Startup GIS in a Growing Consulting Firm

Timothy Harrison

As a consulting firm grows and develops, the company's GIS use should similarly grow and develop. This concept is especially important for a young company establishing a GIS program. The first few years can be critical to the success of the program, especially if company staff and managers are unfamiliar or uncomfortable with spatial data. The GIS manager must ensure that as the new company grows, it begins to incorporate GIS into its work processes and culture. Certain considerations such as understanding what the company requires of the GIS, identifying the essential hardware and software, and knowing how to make GIS an integral part of the marketing and project work are common elements to a successful startup GIS program.

Table of Contents

1.0 Introduction

A small, rapidly growing consulting firm can provide an exciting, dynamic environment ideal for starting a GIS department. Doing so can lead to the company culture embracing and absorbing GIS tools, data, and products in nearly every facet of the company business. There is also a great deal of personal satisfaction for the individual or individuals responsible for the successful GIS program. At the same time, there are pitfalls and unforeseen obstacles that would not be encountered in a company with an established GIS department. Managers and individuals need to be cognizant that company expectations of the GIS system, products, and knowledgeable staff will change rapidly with the growth of the company and with the experience of the users and development of the GIS framework.

This paper is based on a young engineer's experience starting and managing a GIS department over the past three years. It is a discussion of some of the basic principles that the author found helpful while establishing his company's GIS system and a look at some of the practices that would have made the job easier. It addresses four major elements of developing a GIS department that could easily hinder or support the GIS user's efforts, depending on how they are approached. Those four elements are:
- Organization;
- Outreach;
- Training; and
- Understanding.

These concepts will be developed and described at two different stages of GIS department and company development.

2.0 Working Within a Small Firm

Before discussing how to develop a GIS program within a small company, it is important to first understand the innate advantages and disadvantages of working within a small firm. Many of the concepts and changes described in the body of this paper could apply to large companies or agencies. The author's experience in starting a GIS department however is limited to a small civil and environmental engineering/consulting firm. It is up to the reader to discern to what degree a particular guideline is applicable.

For the purposes of this paper, a small consulting firm could be considered to have certain constraints, such as personnel and budget, placed on any endeavor to expand into a field such as geographic information systems. The initial need for GIS products would probably be project driven rather than an academic interest, thus limiting staffing resources to the existing employees. Trained staff are likely not available if this is the case. Any individuals with an interest in learning the concepts and software required would need to split their time among numerous, existing projects. If the company management is not comfortable with a significant investment in hardware and software, the user may face limitations outside of time availability and experience. With these constraints in place, combined with a wide geographic coverage area and many different project needs, the fledgling department faces many imposing challenges from the outset.

While the small consulting firm may impose obstacles, there are also many advantages to working within such a company. One of the primary benefits is that it is easier to market the GIS products and applications to a greater percentage of the company. Doing so increases support for and awareness of the GIS department's efforts to become a part of every day life within the company.   As the support for and interest in GIS grows, many of the challenges described in the previous paragraph become less significant. There is also potentially greater latitude and credibility given to individuals when making recommendations regarding the direction of the GIS department.

As the company and GIS department grow and develop, new obstacles and benefits of working within a small company will be realized. The creation of a GIS department, the subsequent changes, and the keys to success are the foci of the remainder of this paper.

3.0 Keys to Building a Successful GIS Department

The early stages of developing a GIS department within a company can be some of the most rewarding and frustrating. For the author, unfamiliarity with the software was the root of both of these extremes. There is no support network within the company and all of the publicly available resources are unknown or never quite seem to answer the questions that you have. At this stage, with each small advancement in understanding or new trick or application, it seems like you've figured out everything that you could possibly need to know and there is a great feeling of accomplishment. The next time a problem arises or a change is necessary, you feel as though you're back at square one and nothing you've learned could be applicable. The company as a whole is unsure of how to best use GIS or even what GIS can do with the right data, software, and hardware. In the early stages of developing a GIS department, organization, outreach, training, and understanding are especially important as they will lay the foundation for all future efforts.

