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The Diffusion of Geospatial Technologies Among Louisiana Assessors

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The Diffusion of Geospatial Technologies Among Louisiana Assessors

A Dissertation

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Urban Studies

By

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Dedication

To my wife Donna who has been a constant source of love and encouragement. This is as much your accomplishment as it is mine.

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To the Louisiana assessors who gave freely of their time and knowledge to help me understand the challenges that they face; Rich Bailey (Ouachita), Conrad Comeaux (Lafayette), Pam Jones (Lincoln), John Hill (Morehouse), James Laurent (Pointe Coupee), Glenn Waguespack (St. James). I am also indebted to the first Louisiana assessors I had the pleasure to work with, the late Sherel Martin (St. Mary) and the late Gerald McCrory (Ascension), who generously shared their knowledge.

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I am thankful for the support I have received from family and friends. My daughter Hanna and my son Brice offered support and encouragement. My wife Donna, who showed enormous patience, understanding and love throughout the whole process for which I am very grateful.

All that's left to say is… It is written! Thanks to all of you...

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Abstract

The Diffusion of Geospatial Technologies among Louisiana Assessors

The diffusion of geospatial technologies, including Geographic Information Systems (GIS) and Computer Aided Mass Appraisal Systems (CAMA), among Louisiana Assessors has been slowed by limited resources, a lack of communication and slow innovation decision processes. This research considers analysis of the speed of adoption, identifies the key players in decision making and the issues that influence the process based upon the theory of the diffusion of innovation developed by Dr. Everett M. Rogers (1995). The research data collected from online surveys, field visits and interviews of Louisiana Assessors between 2007 and 2013 was compared to identify factors that spurred or impeded the adoption of geospatial technologies among assessment offices. The research finds that proximity, communication, resources and the type of adopter predicts the adoption of GIS and/or CAMA by Louisiana Assessors.

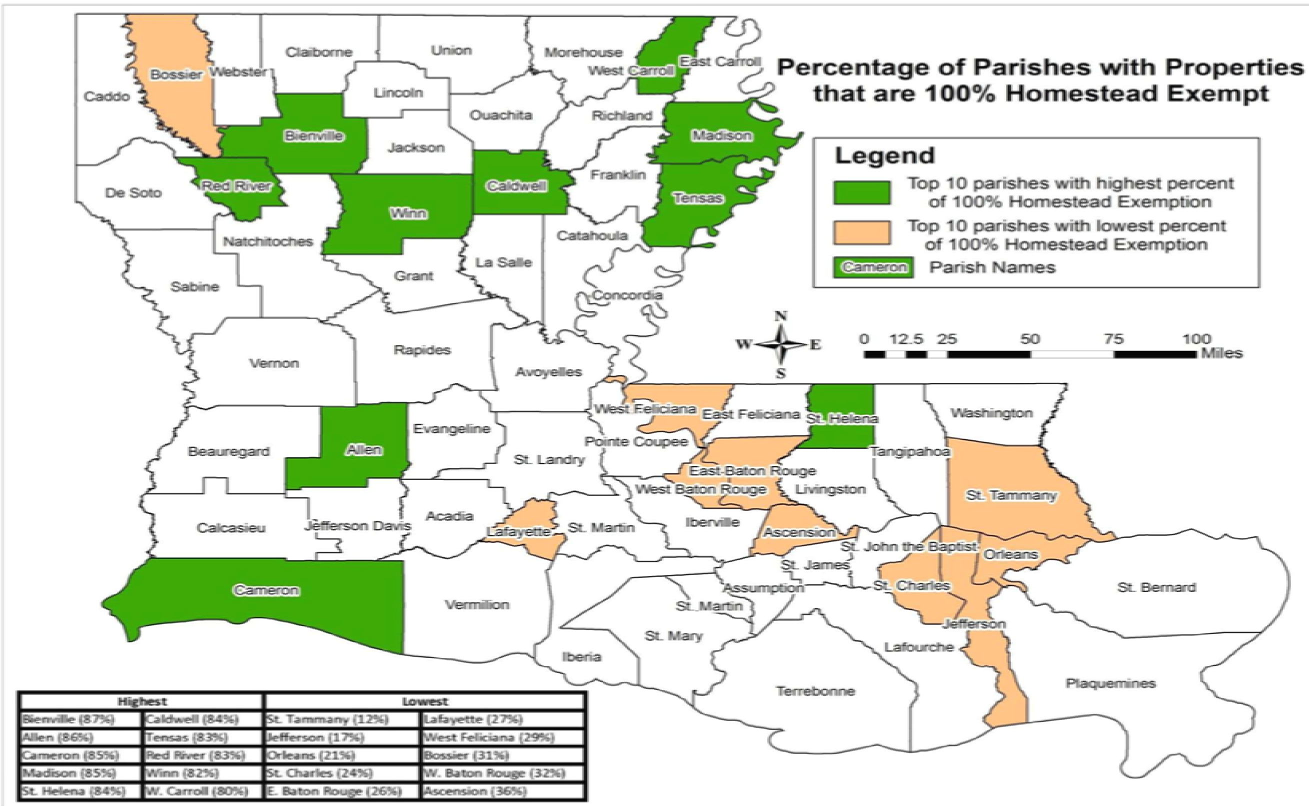
Keywords or Phrases: Assessors, Real Estate Property Valuation, Computer Aided Mass Appraisal (CAMA) System, Diffusion of Innovation, Geographic Information Systems (GIS), Geospatial Technology, Information Technology.

