Analyzing Effectiveness of GIS in Public Organizations Based on Organizational Location

Matthew A. Supert
09/19/06

Table of Contents

Executive Summary

Geographic Information Systems (GIS) is a field of expertise and study that is quickly growing to be one of the most important new technologies that public sector organizations are investing in for the twenty first century to achieve better service and efficiency. While the need to develop GIS within an organization may seem apparent due to the push for greater technological innovation in government, the processes and methods to develop a GIS are still in their infancy and many organizations are finding the development of their GIS to be more costly and complex then they initially realized.

This study is designed to determine if a geographic information system's placement within an organization impacts the way a GIS is used, perceived and funded, and help to identify if public organizations can more fully utilize their investment based on its location within their organization. This study also sought to determine if employee resistance and personnel training has a direct correlation to the success or failure of a GIS within an organization.

This analysis is comprised of two online surveys that targeted generalist administrative managers and GIS managers in public organizations. Survey questionnaires were sent out to online listservs, discussion groups and email lists of public professionals and asked them to answer questions pertaining to the development of GIS within their organization. Separate surveys were given to both GIS and generalist managers to try to address the technical and administrative differences that each party might have had in dealing with GIS within their organization.

The surveys were open for participation for approximately six weeks, and the results concluded with fifty two participants participating in the generalist manager survey and forty two respondents participating in the GIS manager survey. From this number some candidates were removed from the data due to the lack of complete answers to the surveys and the final number of participants used in the analysis included thirty seven respondents to the GIS manager survey and forty eight respondents to the generalist manager survey.

The results from the surveys indicated that the participants experienced little of the problems that the literature and this analysis previously identified as major roadblocks to GIS implementation and management. Very few of the respondents indicated that they experienced employee resistance to the implementation and usage of GIS within their organizations, there also appears to be no correlation between the amount of money spent on training success with GIS. From the participants surveyed, the placement of GIS within the organization appeared evenly distributed while the success rates of GIS implementation was ranked very high. Ultimately, there appears to be little or no correlation in respects to the location of GIS within an organization, and the success of a GIS.

Introduction

Throughout the 1990s public sector organizations, particularly local governments, felt increasing fiscal and political pressure to reduce costs and increase efficiencies. This movement was popularly known as the new public management movement and helped redefine the role of public organizations (Borins 2002). With the advent of the internet and the personal computer almost all public organizations found themselves in the continual process of modernizing themselves, trying to create more efficiency with new computer technology, database systems, and paperless processing. Through this period geographic information systems (GIS), along with many other information technology systems began to emerge with promises of creating a more efficient government with lower costs and better productivity. The problem that arose with these systems however is that they were very expensive to implement up front and many people believed these investments were wasted money because they did not produce a profit return from the investment. When the promised efficiency from the implementation of a GIS did not develop due to technical and organizational problems, many began to wonder if these systems really were the solutions to inefficiency as promised.

Geographic information systems as we know them now first began to develop in the nineteen sixties out of the computer aided drafting systems in mostly public sector organizations. At the time, GIS consisted of mostly custom built software and hardware platforms developed for specific organizations. It was not until the nineteen eighties that a commercial industry was born for this new field and some form of standardization in practice and use began to develop

(Mark et al. 1996). It was not until the nineteen nineties however that the costs and technology of geographic information systems became affordable enough for GIS to be used as practical and affordable desktop applications. Throughout the nineteen nineties GIS was touted by many to be the next step in database management and organizational software because information can be easily referenced visually to a geographic location. This visual representation of data and information is what sets GIS databases apart from traditional databases and was one of the key reasons that GIS could reach mass appeal over traditional database and enterprise systems.

A geographic information system consists primarily of a database linked to maps and aerial or satellite imagery. The real flexibility in a GIS is its ability to add additional layers of information ranging from financial information, property identifiers, water flow data, traffic flow and much more. In a local government for example nearly every department, ranging from public works to finance, has data that can be spatially referenced to property or other locations within the municipal boundaries. As one can imagine the organizational and cross linking information prospects can be very enticing to any public organization.

While this broad application potential opens up a lot of opportunities for a GIS, it can also lead to problems with development because of the different demands and needs that departments within an organization can require of it. GIS's development has occurred in different departments throughout different organizations because of this and in many cases its development became stunted due to the lack of planning from the GIS designers for the developmental need for the broader organization.

Traditionally, the development of most new technology in the public sector began in the finance departments of public organizations during the early introduction of computers through the nineteen seventies and early nineteen eighties. This early development process was largely a byproduct of the fact that finance departments were one of the few, if not only departments to have computers during these early years. As technology progressed through the nineteen nineties, many organizations continued to operate with their technology management occurring in the finance department despite the growth of the personal computer spreading throughout the entire organization. Those organizations that were big enough or that had the financial means to do so, created an information technology department or division to help manage and procure future technology investments. With the advent of modern geographic information systems however, the responsibility of management and procurement of the program often fell upon a wide range of departments needing to interact with each other in a coordinated effort (Walsham, Sahay 1999).

Since GIS has developed in many different departments over the years, attitudes, perspectives and purposes of GIS may be influenced differently depending upon the department and the people who work and develop a GIS. The early development of GIS in the public sector as a whole had promised increased efficiency, but early adopters of the system soon found out that unless they invested a lot of time and money to nurture the development of their GIS, their system did not deliver all of the promises that they had hoped for. Researchers Karla Albuquerque de Vascocelos Borges and Sundeep Sahay (accessed 2006) found that Brazilian

officials were very surprised at the difficulty in implementing a successful GIS in their levels of government. Even with benchmarks of standardization successfully enforced across levels of the government, degrees of specialization with users and separation in department data began to occur (Albuquerque, Sahay, accessed 2006).

Many of the most common problems for Brazil and many other organizations developed out of poor initial planning and long term outlook for the development of GIS within the organization. Employee resistance or inadequate training of staff made to only exacerbate the problem of failing GIS's in the public sector.

In many respects GIS development has seen the same short comings and problems that were associated with enterprise systems in the United States, and most organizations were unprepared or unwilling to invest the attention and time needed to help their GIS grow to the personalized environment that was needed for their organization. The purpose of GIS was to create a more efficient government that could in essence "do more with less". However, because of GIS's complexity and the costs associated with it, many governments found themselves spending thousands, at times millions of dollars on a GIS only to find that they were barely utilizing it or could not get employees to readily adopt the new system. As is the case then with many information systems the "organizations contain[ed] data, but little contain information" (Worral, Bond 1997, 375).

The obvious question to these problems then is to ask "What are we supposed to do?" The answer may not be as inherently obvious as one may think because of the complex nature of

developing any system within a complex organization. Due to the fact that GIS is still considered a young field, many problems can be traced back to the root organizational structure of the GIS from the beginning of its development. Rebecca Somers (1998) noted in her observations; “Most problems can be traced back to conflicting ideas of what a GIS should be.” (Somers 1998, 165)

In many instances people think of GIS as a tool, a department, a support service, or something else altogether, but rarely does anyone try to think of GIS as all of these. No one knows exactly what GIS is and because of this confusion GIS development in most organizations is left struggling to gain the usefulness that so many expect from it.

Literature Review

One of the strongest developmental fields in geographic information systems historically has been the public sector (Mark et al. 1996). However, it appears that in many aspects, the design and implementation of GIS is tailored towards a private sector style of management and organizational design. While GIS on its surface is easy to describe, the metaphorical and practical applications of what GIS is are much more difficult then saying it is a bunch of maps. The basic core goal of any GIS system is to design a database environment that can store and retrieve spatial and geographically referenced data for the user. Once organizations expand beyond this simple goal, the definition of what GIS is and what it should do becomes much more clouded. Some government organizations may simply want to utilize GIS to create a mapping system that allows people to access geographic information across the entire organization. Other organizations may want to develop their GIS with the capability to be a useful policy analysis tool, with the ability to run computer based models. The massive amounts of information that a GIS can accumulate along with the inherent flexibility of displaying and organizing data has created a potential in which a GIS can be everything, yet at the same time be nothing because it is too broadly dispersed in its scope. The organization can find itself with too much information and no way to effectively process that information.

A geographic information system in its most basic form consists of two primary parts: maps and databases. Because of this duality, the development of early geographic information systems in many public organizations usually began in a range of departments ranging from

finance departments to infrastructure departments. As one can imagine, different departments will have different ideas on how to organize information, and consequently different ideas on how to manage a GIS.

Organizationally, early development of a GIS might have been convoluted or confusing to many involved. While larger organizations had the flexibility of having their own GIS team or department, many smaller organizations did not. Therefore, development may have found itself in another line department or perhaps divided amongst several departments. Organizations that began the development of their geographic information system in the mid-nineteen nineties or later may have classified their system under the newly coined information technology department in order to more efficiently manage the technical maintenance of a GIS and its supporting systems. The development of GIS then in the public sector has been one of discontinuity with little or no organizational guidelines establishing examples of how to structure and manage a GIS.