3.1 Organization

The key to organization at this stage is to start early and be diligent. It's important to think beyond your current project and try to see how it fits into the bigger picture. For example, will you ever need or want to reuse your data? Perhaps more importantly, will someone else want to use your data? If so, a given file should probably be better described than "dissolve_output" even though at the time of naming your file, it seems completely obvious what your file represents and from where it came. Chances are, years later you won't remember what "dissolve_output" is and the next analyst to see the data certainly won't know either. Some simple things to help keep your data organized are a consistent, predictable file structure and persistent use of metadata.

3.1.1 Filing Structure

A file structure is important from the earliest stages of GIS development because of the many types of data, geographical features, and locations for which a consultant will need to be able to produce products. It may seem unimportant to a novice user focusing on a single project, but as mentioned above, it is important to see how a single project fits in with the company-wide goals and expectations of the GIS. Talking with co-workers to understand how they hoped to use GIS products in their projects may lead to some

indication of what data is important and how to best organize it, but it will mostly be up to the builders of the GIS system to define the organization. The key aspect of the filing structure at this point is not to have a perfect system, but to have a logical system that is flexible enough to accommodate the rapidly increasing number of data files available to analysts. The longer a data collection exists without an organizational system, the harder it will be to organize it later. It is well worth the extra time to file data in the "right" spot rather than using a catch-all collection folder.

3.1.2 Metadata

Metadata is one of the least glamorous parts of GIS but it should not be neglected at any stage of development. Metadata is simply a collection of information about a particular dataset. It is useful when determining where a dataset came from and for what uses and scales it was originally intended. It may seem like tedious work to document each data file, but it will be helpful not only to the creator of the metadata but anyone else who will be using the associated information. If it's worth the time to create a data file, it's worth the time to create the metadata to accompany the new data.

Similar to the filing system, the sooner analysts get in the habit of creating metadata, the easier it will be to maintain adequate metadata. While working on a project, it is likely that the client will have data that it wishes to include in any relevant GIS analysis. Although there are many pressures to minimize delivery times, be sure to document important information before starting to use the data. This information includes but is not limited to:
- The data owner's (client's) name;
- Contact information for the person who sent you the data;
- The date the data was received;
- The data projection;
- A relevant time period if applicable; and
- Any special requirements or restrictions on the dataset.

A requirement for using the data might be that the work product must reference the data owner and a restriction could be the dataset should only be used on a particular project.

Over the course of a project, the analyst will likely find that the datasets that are part of his or her own collection and the datasets provided by the clients do not exactly represent the message that he or she is trying to convey with the geographical product. New datasets are created based on combinations of, extractions from, and various other manipulations of existing datasets. It is important to collect and document additional information about these new data files. The additional information includes:
- The analyst who created the file;
- The reason for creating the file; and
- The source file(s) for the new dataset.

3.1.3 Documentation

Filing structure and metadata are two ways to document various aspects of the GIS department. Keeping a record of personal and departmental development is equally as important. This GIS diary will provide you with a reference to go back to if you forget how to perform some procedure or need to find a source of information long after you first found it. As you begin to master many of the techniques, from simple to complex, you will essentially be creating a company GIS manual. At a later stage, when others

start to learn GIS, they will appreciate the efforts to maintain the manual so they can reference it for many of their own questions. Documenting processes and quality control procedures will also be helpful if you ever need to recreate any of your work or if the accuracy of an analysis or work product is questioned.

3.2 Outreach

By communicating with individuals within your company about your efforts to learn and use GIS, you are introducing the company to GIS and increasing their familiarity with and confidence in GIS and the accompanying work products. It is especially important to keep informed those individuals who can provide you with opportunities to work on additional projects. The additional experience will help the analyst develop his or her skills while creating additional demand for GIS products within the workplace.

3.2.1 Managers

Project and office managers must be kept aware of what you are able to do for them and their projects with GIS. They have enough experience and specific project knowledge to see how GIS can fit into task work products. As GIS is incorporated into existing work, people begin to see how it creates intuitive, high quality geographic products. Highlighting the ability to interface with other products that are more familiar to co-workers will make it easier to incorporate GIS into existing work products. These other programs may be Word, Excel, or even other spatial programs such as CAD.