Chapter I: Introduction, Research Questions and a Statement of the Problem

Introduction

The job of a Louisiana tax assessor is to estimate the value of residential land, oil fields, airplanes, commercial buildings, wetlands, and a host of other movable and immovable objects within the parish. Assessors do not set the rate of taxes, nor do they collect them. Their sole job is to place a value on property of all kinds. Assessors may hire deputies who can act on their behalf, but they are legally responsible for their actions. Assessors are both state employees and elected officials, so every four years they must run for re-election. Furthermore, the property tax rolls they compile are subject to annual examination by the parishes that where they work, the Louisiana Legislative Auditor, the Louisiana Tax Commission and occasionally a court of law.

As local government officials, the resources they employ to accomplish their mission are closely tied to the resources available to their parish. If the parish has a large industrial or commercial tax base, Assessors will collect a larger amount of real estate and commercial taxes than will a parish without those facilities. Parishes where property values are high collect a larger amount of real estate taxes than do neighboring parishes with lower property values. The Louisiana Homestead Exemption (LA Rev Stat § 20:1) exempts only the first $75,000 value of an owner-occupied residence. Therefore, rural parishes, where home prices are lower, have a greater percentage of properties that are 100% homestead exempt (Table 3). These owners



Highest		Lowest	
Bienville (87%)	Caldwell (84%)	St. Tammany (12%)	Lafayette (27%)
Allen (86%)	Tensas (83%)	Jefferson (17%)	West Feliciana (29%)
Cameron (85%)	Red River (83%)	Orleans (21%)	Bossier (31%)
Madison (85%)	Winn (82%)	St. Charles (24%)	W. Baton Rouge (32%)
St. Helena (84%)	W. Carroll (80%)	E. Baton Rouge (26%)	Ascension (36%)

Figure 1

Figure 1 Percent of Homes with 100% Homestead Exemption by Parish

pay no property taxes, although they may not be completely exempt from all parish taxes. Louisiana is a state that contains parishes with abundant resources yet other parishes have very few resources. Support for this is demonstrated when comparing the financial resources available to assessors from different parishes (Table 4).

In order to better understand why and how this technology is adopted, and to develop strategies to assist assessors with implementation, time series data was collected. This research employs two online surveys of Louisiana assessors, one from 2010 and one from 2013, to determine the factors that contribute to the adoption, or rejection, of geospatial technologies. Geospatial technologies include remote sensing, Global Positioning System (GPS), Geographic Information System (GIS), information technologies, and field sensors that help in collecting, storing, analyzing, displaying and disseminating data tied to a particular location. In the assessment profession, a Computer Aided Mass Appraisal (CAMA) system tied to a GIS is the most commonly used geospatial technology. CAMA technology, if used effectively, can allow an assessor to review hundreds to thousands of appraisals very efficiently and flag those assessments that differ significantly, either higher or lower, from other similar properties. If a CAMA system is tied to a GIS, it can then place those flagged properties on a base map with other information such as the location of flood plains, toxic waste sites, and other hazards that could legitimately lower the value of a property. On the other hand, CAMA and GIS could show that a property is undervalued in comparison to similar sized properties because property values are rapidly rising. When property values are rising rapidly or if there are limited sales, this information becomes more important when estimating property values upon which taxes are based (ad valorem).

Research Questions

After considering the initial survey results and in order to better understand the process of adoption, the research was developed to evaluate the Louisiana Assessors. Comparisons with Assessors in other parts of the United States were not considered due to the dissimilarity in the process of property valuation, tax laws, management systems and adequate survey data.

The surveys of assessors in this project were designed to answer the following research questions. The first set of research questions relates to the financial resources available to assessors that affect their ability to purchase, maintain, and upgrade geospatial technologies. *Are Louisiana assessors receiving grants to upgrade the technology that is used to provide GIS services? Are assessors partnering with other parish entities to share the cost and benefits of developing geospatial technologies? Are assessors charging for any of the digital services they provide, such as GIS or CAMA data?* The answers compiled through online surveys sided in identifying some of the disparities in resources between parish assessors and how those differences may, or may not, affect their ability to adopt geospatial technologies.