Unlike traditional map systems that are updated at regular intervals, or technology management plans that are managed on a fixed basis, GIS is an ever evolving and changing system because of the changing real world environment and the multitude of input points throughout an organization that it touches. Rebecca Somers states that; "GIS complicates an organization by not only implementing new technology, but implementing new technology which will continue to change and evolve over time." (Somers 2006, 49) The implementation of a GIS in this case does not follow most information technology expectations.

GIS implementation has historically been a slow process for most organizations, and that slow implementation and poor success rate is grounded largely in the fact that proper planning for GIS was not invested in as much as the hardware and software purchases were. GIS is not only a mapping tool but also is enterprise software, data resource center, a policy development tool, and even a data retrieval tool (Somers 1998). The implementation of a GIS into any organization is not simply the implementation of a new technology as many mistakenly think, but rather the implementation of new processes. The most common problems can be traced back not to the software or hardware issues in and of themselves, but rather the conceptual differences people within an organization have in regards to what the GIS should be and how it should be used (Somers 1998).

Researchers have found the investment in a complete needs assessment or strategic plan for an organization's GIS could be critical in determining the long term success of a GIS. The creation of a strategic plan or needs assessment will help to guide the development and implementation of a GIS because of the long time frame which is required to develop a GIS. The strategic plan will help users and organizations identify landmark points within that GIS to measure their progress. For example, while most people might think of GIS existing as a database of information that generally produces maps, GIS could actually branch in several different directions throughout an organization handling multiple tasks such as billing information, GPS tracking and more. GIS could become an enterprise platform reaching many different parts of an organization such as the finance department or administrative offices, or it

could be developed as a forecasting tool that could estimate the potential growth in an area based on the introduction of a retailer (Somers 1998). The strategic plan in this instance will help the organizations identify the areas within the organization that can utilize a GIS and also help to set forth a road map that can successfully implement the GIS into those identified areas.

The development of any information technology system is an incremental process and a strategic plan will help organizations identify those incremental steps and criteria in which to progress through their development. The implementation process has several levels of implementation that exist on the micro and macro levels.

The micro level implementation plan consists of information that is traditionally recognized in most strategic plans. The micro level implementation usually covers the installation of hardware and software, purchasing plans and sometimes training. GIS planning on a macro level is a much more anamorphic problem due to the undefined boundaries between transition periods, the long time frame in which progress occurs, and the difficulty associated with quantifying implementation processes. The broader implementation paradigm of the macro level progression can be broken down into three basic landmark steps that appear to be common amongst all organizations in their development. These steps were identified by Stephan J. Ventura (1999) in an article entitled Uses of Geographic Information Systems in Local Government, which was published in the Public Administration Review.

The first stage or transitional period of the macro level implementation is the development of base maps and usually involves the implementation of hardware software and adoption of a

system by the employees of the organization. One of the identified problems during this stage is that many organizations' strategic plans or needs assessments successfully cover this implementation stage and the micro implementation, but then stop and do not develop implementation or management strategies beyond this stage (Nedovic-Budic, Godschalk 1996).

The second stage of GIS development involves GIS being elevated beyond a database tool of storing and retrieving information to that of a decision making tool, providing data and resource access to policy and decision makers in a quick and meaningful manner. In this stage, the development of the GIS is complete, but procedures need to be put into place governing how information is used and extracted out of the GIS in a practical and useful manner.

The third and final stage would be a policy development tool or modeling tool. This can often times be seen in an enterprise format where information is interconnected across an organization to all members. In this form not only can information be accessed for decision making processes, but it can also be used for forecasting and policy development within an organization (Ventura 1999). In essence the GIS can run hypothetical scenarios ranging from policies to financial plans to predict what outcomes might occur over defined time frames.

Stephan Ventura found each of these stages to take about five years to develop, but noted that it is not inherent for an organization to move from one level to the next and many organizations may find themselves stuck at one level. From Ventura's model, the process of macro level implementation is an extremely long time frame, fifteen years or more, and in many instances there is no guarantee that one's organization will be able to progress to the next stage.

This large time frame and level of uncertainty makes managing and successfully implementing a geographic information system extremely difficult, but may justify to some opponents of geographic information systems that the benefits associated with a GIS are not worth the costs to implement and mange such a large and complex system.

While many proponents focus in on the monetary costs that would be associated with this large and long term investment, most authors who write about information technology in the workplace and the implementation of GIS recognize that cost itself is usually not the problem with the implementation of these systems, bur rather the biggest hurdles to this process and its progression are the users and getting them to adopt and accept the new processes involved.

Information technology may be confusing or burdensome upon first time users of the system due to the structure of the organization, the transition to the software, or the lack of management and training for the users. GIS on many aspects could be used as an integration tool across an entire organization, but many organizations and their employees view GIS as merely another mapping or presentation software (Nedvic-Budic, Godschalk 1996). Two different studies by Les Worral and Derek Bond (1997) analyzing the British civil service's implementation of GIS and a study of information technology implementation in government by Brown, O'Toole and Brudney found that non-hierarchical organizations or flattened organizations tended to be more successful at implementing information technology systems because information is more easily disseminated between levels of the organizations (Brown, O'Toole, Brudney 1998; Worral, Bond 1997). More flatly structured organizations were able to

more effectively distribute and manage resources across the organization as a whole, and as GIS is an organization wide tool so this approach helped those organizations in implementing a GIS and mitigating the negative impacts upon first time users.

Many American organizations, including government organizations, are traditionally hierarchical or pyramidal compared to the flattened system of other organizations, and while this does create for an efficient accountability structure it does not allow these organizations to effectively manage their resource distribution or achieve a dialog between sectors through the implementation of GIS within the organization (Worral, Bond 1997). Within this hierarchical organization structure there tends to be compartmentalization of divisions and even at the job level there can be divisions and further separation between employees. One person in the office for example might be considered the "computer guy", or there could be a situation with GIS where the department engineer is only interested in GIS related tools to engineering and not anything else (Walsham, Sahay 1999). The goal then of developers is to try to get employees to think more broadly about the scope and impacts of the system.

In any GIS implementation the organization needs to have the capacity and willingness to absorb the new technology and encourage its usage (Ventura 1995). Often times many organizations will find that this will not occur unless the organization is faced with a "catastrophic event" or is mandated by a higher authority to do so (Ventura 1995). The absorption rate is not there and many employees who feel they are performing efficiently already will not bother to take up a new technology. Other times the software can be seen as too

complex or inefficient to use and will make many employees and organizations feel that they are losing efficiency or capability with the introduction of the new technology. (McGarigle 2000)

As with the development of any new program or technology, the development of GIS is not a static exercise, and while some may think that an internal process like GIS might be immune to external factors, there are in fact a wide range of external forces that can and do influence its development; such as politics and economic forces (Nedevic-Budic 1996). Just as much as external factors can play a significant role in the adoption and development of GIS, internal factors of the organization are equally important. The incorporation of technology within an organization is a reciprocal process, and an organization does not just make a purchasing decision and then implement that decision with the impact focused towards the user end of the equation. The organization and the technology each influence diffusion of technology in different ways, and in many respects the users and other factors within the organization influence the software or technology model being implemented (Nedevic-Budic 1996). The decisions and the decision making process feeds back upon itself in a cyclical manner. Decisions in any instance through this process then need to be made carefully because they often times cannot be rescinded after they have been executed.

The breakdown of GIS problems continues further down to the user level and in many instances the most recurring problems can be traced back to patterns in the attitudes of the users within the organization; both those who use and those who do not use GIS in their every day tasks. In research by Zorica Nedovic-Budic and David R. Godschalk (1996), the researchers

found that employees who naturally networked within their organization, and communicate across organizational ties, were more computer oriented, and much more receptive to the implementation of GIS. Perhaps most important is that they found that technology or computer skills were not the determining factor in an employee's acceptance of GIS, but rather it was the employee's use of communication in their job that had the strongest correlation. The better an employee was at communicating with his or her fellow employees within the organization the better they were at adapting to the implementation of new technology. The researchers did find a trend that shows established GIS users do have a predisposition of being previously heavy computer users, either at home or at work, but Nedovic-Budic believed that these variables are not correlated, but rather both results of the networking and communication skills of the employee (Nedovic-Budic, Godschalk 1996).

Other important factors found in the employee adoption level of technology in the workplace were the work environment of the employee. Employees, who had negative personal relationships at work or employment positions which were isolated, had a negative attitude towards change within the work environment and tended to enjoy a static work environment (Nedovic-Budic, Godschalk 1996).

Departments such as public works facilities are common places for the establishment of GIS programs within many organizations due to the geographic nature of the infrastructure work and the maps involved, but their employees tended to share the similar aspects of those described by Nedovic-Budic as having negative attitudes towards change or working in a static working

environment. The problem then is that many organizations seem to try to develop a communication based process in a potentially resistant environment.