As managers use the company GIS resources more extensively, they will likely see the value of bringing on additional capabilities through new software and extensions, upgrading the GIS hardware, or adding GIS talent. Of course, it is up to the GIS department leader to make reasonable requests that have sound business logic as a foundation. It's important to be able to link a funding request for new GIS resources with an needed and relevant capability that is currently not available.

3.2.2 Marketing Coordinators

One of the best ways to insure that GIS will be used on a project is to include it in proposals and interviews for new work. Be sure to offer to help out with a map or two for any projects that your company is pursuing. Marketing coordinators will best know how to incorporate GIS products into the report or presentation but a proactive GIS department leader will be able to offer suggestions based on the data and capabilities that are currently available. Once your company wins the project, the client will likely want to use the GIS skills that were put on display.

3.3 Training

As the GIS program is just starting and you or other analysts are still learning the basics, it's probably best to concentrate on developing individual skills rather than training co-workers. Understanding GIS is like a complex puzzle where two or more of the pieces may initially seem to fit together until a piece is added that doesn't seem to fit anywhere. In such a case you need to take the puzzle apart and rearrange the pieces in such a way that the newest piece fits as well. Because of this, it is best if multiple people don't need to relearn information or rebuild the blocks of understanding.

Classes, seminars, technical support, and conferences are good ways to increase knowledge in specific areas of GIS and its applications. On-line resources, such as

http://support.esri.com, are an excellent way to tap into many sources of knowledge. The most helpful way that the author found, however, was by experimenting with the software as much as possible. Creating a temporary folder and copying some data into it is a great place to start interacting with the data and learning what you can do with the data. Reading articles and talking to people lays a framework for your own understanding of how it all works together. By becoming comfortable with data and analysis, it's possible to fill in that framework.

Quickly expanding your knowledge base in the beginning of the process serves several purposes. First, the steep learning curve makes things very exciting for the new user. As mentioned earlier in this paper, there will be trade-offs between feeling good about using GIS and feeling like you'll never be able to efficiently use the program. Mastering new skills and processes quickly will hopefully keep the positive feelings outweighing the negative feelings. Also, it's important for the company GIS pioneer to be able to communicate with the client's GIS professionals. While the author has found that most GIS analysts and managers are very patient with the novice user, learning the GIS language and concepts will allow efficient and accurate conversations. If you are requesting data, important things to know ahead of time include:

- What type of data would meet your needs?
- Are there alternative datasets that might also be beneficial?
- What is the physical extent of your data and project needs?
- What file formats and projections can you use?
- What are the possible delivery formats for various sized attachments? and
- For what project will you be using the data?

The last item is important because, like you, the person on the other end of the telephone or receiving end of the email is probably involved in many projects and will need to document or at least be aware of why he or she is sending you data.

3.4 Understanding

In addition to understanding the technical side of GIS, the leader must also understand the human side of creating a GIS department. The following sections touch on both the technical and softer sides of establishing GIS within your company.

3.4.1 Personal Limits

One of the stereotypes about consultants is that they will never say that they can't do something. The stereotypical answer is, "Yes, we can do that for you!" That may not always be the case when starting to develop GIS within your company. It's important to know when to say, "Yes, that's possible" and when it might be better to offer an alternative solution to the request. In order to do that, you need to be aware of your own capabilities and limitations. Doing any project takes a certain amount of GIS skill and time and without these two pieces, you may end up creating a poor product or not being able to finish the assignment. Either of these results may lead to a decreased interest and confidence in using GIS as a tool for that and other projects. This would probably incur a significant set-back in the goal to incorporate GIS into the company culture.

3.4.2 Company

The GIS pioneer must also understand the company comfort level with GIS and using GIS products. This awareness and its ramifications have been discussed in previous

sections. What has not been discussed is that individuals requesting and using GIS products need to realize that there are dataset limitations. In the early stages of GIS development, the company should be cognizant that datasets were created and intended to be used at a certain scale and for a specific purpose. Using a dataset at a scale or for a purpose other than originally intended may or may not make the data and any resulting analysis invalid. For example, a road layer created at a 1:500,000 scale may be more than adequate for the original user's project, which was a simple visual analysis of a regional highway system. However, at a 1:24,000 scale the road may be drawn over a nearby lake and the calculated length of a segment of highway may be significantly lower than expected. It is the responsibility of the GIS user to help others to understand this important detail, or co-workers may not understand why map details can "look funny" or why unexpected results can arise from an analysis.