The second set of research questions evaluates the data collected in the surveys on the communication channels between parish assessors *How many assessors take advantage of opportunities to learn more about geospatial tools that might be available* *to them? How many assessors regularly communicate with other assessors in their area? Do they meet regularly to discuss issues and visit each other's offices? How effective is the Louisiana Assessor's Association in meeting the needs of Louisiana Assessors for technical information on GIS and CAMA?*

The third set of research questions asks assessors how they first heard about GIS and CAMA technologies. *Did they learn about geospatial tools from the Louisiana Assessors Association (LAA) or the International Association of Assessing Officers (IAAO)?* The survey asked if they meet regularly with vendors and consultants to learn about new geospatial products and services that might be available. The survey attempts to discover when they first started using GIS and CAMA tools and the kinds of issues were being faced in using these technologies to their fullest advantage. The point of these questions is to determine if the assessor is open to learning about new systems and whether or not staffing, technical assistance, access to consultants, and the financial resources required to use these systems effectively. The survey seeks to determine if each assessor has adequate resources to adopt GIS and CAMA technologies. Louisiana assessors have noted in past surveys, that a lack of resources is their greatest obstacle.

Dr. Everett Rogers noted that a "slow innovation decision process will impact the speed of the adoption and potentially the success of the project. " A slow decision process can be related to risk avoidance or to a lack of information on which to base a decision. That lack of information can be tied to poor communication that is caused by social or geographic isolation from other assessors. *What communication methods* *could be used to include those assessors that are not being reached by more traditional methods?*

The fourth set of research question relates to staffing. *Are assessors able to find staff who can implement geospatial technologies? Can they find the skilled professionals that they require?* If assessors could hire someone today, what skills would they be looking for? Staffing questions were separated by the number and type of internal staff and by the number and type of external staff, consultants and contractors. Those questions are answered in the Results Section.

In addition to the research questions, the researcher has to be open to the possibility of unexpected discoveries within the data. While conducting personal interviews with Louisiana assessors I often heard the Lincoln Parish GIS Commission mentioned as a good example of proactive governance. The GIS Commission is an eight member board representing the largest taxing authorities in Lincoln Parish. Besides the Assessor the GIS Commission includes the Police Jury, City of Ruston, Communications District, Sheriff's Office, Fire District, Clerk of Court and the School District. The Parish GIS Commission has received grants for its innovative approach to GIS governance. The Lincoln Parish GIS Commission is an example of a geospatial "best practice" that other assessors should consider adopting.

Another idea that developed from an analysis of the 2010 and 2013 surveys was the correlation between parishes that have multi-agency GIS initiatives and those that have managed to merge their GIS and CAMA systems. Of the eight parishes that have