While GIS continues in its allure to have seemingly unlimited potential, the mounting evidence of problems and speculation to the benefits of the programs continue to plague many geographic information systems, discouraging many people from effectively adopting the platform. Empirical evidence such as the cost-benefit analysis by the University of Albany/ SUNY tried to balance out the potential benefits of IT investments while taking into account hardware and software costs, training, operational costs and other cost factors. The outcomes from the analysis from the University of Albany/SUNY (1995) showed that despite the inherent problems that are commonly associated with the development and implementation of IT related investments, these investments did indeed create improved efficiency, enhanced decision making and improved service to the public. (Center for Technology in Government Albany/SUNY 1995)

What lays ahead for the public officials who wish to implement a geographic information system is uncertain due to the lack of experience and past models to rely upon. While one of the most popular trends in the government sector throughout most of the nineteen nineties was the utilization of partnerships and networks, evidence seems to suggest that there is a diminishing level of return as partnerships become more complex. Brown, O'Toole and Brudney warn that the over reliance upon a partnership, such as a contractor or regional organization can be significantly detrimental to the development of any GIS because it increases the number of

leaders, creating conflict, and leading to lower expectations and slower decision making processes (Brown, O'Toole, Brudney 1998).

When the GIS development team for Grand Victoria, Canada came into an organization with a negative view towards GIS implementation, they focused on the users as the means to implementing a successful GIS program, not the technology. They set out by demonstrating the software to different departments throughout the government asking for employee feedback on what they would like to be able to do. The GIS team then reduced competition between departments for information and ensured equal access to the GIS for everyone. From the beginning of the new GIS design, the GIS team focused on milestone achievements over a multi-year implementation plan without worrying about immediate or early returns. The authors of this case study Tai On Chan and Ian Williamson (1997) stated that the designers thought that focus on immediate results would create duplicate and wasteful information as well as department specialists. From this multi year plan in Grand Victoria, the government was able to successfully implement an organization wide GIS program that is accessible and accepted by all users within the organization. (Chan, Williamson 1997)

While Grand Victoria was successful in its GIS implementation the second time around, it encountered many of the same problems that most organizations do in their first try at implementing a GIS. Haste in development, resistant employees, too much focus on the technical aspects and lack of long term management appear to be reoccurring themes in any GIS implementation.

What is still unclear however is the impact that the department involved has upon the development itself. While many studies show success and failures from a variety of organizational locations of GIS, not all organizations have the same opportunities for deployment as others. The role of the GIS location itself and the impacts of that location, if any, could play a defining role in success or failure of an organization's GIS.

Research and Design

The purpose of this analysis is to determine if the placement of a Geographic Information System (GIS) within a public organization influences a GIS's usage, development, funding, and perspective in regards to information technology and overall organizational effectiveness. The following hypotheses were proposed for this analysis:

1. The location of a geographic information system influences the usage, development, funding and perspective of a geographic information system within a public organization.
2. The lack of long term planning in GIS development will be detrimental to the development of the system.
3. The lack of employee training and education is a significant detractor to the development of a GIS

Individuals for this study were chosen by their participation level in online listservs associated with geographic information systems (GIS), information technology or generalist management in the public sector. Volunteers were solicited through these listservs to voluntarily participate in an online survey answering a survey comprised of mostly multiple choice questions pertaining to the development of GIS within their organization.

Due to the nature of the participants involved in this survey, bias is a definite possibility based on the number of respondents and types that respond. In municipal government the type of software used or the existence of contractors tend to be more consistent then compared to other public organizations. It is also likely to assume that a good majority of respondents to the survey will be municipal government employees based on the use of the IAMMA and GMIS-L listservs and their association with the Northern Illinois University Public Administration

program. This association between the organizations could artificially suggest a trend that may exist in local governments in Illinois, but may not be prevalent in other public sector organizations or in other geographic areas of the country.

Alternative designs could have covered more in-depth analysis on more employees within organizations as well as made an effort to ensure a more encompassing sample of geographic regions and organizations. Since the development of GIS is also a multi-year process, follow-up surveys tracking trends of organizations over time would better help to understand the impact of a GIS's location upon its development. Unfortunately, the current survey only takes a snapshot of an organization's state of progress at this point in time, and it is very likely that within a few years from the point of the survey the success or failure of an organization's GIS development could have radically changed.

Results/Findings

The survey results of this study were analyzed using linear regression of key independent and dependent variables to compare the response rates of individuals and the successes and failures associated with their organization's GIS. Qualitative analysis of the participant's responses from open ended questions was used to determine the successes and problems associated with an organization's GIS compared to their quantitative answers. Opinions were compared against the actual quantitative responses to judge if participant's answers were consistent. Descriptive statistics were used on certain key variables within the analysis in order to convey a broader understanding of where public organizations in this study stand overall in regards to the development of their GIS. The comparison of the quantitative data to that of the qualitative results was used to determine if the location of a GIS within an organization demonstrated any significant impact upon the success level associated with a GIS and the problems addressed by the participants. The actual "n" values for particular measurements will vary slightly depending upon the amount of participants who decided to respond to a particular question.

The survey's sample participants came from a broad range of online sources including professional listservs, online forums and personal email contacts. The surveys had thirty two respondents from GIS managers and forty seven respondents from generalist managers.

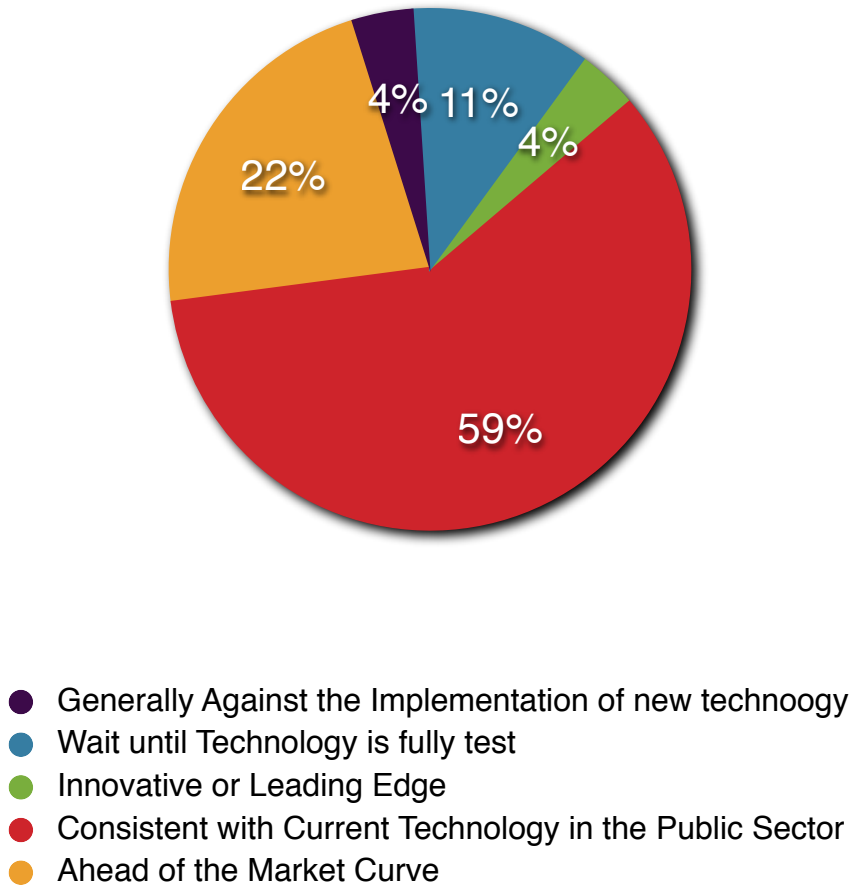
In this analysis several variables were determined to be dependent variables and at times may have been considered independent variables depending upon the other variables being measured in the particular analysis. Key dependent variables measuring the success of a GIS include: ranked accomplishments of the GIS within the organization , ranked level of employee

resistance, approximated GIS budget and successful development of base maps. Independent variables include: the type of department(s) that use GIS, the years the GIS has been in the organization, the number of full time equivalent employees, the percentage of employees that use GIS, and whether or not the organization conducted a feasibility study.

Data

The initial review of the data shows that most of the organizations consider themselves to be consistent with the current technological movements in the public sector, with 83% of the respondents believing that they are current or ahead of the current trends in technology in the public sector. This statistic is important because it sets a standard of the organizations that have participated in this study as possibly having higher success levels with their implementation of their GIS then what is perceived from the success of other information technology endeavors and GIS programs.

Chart 1. Organizational goals with respect to the implementation of new technology. Generalist Manager Survey n=27



This observation of higher success in GIS development in the surveyed organization is further brought forward by the distribution and participation of departments that have access to GIS. The number of departments that use GIS within the participating organizations is fairly high, with a fairly even distribution amongst departments and all of the department options obtaining at least one response from the survey participants.