3.4.3 Software and Hardware

Understanding which software and hardware is right for your company can only be decided by individuals close to the organization. There is a great deal of literature and first hand knowledge of what different software packages and extensions are available. Needless to say, it will take a good deal of research to understand what each software suite will allow you to do and how hardware could limit the applications. It is probably fair to say that you don't need every capability available right away. Reasonably limiting the capabilities of the software will make the program easier to learn and less overwhelming. It is important to be knowledgeable about additional available capabilities and be aware of when it is time to invest in additional software or hardware.

4.0 Keys to Expanding a Successful GIS Department

There are many signs of a successful GIS department. Many of the early pitfalls and hiccoughs have been avoided or dealt with and the GIS pioneer has taken advantage of many of the opportunities of working within a small company to benefit the department. After a year or two, the GIS leader has become proficient in many GIS applications and can handle most, if not all, of the requests made by the company. The company feels comfortable with GIS and has started to incorporate GIS products into nearly every project at some level, even if it is just to create a basemap to be drawn upon by an engineer or graphic artist. The company has grown however and, with all of the additional requests, the GIS department leader has started to realize that working on GIS requests has become more than just a part-time occupation. The focus of the GIS manager needs to start to shift from learning to teaching and from just meeting the requests of co-workers to creating new applications and uses for GIS. The four elements of a successful GIS department developed in the previous sections still apply in many of the same ways now that there is a solid foundation, but there are additional facets that need to be explored.

4.1 Organization

If organizing your data diminished in priority at some point, it is not too late to catch up. As more people in your organization start to use the GIS system that you built, it is more important than ever to establish a system and be vigilant in your organizational habits.

4.1.1 Filing Structure

The filing structure that made sense for one or two users may not be adequate for a larger pool of users. The total storage space required for the GIS library has probably expanded greatly. For these two reasons, it's likely that the organizational system needs an overhaul. Be sure to store the new library in a place that is easily accessed by everyone within the office or company. Also, if storage memory is an issue, large or infrequently used datasets are prime targets for burning to a CD or DVD rather than using storage space on the server or hard drive.

4.1.2 Metadata

As data has been collected from public and private databases or created in your own GIS shop, there have been many opportunities to fine-tune what information is important for your company to collect about each dataset. These efforts should be continued, especially for data that is continually used or modified. If the metadata for some of these files was never created or lost at some point, it may be worthwhile to recreate the history of the dataset as best as possible to determine the source or discard the dataset and replace it with a similar file that has a documented history.

4.1.3 Documentation

As the analyses and procedures have become more complex and drawn out, it has become increasingly important to document the steps taken to reach an end product. Also, it's likely that your spatial work products are being used more often to define policy, make engineering recommendations, etc. A record must be kept to validate the decisions made. The GIS manual that you wrote when the department was just getting started should be continually augmented with the latest information.

4.2 Outreach

Outreach continues to be extremely important at any stage of development in the GIS department. In addition to the considerations discussed earlier, there are new aspects of GIS to discuss, more people with whom to communicate, and new outreach methods help to highlight opportunities to incorporate GIS into the company work flow. These are discussed in the sections below.

4.2.1 Managers

Managers are probably aware by now how important GIS is to their projects and the amount of effort it takes to produce a quality product. When the next round of budgets is set or a new contract is signed, suggest to them that they include a GIS task and budget as a stand-alone task or as part of another relevant task. Be prepared to suggest a level of effort required for their GIS needs once you fully understand what the project will entail. Be sure to consider how the project can most benefit from the analysis and spatial products that GIS can provide.

4.2.2 Staff

It is very important to have staff interested in GIS capabilities. Not only will they want to use GIS in their current work, but they will someday be managers and be responsible for including or excluding GIS in their own projects. A staff member who understands the value of GIS will likely want to use it as much as possible. The best way to encourage interest is by talking about what you can do with it and showing how it has improved and

facilitated your work. Another helpful method is to hold mini-seminars explaining how they can be involved and how GIS can fit into their current workloads.