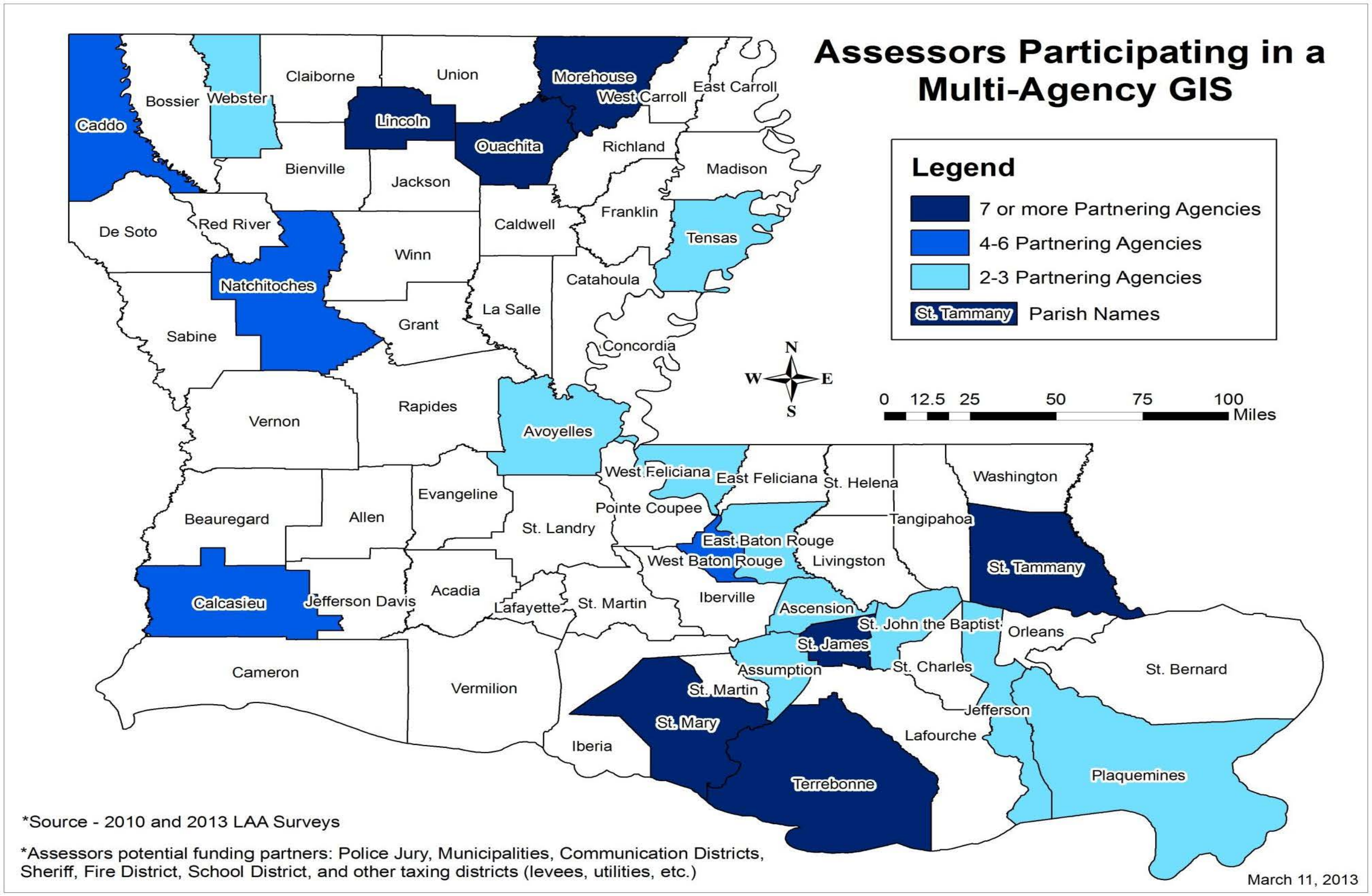


Figure 17

Figure 17: Parishes with a Multi-Agency GIS

merged their GIS and CAMA data sets seven of them are multi-agency GIS Initiatives. This should not be too surprising when you realize that parishes with a multi-agency GIS have more experience than most local governments in the use of Extract/Transfer/Load (ETL) procedures for incorporating different data sets. The CAMA database comes in a variety of different formats depending on the vendor, but it is ultimately a relational database that can be linked by a common key to the map graphics.

The Louisiana Assessors Association should provide new assessor's contact information for consultants with experience in GIS and CAMA development as well as IT, database management and web development. In addition to contacts with vendors they should maintain a description of "best geospatial practices" by Louisiana assessors and make that available on their website.

The GIS/CAMA surveys revealed that all Louisiana assessors have a need for current, high resolution ortho-imagery every three to four years in order to create planimetric data layers and as a cadastral data update tool. This is a need that the state should fill. The cost per square mile for one parish is considerably more expensive than the cost of imagery collection per square mile for a larger area. The state should contract to have the entire state flown on a regular schedule, every three or four years. Leaving individual assessors with the option of buying up to receive enhanced data products. The state should provide that imagery to state and local governments, at no cost, but it should ask in return that the cadastral data created meet minimum cadastral data standards.   Over time, the state would help local assessors build a cadastral data layer that serves both state and local needs. The state should develop a long term cooperative relationship with Louisiana assessors and that could be initiated by providing assistance in return for common data standards.

The goal of these research questions is to evaluate the most critical factors that impact the diffusion of geospatial technologies among Louisiana Assessors using Everett Rogers' *Theory of the Diffusion of Innovation* (1995) as a conceptual starting point. The surveys should assist us in identifying the problems and allow us to make policy recommendations that address these issues. The recommendations will serve to inform Assessors about resources available and inform state agencies on ways to increase adoption with better communication and resources that will increase diffusion and implementation.

Statement of the Problem

Hypothesis: *The diffusion of geospatial technologies, including GIS and CAMA, among Louisiana Assessors has been slowed by limited resources, a lack of communication and slow innovation decision processes that is consistent with the theory of "diffusion of innovation" developed by Dr. Everett M. Rogers (1995) .*

Dr. Everett Rogers was a communications scholar and sociologist at Iowa State University, who wanted to know why some farmers use the latest hybrid drought resistant seeds, while others were content to use the same ones their fathers and grandfathers used. Rogers grew up on a farm in Iowa, so he was familiar with the concerns of farmers regarding adopting new technology. He interviewed hundreds of farmers and developed a theory that explains the process by which new ideas are adopted by a social group, in his case Iowa corn farmers. Rogers categorized those who adopt a new innovation or idea as the following: innovators (2.5%), early adopters (13.5%), early majority (34%), late majority (34%) and laggards (16%). He was able to place these different groups on a bell curve making it possible to predict the technology diffusion process. Rogers developed a list of factors that affect the rate of adoption, such as adopters' ability to try out the innovation, the level of risk they are comfortable with, the communication channels used by the adopter, and other factors that allowed him to make predictions as to how quickly about the temporal aspects of adopting innovative methods and technologies.. Adopted by many different disciplines, his theory is useful for determining the speed at which different innovations will be diffused within a social group. This research applies Roger's theory as a major tool to assess the relative speed in which Louisiana assessors have (or have not) adopted geospatial technologies.