Chart 2: Survey of departments that use GIS within participating organizations. Generalist Manager Survey n=37

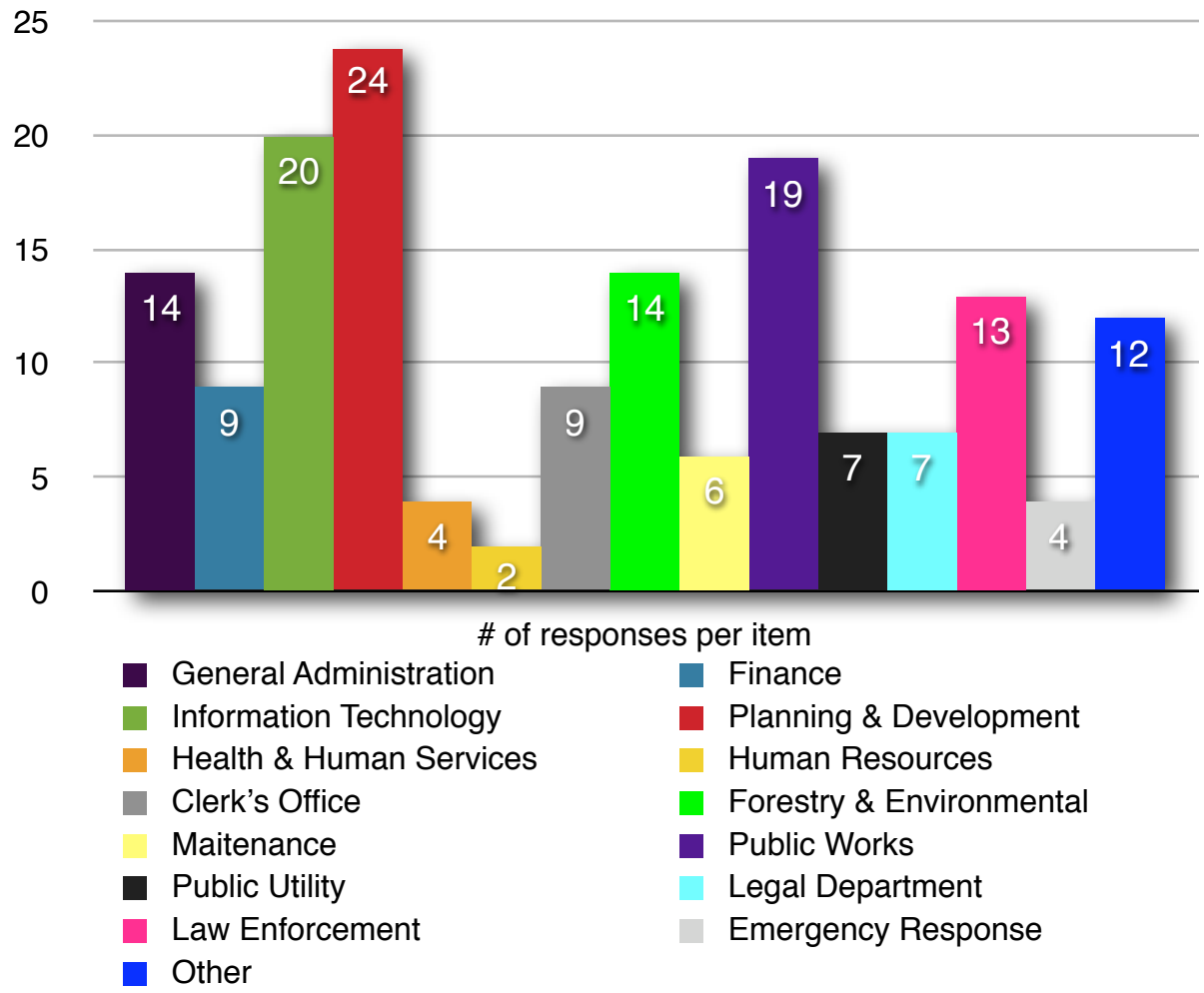
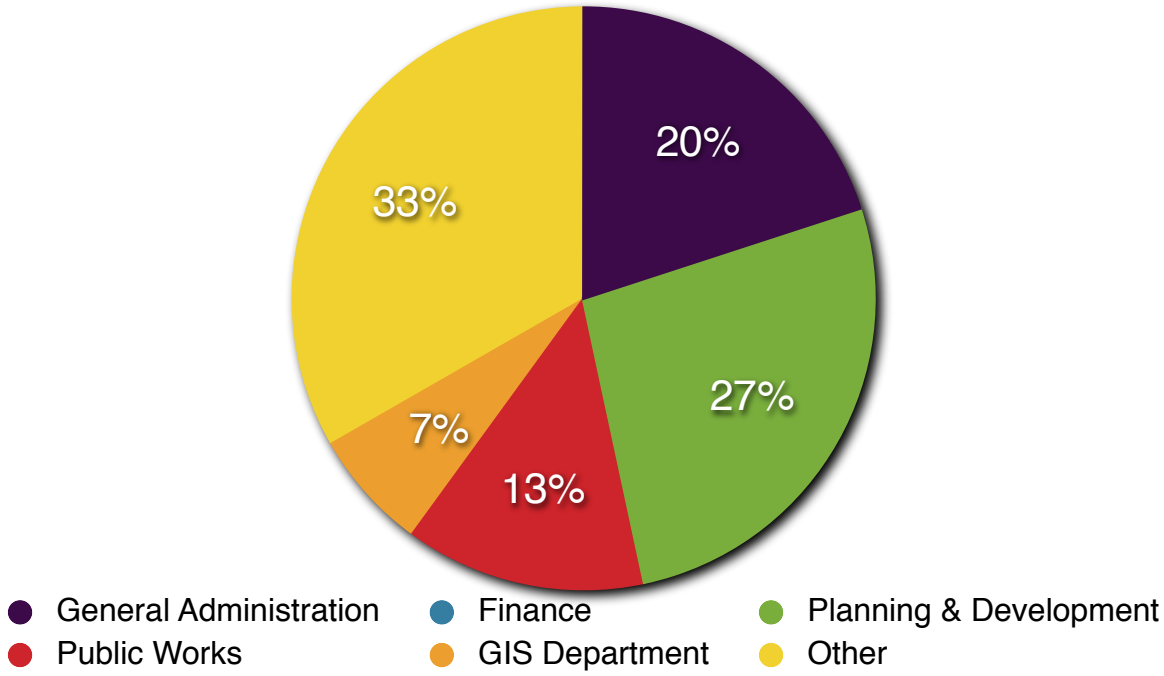


Chart 3: What Department is primarily in charge of your organization's GIS? Generalist Manager Survey n=16



The varied participation of departments within organizations continues with the distribution of departments that are in charge of GIS within the organizations. From the results of the surveys the distribution of the GIS management within organizations was extremely varied with planning & development departments being one of the primary locations for the development and management of a GIS. Surprisingly none of the participants listed an information technology department as being in charge of their GIS and distribution of GIS management was limited primarily to five locations with a few "Other" responses. This result contradicts many of the authors analyzed in this study who site the common problems with GIS development and often times recommend an information technology department as a solution because of it being a data management tool rather then a mapping tool. The "Other" responses in

the analysis came from the non-municipal government entities that participated in this analysis and included one “technology research”, one “university partnership”, and three responses that included “engineering” as key word .

Table 1: Please rate to what extent (1=None at all, 5= A great deal) has your organization experienced each of the following accomplishments with the development of your GIS. Generalist Manager Survey n=21

Ranking	1	2	3	4	5	Avg. Score
Development of base maps	0% (0)	25% (5)	20% (4)	20% (4)	**35% (7)**	**3.65**
Successful usage/ adoption by employees	10% (2)	**43% (9)**	24% (5)	14% (3)	10% (2)	**2.71**
Integration with other systems	20% (4)	**30% (6)**	25% (5)	15% (3)	10% (2)	**2.65**
Consistent or accurate data development	10% (2)	24% (5)	**38% (8)**	14% (3)	14% (3)	**3.00**
Successful short term planning	5% (1)	30% (6)	**40% (8)**	10% (2)	15% (3)	**3.00**
Successful long term planning	5% (1)	35% (7)	**45% (9)**	0% (0)	15% (3)	**2.85**
Adequate or strong political support	14% (3)	19% (4)	**33% (7)**	14% (3)	19% (4)	**3.05**
Adequate or strong executive support	10% (2)	14% (3)	**29% (6)**	24% (5)	24% (5)	**3.38**
Other	**100% (3)**	0% (0)	0% (0)	0% (0)	0% (0)	**1.00**