4.2.3 Word-of-Mouth

One of the benefits of working within an established, successful GIS department is that co-workers talk about the many applications of GIS and the type of products that can be produced. Therefore a lot of your outreach work is happening all the time without you actively doing anything except continuing to produce high quality spatial work products.

4.2.4 Clients

Outreach to clients is as simple as showing them how their deliverables have been improved by incorporating GIS products. A quality spatial product makes understanding a difficult problem easier which can lead to better solutions. Appreciating a work product leads to additional work products of the same type, which entails more GIS work for your department. Ideally, it will mean additional contracts for the company as well.

4.3 Training

Training while first setting up the GIS department was focused mainly on self-tutelage. You should continue to expand your own knowledge for many reasons. Among them are 1) it is good to learn new things and 2) it will allow you to develop better tools and processes for applications to your company's work.

The focus of your training efforts should be directed toward others once you are comfortable with the concepts and tools of the trade and the department has been established. By training others to use and understand GIS, you accomplish several objectives. Spreading the training among several other co-workers incorporates GIS into the company culture better than one or two people doing all of the GIS work for everyone else. It becomes more of a standard skill-set than a specialty. Having several knowledgeable analysts within the company also expands the experience base and provides an internal support structure. Finally, with the growth of the company has come new projects, many of which require GIS analysis and products. In order to accommodate all of the requests, there will need to be more than one or two people. Opportunities to train people or make them more comfortable with GIS shouldn't be too hard to come by. A simple markup on a map can easily be turned into a quick lesson or tutorial. A more complex problem can become an independent GIS project for a novice user with the GIS manager available for guidance and assistance.

4.4 Understanding

Like the organization and outreach elements described above, the understanding element is largely unchanged in the developed stages as from the early stages of development. All of the same concepts apply but there are some additional aspects that become more relevant as more people use the GIS system capabilities.

4.4.1 Co-workers

When training your co-workers, it's important to understand that your co-workers will have the same skill and time limitations that you had when you were first learning about GIS. You must be patient and try to remember all of the questions and uncertainties that you once had. It can be time consuming, but training others will save time in the long-

run when you don't have to do all of the GIS work yourself and it benefits the GIS program. It can also be quite rewarding to be able to now be the equivalent of one of the resources upon which you used to rely so heavily. Review of GIS products must also be incorporated into the company's quality assurance program.

With additional people of various skill levels performing analyses, it is important to maintain a high quality work product. This will require review not only by the project manager for overall appearance but by a knowledgeable GIS analyst for technical approach and accuracy. The reviewing analyst does not necessarily have to be the GIS department manager but does need to be someone with adequate training to understand the process and limitations of the analyses performed.

4.4.2 Software and Hardware

Another change that comes with a growing company and additional people using GIS is the need for additional software and hardware. While new hardware may be determined by company policy, requests for additional software should come from the GIS department leader. Not every person that uses GIS needs their own software license. Instead, additional licenses should be acquired when the project demand requires it. Until there is enough demand, users can share licenses by trading computers temporarily if necessary. If the office can accommodate the cost and space, it might be helpful to load a GIS license onto a non-assigned computer to create a GIS terminal. The GIS terminal could then be used on a rotating basis as it is needed.

5.0 Conclusion

There is a great deal of work involved in starting a GIS department from scratch beyond learning how to use the software. Incorporating GIS into the work processes and culture of a young, growing company provides the company with a powerful tool. The tool can be scaled and customized to meet needs at any company size and for nearly any application. On a more personal level, starting the department provides the GIS department leader with an exciting challenge and creates opportunities for company members to enhance their own skill sets.

As the company grows and the GIS department matures, there will be changes in the way that GIS is used, including frequency of use and types of applications. The GIS manager should be ready for these changes and should strive to understand the organizational, outreach, and training needs of the company and GIS department at every stage of development.

Acknowledgements

Author information

Timothy Harrison, P.E.
Project Engineer

Raines, Melton and Carella, Inc.
2001 North Main Street, Suite 400
Walnut Creek, CA 94596

Phone: (925) 299-6733
Fax: (925) 299-6736
Email: tharrison@rmcengr.com