Interestingly, the current level of adoption of geospatial technologies among Louisiana assessors varies significantly. In a 2007 Survey of Louisiana Assessors that was conducted by the Louisiana Geographic Information Center and characterizes assessors' GIS capability, slightly more than a third of assessors had fully functioning GIS systems. By 2010, the number of assessors stating that they have fully functioning GIS systems increased to 64%. As noted in the 2010 LAA survey, many assessors are using GIS software and over half are using a CAMA system. However, according to that survey, only 13% have actually integrated their CAMA system with their GIS system (2010 LAA Survey). Although geospatial technologies are universally accepted among Louisiana Assessors as an essential next step forward, very few have been able to employ them to their fullest capabilities.

According to the results of the 2004 National Association of Counties) Survey of local governments, issues related to funding ranked as the greatest obstacle to the adoption of geospatial technologies (NACO 2004). Lack of adequate funding was also mentioned as a major concern for Louisiana assessors according to a 2007 survey of Louisiana Assessors (LAGIC, 2007).

Factors that slow the adoption of geospatial technologies

According to the results of the 2004 National Association of Counties (NACO) survey of local governments, funding issues ranked as the greatest obstacle to the adoption of geospatial technologies (2004). This was affirmed by a 2007 survey of Louisiana assessors that revealed that lack of adequate funding is a major concern for Louisiana assessors. Typically, Louisiana Assessors fund their own staff and capital improvements through a percentage of the ad valorem taxes collected. However, many rural parishes lack a sufficient ad valorem tax base to fund major improvements due to a small population of tax payers and/or the lack of either commercial or industrial facilities within their parish. This leads to rural parishes with a small tax base having a distinct disadvantage to assessors from larger jurisdictions in funding geospatial technologies.

To understand the reason for these disparities in GIS capability, it is necessary to explore the resources available to assessors and see how they differ by parish size and the strength of its tax base. The U.S. Office of Management and Budget characterizes Louisiana parishes as either metro (29 parishes), micro (18 parishes) or rural (17 parishes). Parishes falling within one of these categories—metro, micro, or rural have similar characteristics in regard to both their resources and their ability to adopt geospatial technologies. Parishes falling within different categories, however, differ significantly from other categories in available resources. As noted in the introduction, one difference between rural and metropolitan parishes is the number of homeowners who qualify for a 100% exemption on their property taxes. The average percentage of owner-occupied homes that qualify for the 100% state exemption on their property taxes is 46% for metro parishes, 63% for micro parishes, and 77% for rural parishes (Table 3). In other words, owner-occupied homes in metro parishes are more likely to pay property taxes then are homeowners in rural Louisiana parishes. On average, 77% of owner-occupied homes in rural Louisiana parishes pay no real estate tax because the assessed value of their homes fall below the Louisiana Homestead Exemption threshold of $75,000. In Bienville Parish, for example, the rate of owner-occupied homes in 2010 that were granted a 100% exemption from real estate taxes was 87% (Louisiana Tax Commission). In addition to the homestead exemption reducing potential tax revenues, the median price of a home in a rural area is significantly lower than in a metropolitan