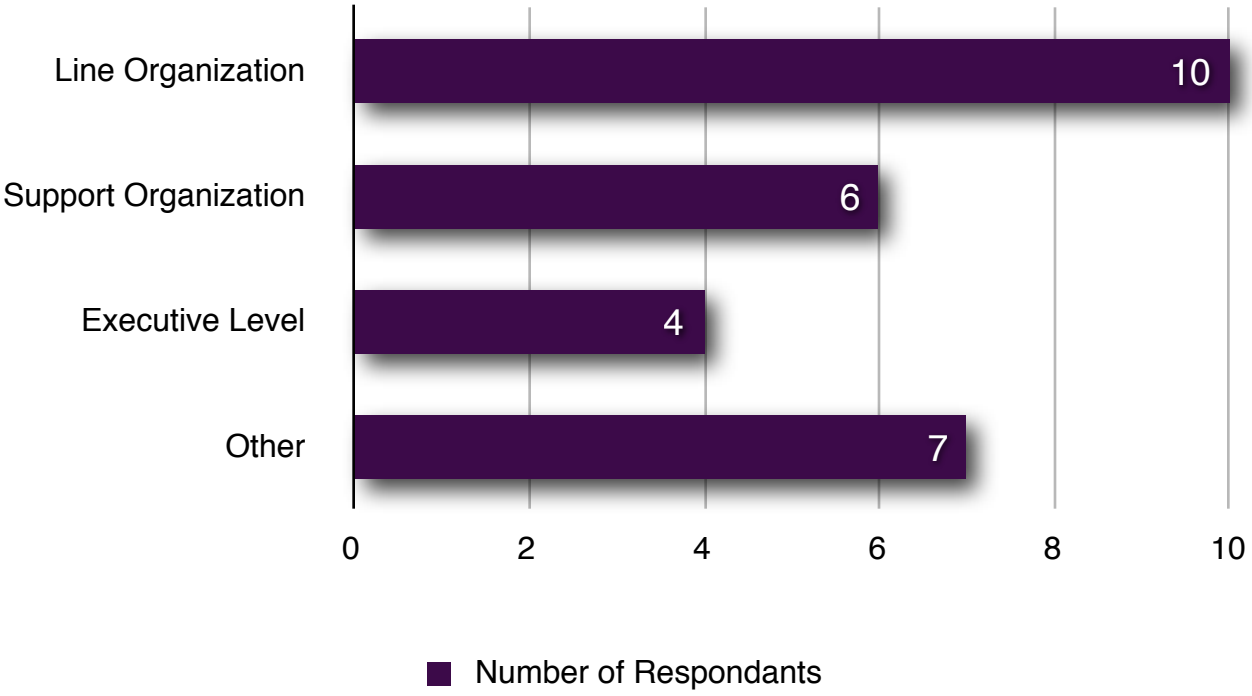
Table 2: Please rate to what extent (1=None at all, 5= A great deal) has your organization experienced each of the following accomplishments with the development of your GIS. GIS Manager Survey n=27						
Ranking	1	2	3	4	5	Avg. Score
Development of base maps	7% (2)	4% (1)	7% (2)	11% (3)	**70% (19)**	**4.33**
Successful usage/ adoption by employees	0% (0)	22% (6)	26% (7)	**44% (12)**	7% (2)	**3.37**
Integration with other systems	7% (2)	19% (5)	**41% (11)**	26% (7)	7% (2)	**3.07**
Consistent or accurate data development	0% (0)	8% (2)	15% (4)	**46% (12)**	31% (8)	**4.00**
Successful short term planning	4% (1)	22% (6)	22% (6)	**33% (9)**	19% (5)	**3.41**
Successful long term planning	11% (3)	11% (3)	33% (9)	**37% (10)**	7% (2)	**3.19**
Adequate or strong political support	4% (1)	15% (4)	**38% (10)**	23% (6)	19% (5)	**3.38**
Adequate or strong executive support	4% (1)	7% (2)	26% (7)	**37% (10)**	26% (7)	**3.74**
Other (Please explain below)	0% (0)	0% (0)	0% (0)	0% (0)	**100% (1)**	**5.00**

The varied location of GIS within an organization does not appear to impact the success of the GIS within the organization. From the graphs of the technical accomplishments associated with the development of a GIS from generalist managers and GIS managers, the results tend towards the "successful" responses. The development of base maps in a GIS program can arguably be identified as the most simple baseline measurement of success in GIS development.

The generalist manager survey returned an average score of 3.65 out of 5 and the GIS manager survey returned an average score 4.33 out of 5 in the development of base maps.

Interestingly enough forty three percent of respondents stated that adoption by employees was a ranking of just “2” on a “5” point scale and the average score for employee adoption was only a 2.71 out of 21 generalist managers. Results from the GIS managers survey however showed strikingly different results, even when many of the respondents involved in both surveys were members of the same organization. Seventy seven percent of GIS managers ranked employee adoption as a “3” or higher in regards to success in that criteria.

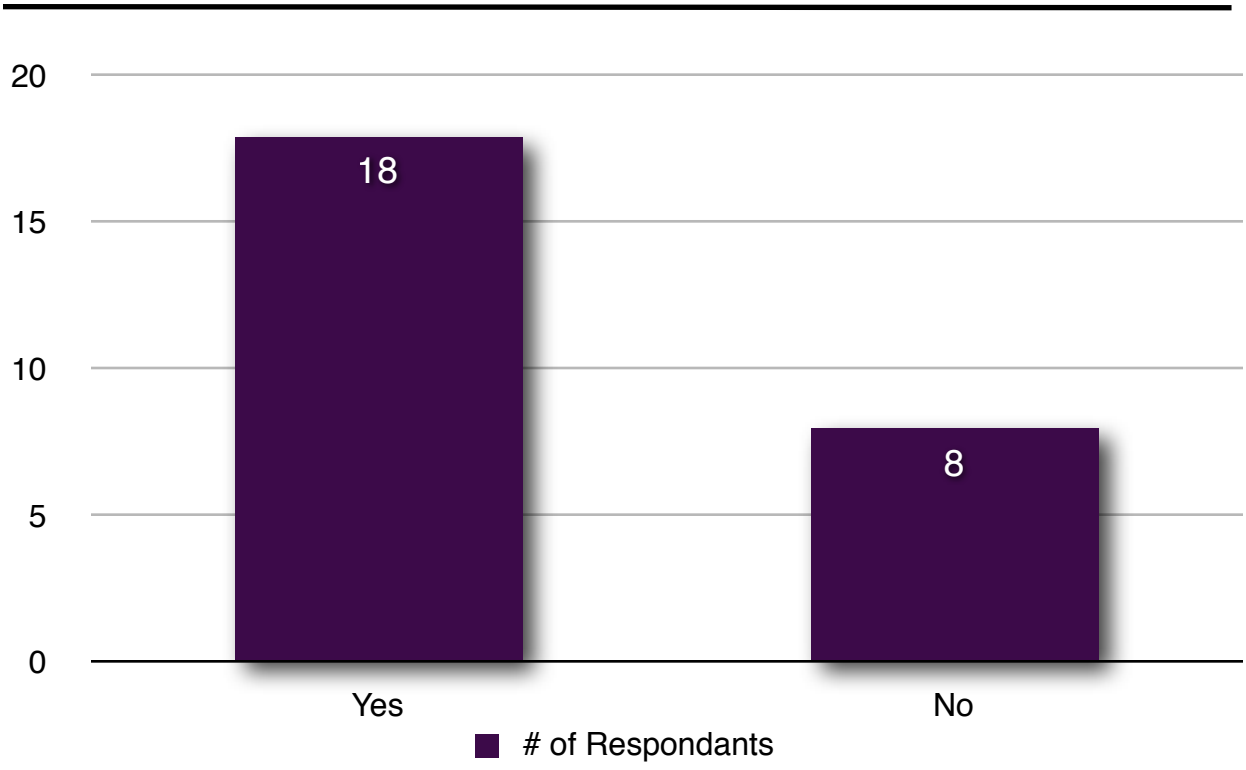
Chart 4. How is your GIS unit classified within your organization? Generalist Manager Survey. n=27



The organizational structure of the GIS within different organizations demonstrates that there is a stronger trend in the respondents to this survey to classify their GIS development in "Line Organizations". Line Organizations are defined as departments that have their own executive and operating budget. The second strongest response to the survey question was a response of "Other" which had responses including various descriptions of partnerships, and a response as a university/public/private consortium.

