strongly Disagree



2 6%

Total Respondents 34

(skipped this question) 6