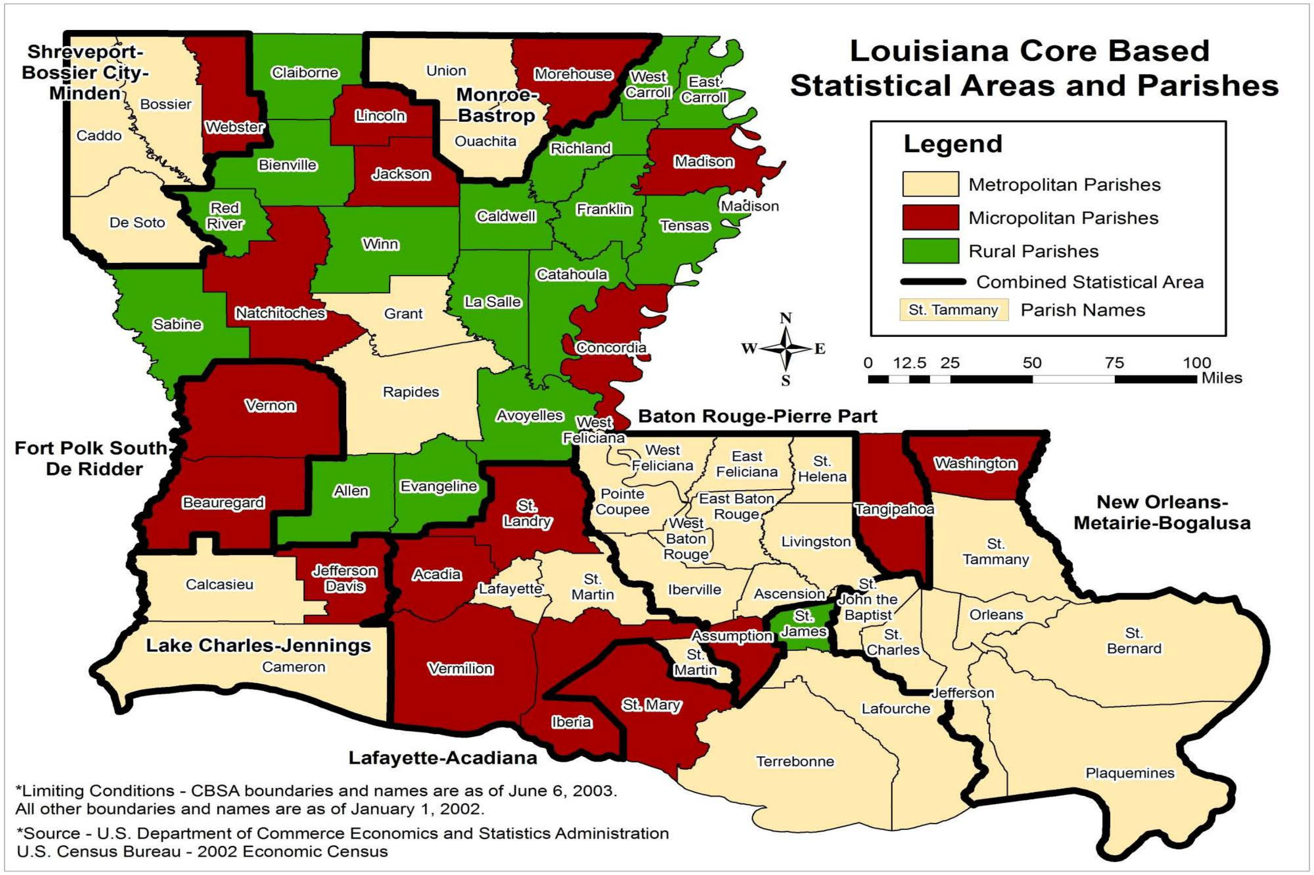


Figure 4

Figure 4 Office of Management & Budget, Louisiana Core Based Statistical Areas

parishes resulting in a greater disparity in the percentage of tax revenue collected from each residential property. The median cost of a home in a Louisiana metro area is \$132,100, \$89,600 in a micro area, and \$73,200 in a rural area (Table 3). An assessor in a rural parish with few industrial or commercial taxpayers, a small number of residential tax payers, and fewer taxes collected per property will find that the options for funding geospatial technology are limited.

Additionally, Louisiana assessors operate under other constraints. According to the 2007 LAGIC Survey, they have difficulty retaining experienced technical staff and providing their existing staff with adequate training opportunities. In addition to funding constraints as discussed earlier, these issues impede assessors' ability to adapt to technological change.

While it is evident that geospatial technologies present challenges, they also provide some equally significant opportunities. For example, adopting new technologies can result in increased efficiencies, better services to the public and better access by providing these services directly to citizens in their homes and businesses through the Internet. This research project illustrates both the incentives and impediments to the diffusion of geospatial technologies, specifically Geographic Information Systems (GIS) and GIS linked to Computer Aided Mass Appraisal (CAMA) systems within the Louisiana assessor community.

Louisiana assessors could benefit by learning from the experiences of others. Currently no local organization exists to track the progress of assessors or document problems that they encounter as they build their GIS or CAMA systems. Documenting the steps involved in building these systems could assist other assessors who might learn from their efforts. A number of successful projects would qualify as "best practices" based on the exemplary methods that were used and the repeatability of those efforts.

Using the U.S. Office of Management and Budget (OMB) designation of Louisiana's parishes as either metropolitan, micropolitan, or rural areas, data was collected from assessors through the use of an online survey. That data was sorted by the OMB designations as well as assembled into statewide averages. Furthermore, a representative number of metro, micro, and rural parishes were surveyed from around the state to account for any regional differences. This research will provide examples of how some parishes have adopted innovations quickly while others have been slow to adopt new technologies. It will give special emphasis to those factors that Rogers (1995) considers most likely to slow the adoption of geospatial technologies: lack of resources, poor communication channels, and a slow innovation decision process.

GIS and CAMA Implementation

GIS is an information management tool that combines graphical features with tabular data. Among Louisiana assessors, the standard, or basic, GIS implementation is a stand-alone mapping system that is used to locate parcels, help identify factors that might affect the assessed value (zoning, hazardous waste sites, and flood zones) and produce hard copy maps for field review and appeals. Generally, it is the first geospatial technology that is implemented by assessors, yet it is rarely used as a tool for spatial analysis, especially during the early years of implementation.

Computer Aided Mass Appraisal Systems (CAMA) has been defined as "an automated system for maintaining property data, notifying owners, and ensuring tax equity through uniform valuations" (Massachusetts DOR). The typical CAMA database is relational in that different data attributes are related through a common key or link. The CAMA database structure is very similar to a GIS database with the exception of the geographic coordinates for points, lines, and polygons and topology found in the GIS database. CAMA systems will have at least four subsystems: the valuation system, the performance analysis system which ensures consistency in valuations, a data management system, and an administrative function (Linne, 2010).