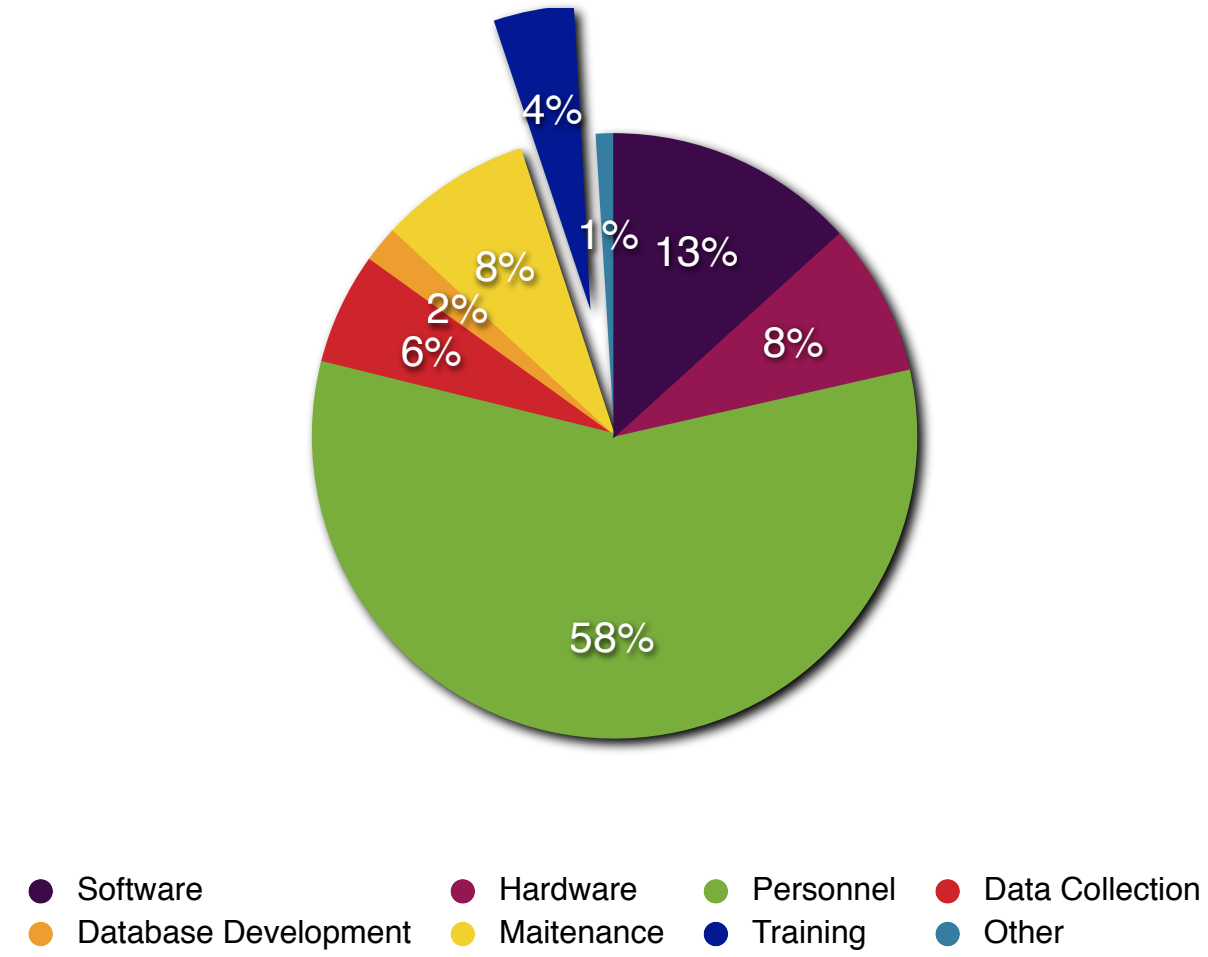
Following with the trend of no information technology departments being in charge of a GIS, eighteen of the twenty six respondents to the questions stated that they separate their GIS expenses from their organization's IT expenses.

Chart 5: Is your organization's GIS expenses separated from your Information Technology expenses? GIS Manager Survey n=26



Based on these results it then appears that the development of GIS within these organizations does not seem to have run into the organizational or performance problems associated with many GIS projects as reported. Qualitative responses in regards to the development of an organization's GIS were overly positive. Only six respondents out of fifty mentioned employee resistance as a problem during the development of their GIS and of those respondents only two cited it as being a significant problem.

Chart 6: Mean estimated average distribution of GIS budget within surveyed organizations. Percentage costs allocated towards GIS training. GIS Manager Survey n=25



The importance of agency wide training is expressed through many of the respondents qualitative responses as being and important component to the success of their GIS. In the fifty qualitative responses to the survey, thirty one respondents from both surveys identified training or some sort of education as being a component that is important to GIS development. The quantitative responses however from the survey participants however show that training was not budgeted in any significant way in most GIS budgets. On average respondents estimated that

only four percent of their budgets for GIS within their organization is designated towards training, with nearly fifty eight percent estimated to go towards personnel. One participant in the study said; " GIS is labor-intensive. Every project requires lots of staff hours, so overall we are very limited in what projects we take on." Other respondents were quoted saying "...we would like to train existing employees to do GIS", and "[that] functional skills are OK, but innovative talent is more difficult to find."

The other perceived detrimental factor to most organizations is the lack of a long term plan or feasibility study in the development of an organization's GIS. Most of the participants who answered the questions pertaining to a feasibility study or long term plan did state that they used some sort of plan as part of their process in the development of their GIS. Moreover, seventeen of the twenty one respondents who did a feasibility study did incorporate long term goals, and thirteen of the twenty one respondents incorporated some information regarding training. Both of these issues were identified Stephan Ventura as being important to the long term development of a GIS. Of these feasibility studies covered many of the long term and employee oriented goals that were stated by the various authors to be important to the development of a GIS appear to have been identified or recognized by many of the participants in this study.

Chart 7: Did the organization conduct a feasibility study or long term study before beginning a Geographic Information System? GIS Manager Survey n=29

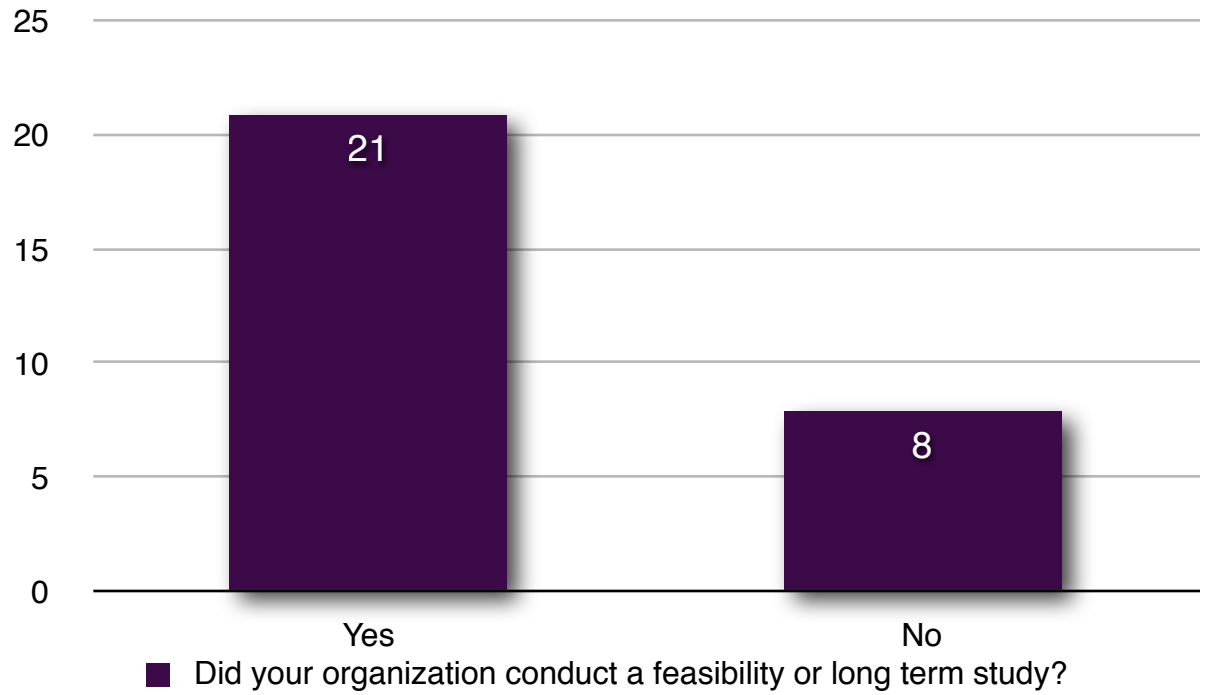


Chart 8: Participant responses to included topics within the feasibility study or long term plan. GIS Manager Survey n=21

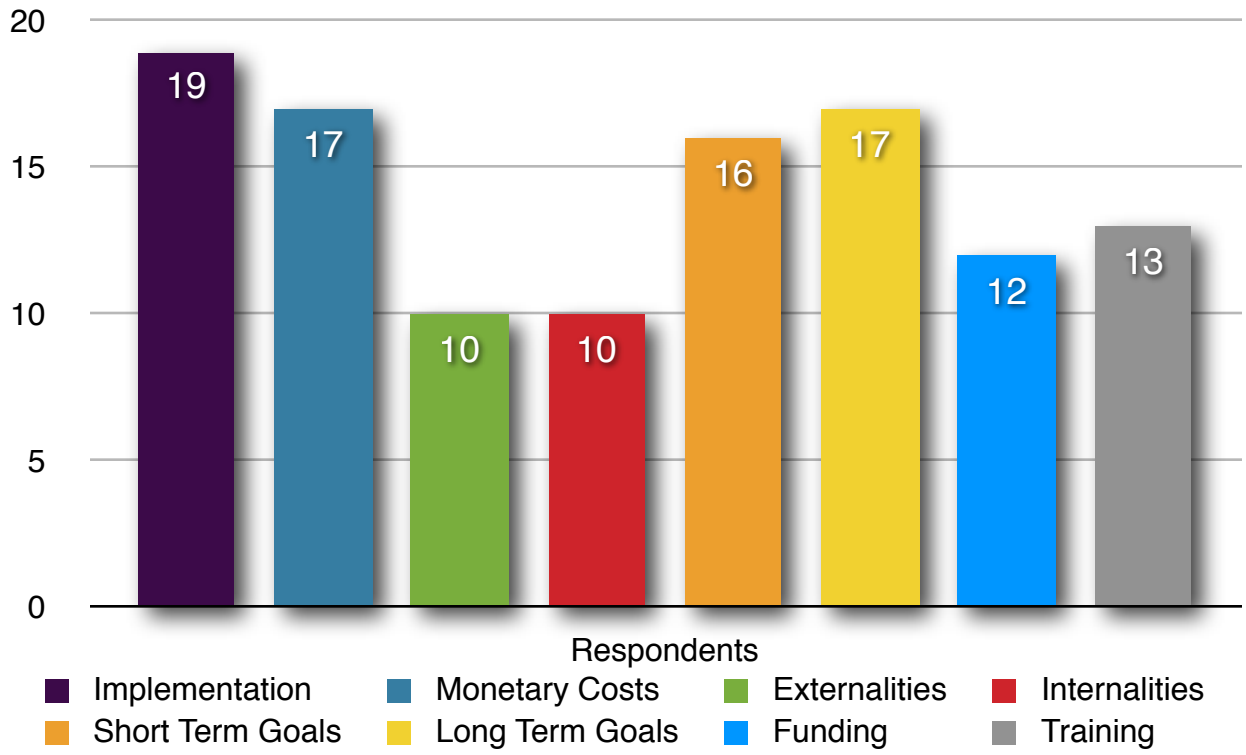
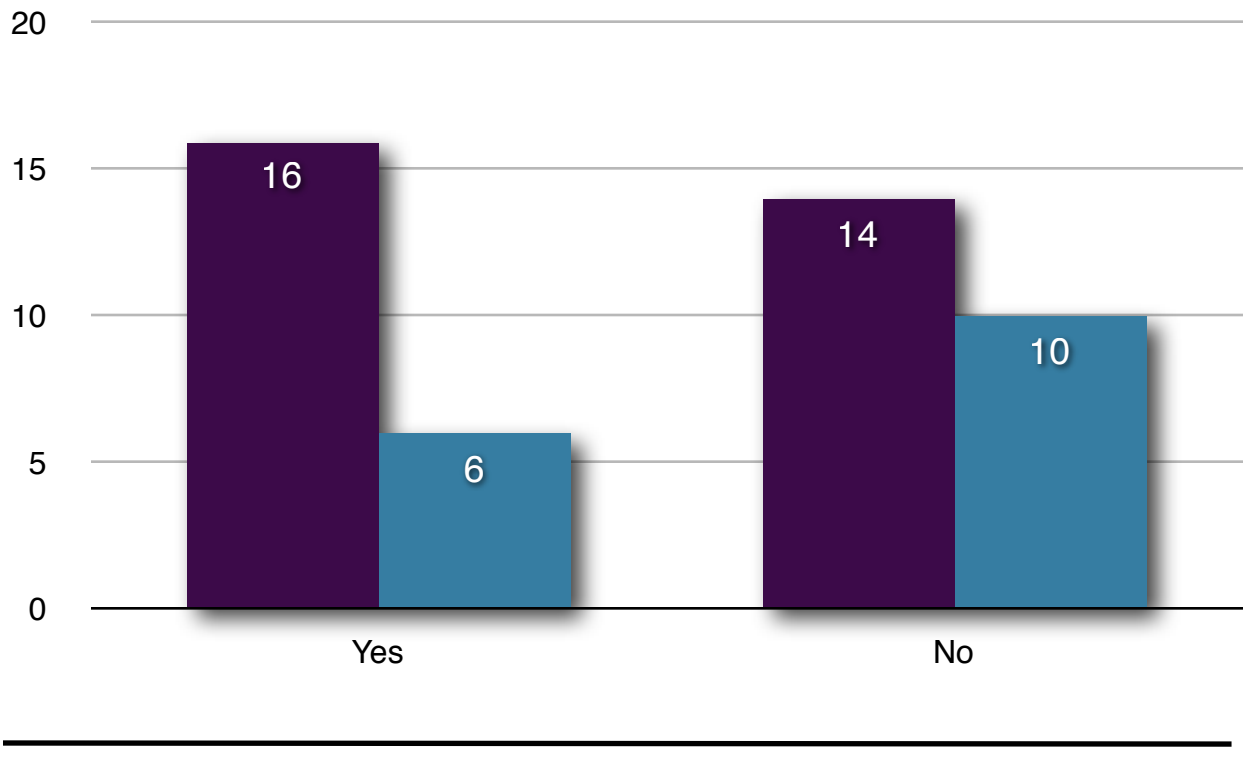
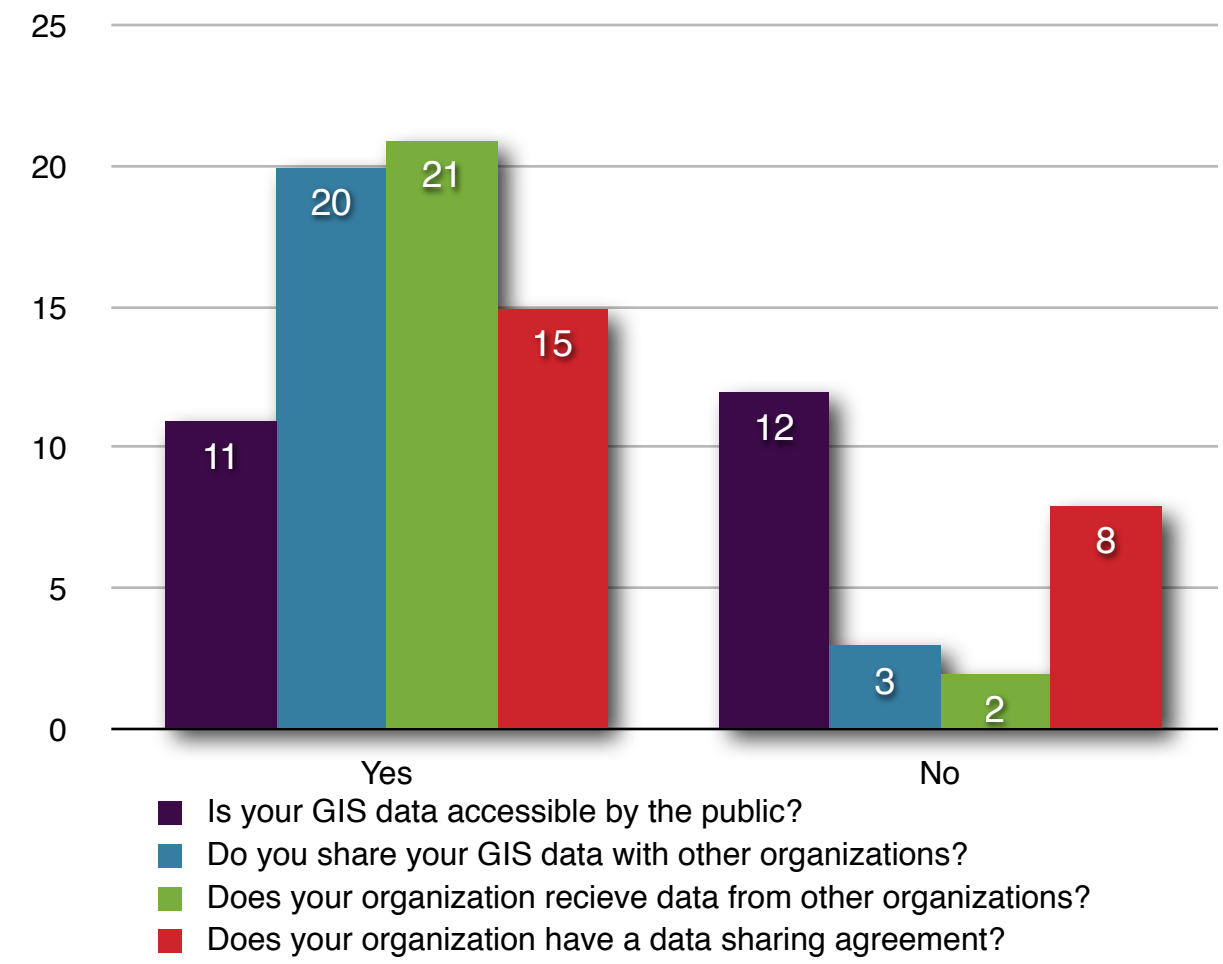


Chart 10: Did the organization hire a private contractor to help develop their GIS? GIS Manager Survey n=30



The utilization of a private contractor in the development of a GIS within the organization was very close with approximately fifty three percent utilizing a private contractor and forty seven percent not using a contractor. Of those who did hire a contractor only six stated that the contractor continues to work with them in some capacity after the initial development of the GIS.

Chart 11 Measurement of organization's willingness to share information with the public and other public organizations. GIS Manager Survey n=30



One interesting result from this survey that perhaps does not have any direct impact upon the success of the GIS development is the access to GIS data that organizations afford to the public and the access that they afford to other organizations. GIS access to the public was lower then expected result with only forty eight percent of respondents saying that they allow access of their GIS data to the public. This compared to the near eighty seven percent of the respondents

who state that they share their GIS information with other organizations and ninety one percent who state that they received data from other organizations.

Table 3: Regression from Generalist Survey comparing successful development of base maps to a department's number of full-time employees, third party contractors, and the organization's attitude to technology.

	B	Std. Error	Beta	t	Sig.
Constant	4.495	1.340		3.354	.006
Full Time Equivalents	0	0	-.377	-1.544	.149
3rd Party Contractors	-1.306	.668	-.483	-1.955	.074
Respect to Technology	-.148	.433	-.083	-.341	.739
R =.555	adj. R^2 = .135		F = 1.783		n = 38

Table 4: Regression from GIS Survey comparing successful development of base maps to a department's number of full-time employees, third party contractors, and the organization's attitude to technology.