Merging GIS and CAMA data allows assessors to relate the tabular data found in their CAMA System to the map graphics found in their GIS. Using a relation database management system (RDBMS), the GIS and CAMA systems could reside in different departments of parish government and permissions could be created that allow only the assessor's staff to make changes to the CAMA data and another set of permissions that only allow the GIS Department to change the map graphic layers. Moreover, there is many potential ways that the two systems could be integrated

According to the 2013 LAA Survey, only eight parishes have successfully merged their GIS and CAMA systems. Four of those eight parishes have mature GIS systems that have been operating successfully for ten years or more.

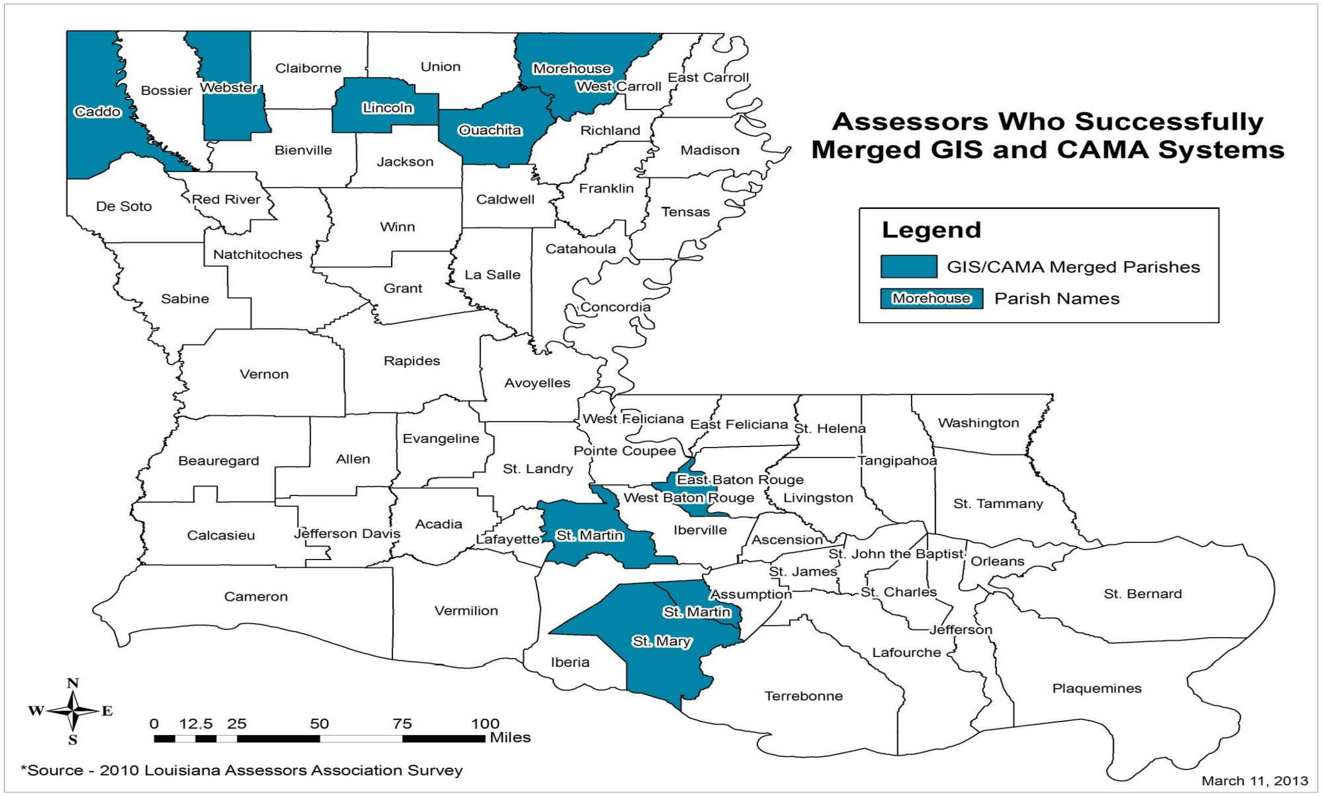


Figure 14

Figure 14: Assessors who successfully merged their GIS and CAMA Systems

Four Theories on the Diffusion of Technology

In order to understand why one parish assessor would adopt the latest technologies while another would be skeptical of any innovation, it is necessary to rely on theories that explain the diffusion of technology. Described below are the relevant theories after the name of the main proponent and the date of their relevant research

1. Gabriel Tarde (1903)

As the first researcher to define the process of innovation, Tarde described it as a series of five steps: 1) first knowledge; 2) forming an attitude; 3) a decision to adopt or reject; 4) implementation and use; and 5) confirmation and decision. He also developed the S-Curve as a way of describing the innovation life cycle from the introduction of the innovation to its growth and eventual decline. Most researchers in the field of innovation have built on Tarde's groundbreaking theories.