	B	Std. Error	Beta	t	Sig.
Constant	4.665	.652		7.158	.000
Full Time Equivalents	-.026	0.052	-.112	-.503	.621
3rd Party Contractors	-.416	.510	-.181	-.816	.425
Respect to Technology	.484	.493	.221	-.981	.339
R =.307	adj. R^2 = -.048		F = .661		n = 38

Using the development of base maps as the most basic identifier of an organization's success in GIS, independent variables were measured to try to identify their impact upon the development of base maps. The impact of an organization's size (Full-Time Equivalents), use of a third party contractor and attitude towards technology appear to have no affect upon the development of an organization's base map development. The adjusted R squared has a value of . 134 illustrates that the independent variables only account for 13.4% of the variance in the data. The t values in all cases are much above the .05 significance test and therefore the independent variables do not reliably account for the results in the development of base maps.

The results from the GIS manager's survey show similar results with an adjusted R squared value accounting for only 4.8% of the variance and none of the t values are even close to the .05 significance level.

Table 5: Regression from Generalist Survey comparing successful successful adoption of GIS by employees to a department's number of full-time employees, third party contractors, and the organization's attitude to technology.

	B	Std. Error	Beta	t	Sig.
Constant	1.8383	1.098		1.674	.118
Full Time Equivalents	01.23E-005	0.000	.020	.077	.940
3rd Party Contractors	-.803	.690	-.300	-1.164	.265
Respect to Technology	.350	.370	.242	-.947	.361
R =.400	adj. R^2 = -.034		F = .826		n = 38

The results in this regression analysis show an adjusted R squared that only accounts for 3.4% of the variance in the data. The results of the t scores in this case are also much higher then the significance requirement of .05 to have a significance value of any impact.

Conclusions

The overall conclusion from the results of the survey seems to indicate a much different trend then was identified by the literature. The location of GIS within an organization does not appear to have any significant impact upon the success rate of GIS. In the survey results the participants identified high degrees of success in the development of their GIS while at the same time demonstrating a diverse amount of GIS locations. In fact not a single participant identified an information technology department as being the location of their GIS management.

Training logically would be an important factor in the success of any program but according to my survey training seems to not have been identified as an important budgetary factor in any of the participant's GIS budget. While expressed qualitatively by some respondents as being important, only thirteen stated that their feasibility studies or long term plans discussed training. Again the high degree of success in the organizations seems to indicate that the impact of training may not be critical to the success of a GIS. However, with eighty three percent of respondents stating that their organizations are current with or ahead of technological trends and numbers showing employee resistance relatively low, this could indicate an organizational atmosphere that is more progressive and accepting of technology on the whole.

This study's findings seem to indicate that the location of a GIS within an organization does not impact the success of that GIS's development. The exact inputs that do determine the success or failure of a GIS within an organization unfortunately are not accurately determined by this study. The unusually high technological status in terms of technology of the participating organizations may have skewed the data and thus these results may not be representative of situations elsewhere.

Bibliography

'A Framework for Evaluating Public Sector Geographic Information Systems'. *Center for Technology in Government, University of Albany/SUNY*. Copyright 1995.

Albuquerque de Vascocelos Borges, Karla; Sahay, Sundeep. 'Learning about GIS implementation from a Public Sector GIS Experience in Brazil'. Retrieved from GISdevelopment.net http://www.gisdevelopment.net/application/urban/overview/urbano0004.htm

Borins, Sanford, Scholar in Residence, Cabinet Office Professor of Public Management, University of Toronto. 'The Challenge of Innovating in Government'. *University of Toronto. Pricewaterhouse Cooper's Endowment for the Business of Government*. February, 2001. http://www.businessofgovernment.org/Pdfs/BorinsReport.pdf

Borins, Sanford, Professor of Public Management. 'New Public Management, North American Style.' Originally published December, 2000. *The New Public Management: Current Trends and Future Prospects*. Edited: McLaughlin, K.; Osborne, S. P.; Ferlie, E. Routledge, 2002.

Brown, Mary Maureen; O'Toole L. Laurence J., Jr.; Brudney, Jeffery**.** **'**Implementing Information Technology in Government: An Empirical Assessment of the Role of Local Partnerships'. *Journal of Public Administration Research and Theory: J-Part*, Vol. 8, No. 4. (Oct., 1998), pp.499-525.

Chan, Tai On; Williamson, Ian P. 'Definition of GIS: The Manager's Perspective'. *International Workshop on Dynamic and Multi-Dimensional GIS*. Hong Kong, Aug. 25-26, 1997.

Chan, Tai On; Williamson, Ian P. 'Justification of GIS as an Infrastructure Investment - Some Observations Regarding GIS Management in Victoria'. *Reproduced from the Proceedings of AURISA '95 Conference*. Melbourne, Australia. November 1995.

Mark, David M.; Chrisman, Andrew U. Frank; McHaffie, Patrick H.; Pickles, John. 'The GIS History Project'. *National Center for Geographic Information and Analysis (NCGIA) and the National Science Foundation*. Founded Sept., 1996. http://www.ncgia.buffalo.edu/gishist/

McGarigle Bill, Contributing Editor. 'Tackling GIS Credibility Issues'. *Government Technology Magazine*, Dec 12th 2000.
http://www.govtech.net/magazine/story.print.php?id=3025

Nedovic-Budic, Zorica; Godschalk, David R. 'Human Factors in Adoption of Geographic information Systems: A Local Government Case Study'. *Public Administration Review*, Vol. 56, No. 6. (Nov.-Dec., 1996) pp. 554-567.

http://links.jstor.org/sici?sici=0033-3352%28199611%2F12%2956%3A6%3C554%3AHFIAOG%3E2.0.CO%3B2-4

Somers, Rebecca. 'Developing GIS Management Strategies for an Organization'. *Journal of Housing Research*. Vol. 9, Issue 1. Fannie Mae foundation 1998 pp. 157-178.

Somers, Rebecca. 'GIS Organization and Staffing'. *Urban and Regional Information Association*. URISA pp. 41-52, accessed 06/06/2006. http://libraries.maine.edu/Spatial/gisweb/spatdb/urisa/ur94004.html

Ventura, Stephan J. 'Uses of Geographic Information Systems in Local Government'. *Public Administration Review,* Vol. 55, No 5 Sep. - Oct., 1995 pp. 461-467. http://links.jstor.org/sici?sici=003-3352%28199509%2F10%2955%3A5%3C461%3ATUOGIS%3E2.0.CO%3B2-9

Walsham, Geoff ; Sahay, Sundeep. 'GIS for District-Level Administration'. *MIS Quarterly*, Vol. 23, No. 1 (Mar. 1999), pp. 39-65. http://links.jstor.org/sici?sici=0276-7783%28199903%2923%3A1%3C39%3AGFDAII%3E2.0.CO%3B2-R

Worral, Les; Bond, Derek. 'Geographic Information Systems, Spatial Analysis and Public Policy: The British Experience'. *International Statistical Review.* Vol. 65, No. 3. (Dec., 1997), pp. 365-379. http://links.jstor.org/sici?sici=0306-7734%28199712%2965%3A3%3C365%3AGISSAA%E2.0.CO%3B2-T

Appendix A

Listservs

LOCALGOV

Sponsored by the Municipal Research & Services Center.
Yahoo Groups.

Econ-Dev Washington State

majordomo@csn.org

GOVMANAG

Government Managers Listserv
LISTSERV@LIST.NIH.GOV

MUNINET

All local government officials. Run by University of Vermont
Listserv.list.uvm.edu

Communet

listproc@list.uvm.edu

LGTECH

Lgtech-request@mail.institute.virginia.edu

WEB4LIB

Library internet and server technology group
listserv@library.berkley.edu

WIFF

Washington Information Issues Forum
listproc@wIn.com

Community Development

CD4VRBM

Sponsored by Community Development Society
majordomo@can-inc.com

UDEPNET

Urban Development & Environmental Professionals
requests@n2town.com

Muni-cable

Yahoo Group for municipal cable services

Appendix A (cont.)

Telecom-cities
listproc@lists.nyu.edu

Michigan GIS Users
http://www.michigan.gov/cgi/0,1607,7-158-12761_15402---,00.html

Nature Serv-Natural Heritage Network
gis@lists.natureserve.org

CPGIS
Chinese Professionals GIS
listserv@uvbm.cc.buffalo.edu

GAGIS
Geological Association of Canada
listserv@uvbm.cc.buffalo.edu

Kyvgis-1
Kentucky GIS Users
listserv@ukcc.ukg.edu

mdgis-1
Maryland GIS
mailserv@toe.towson.edu

wvgis-1
West Virginia GIS
listserv@wvm.wvnet.edu

Appendix A (cont.)

Yahoo Groups
Arcview

Free-gis

gisindia

locagis

gis-t

localgis

Email
Email was sent to randomly selected cities, counties and states from the Center for Digital Government's list of the top ranked technology cities, stats and governments http://www.centerdigitalgov.com/