2. Everett Rogers (1995)

Everett Rogers' theory explains how new innovations are diffused through an organization or group. According to Rogers, diffusion is a process by which an innovation is communicated through certain channels over time among members of a social system. By using the S-Curve developed by Gabriel Tarde, he created five categories for the different adopters: innovators, early adopters, early majority, late majority and laggards. His theory has been used to explain the trajectory of hundreds of different technologies and it has been tested in a variety of different conditions. However, there are three main criticisms of this theory. The first is that there is a pro-innovation bias to the theory. In other words, he endorses the expectation that innovation is good, useful and benefits all. However, often an innovation is a mixed blessing, meaning there are side effects in addition to benefits. Another criticism is that the theory blames the individual if the innovation is not accepted. Not all laggards are ignorant or resistant to change; in fact, they may have very legitimate reasons as to why they are not interested in adopting the innovation. The third criticism is that Roger's theories often end up increasing income inequality in Third World countries because the farmers who most welcome new seeds and machinery are the ones who can afford to invest in technology and subsequently benefit the most from these new technologies.

3. Fred Davis (1989)

A major contribution of his has been to develop a model explaining new information system acceptance or rejection known as *The Technology Acceptance Model* (TAM), a theory built on the earlier work of Fishbein and Ajzen called the *Theory of Reasoned Action* (TRA). The TRA was a practical model that explains the behavior of an individual based on his/her prior intention (behavior intention) and normative beliefs. Davis identified two distinct factors that influenced the decision to adopt technology: perceived usefulness and perceived ease of use. As he defines them:

- *Perceived usefulness is the degree to which an individual believes that using a particular system will improve their job performance.*

- *Perceived ease of use is the degree to which an individual believes that using a particular system would be free of physical and mental effort.*

The main criticism of TAM is that its two variables do not account for all the reasons that a technology is accepted or rejected and therefore it can only accurately predict the correct response about 40% of the time.

4. V. Venkatesh (2003)

The *Unified Theory of Acceptance and Use of Technology* (UTAUT) seek to explain a user's intention to implement an information system. According to Venkatesh, four factors determine usage intention and behavior: 1) performance expectancy; 2) effort expectancy; 3) social influence; and, 4) facilitating conditions. This theory was criticized by R.P Bagozzi, (co-author of the original theory) for being too complex for practical use because it has forty-one independent variables for predicting intentions and eight independent variables for predicting behavior.

Research Focus – Diffusion of Innovation

After considering these four theories, I selected Dr. Everett Rogers' theory, as described in his seminal work *Diffusion of Innovations* first published in (1962), for two reasons. First, this theory mirrors quite accurately the spread of GIS technology among Louisiana assessors. Secondly, Rogers' model accounts for the importance of communication among professionals. My research showed a strong correlation between assessors who communicated frequently with other assessors and parishes that adopted technology more quickly. For those reasons, I have selected Rogers' models for this project with an understanding it is not without its flaws. For example, Rogers' theory is weakest in not acknowledging the difference in resources between different organizations and how that factor can impact their ability to adopt new technologies.

According to Rogers, the main elements in the diffusion of new ideas are 1) to have an innovation; 2) to communicate the innovation through certain channels; 3) to do this over time; and 4) to spread it among the members of a particular social system.

The first element in the diffusion process is the innovation itself which in this case is the use of geospatial technologies by Louisiana assessors. This innovation was communicated to Louisiana assessors by professional organizations, trade journals and from other assessor's over a period of two decades. Using geospatial technology was very new in the early 1990s, and thus involved a high degree of risk in adopting this technology. To reduce uncertainty, those assessors who were interested in adopting GIS technology wanted as much information as possible about experience other assessors had implementing these systems. The LAA surveys show that assessors from metropolitan and micropolitan areas of the state had more potential sources of information on the use of GIS technology than did their rural counterparts. In addition, metro and micro assessors communicated with a larger number of their peers while deciding whether to implement GIS.

According to the 2013 surveys, the most common communication channel was a site visit to a neighboring assessor who was implementing GIS technology. Other communication channels for GIS information included workshops and conferences hosted by the International Association of Assessing Officers (IAAO), the Louisiana Assessors Association (LAA), and other GIS professional organizations such as the Louisiana Chapter of the Urban Regional Information Systems Association (URISA). Vendors and consultants also played a valuable role in explaining the advantages of various technological improvements.

The third element in the diffusion process is the concept of time. The rate of adoption of an innovation can occur over a long or short period of time depending on the innovation, the degree of risk, and the consequences of a poor decision. Rogers' theory of the speed of the "Diffusion on Innovation" describes a series of five steps that he labels the "innovation decision process." The five steps involve: (1) knowledge; (2) persuasion; (3) decision; (4) implementation; and (5) confirmation. These five steps are the process through which an individual or organization gathers information as they make a decision to either implement or reject an innovation. To decrease uncertainty, an individual or organization will ask for additional information during any step of this innovation decision process. The 2013 surveys ask assessors questions specifically about how they first heard about GIS and/or CAMA Technologies and what problems they experienced while implementing these new systems. A slow innovation decision process impedes an organization's efforts to adopt technology. A slow decision process is generally caused by either a lack of sufficient information to make a decision or an aversion to risk.

The fourth element involved is the social system, which for the purposes of this research are the sixty-four Louisiana assessors being surveyed. Rogers defines a social system as a "set of interrelated units that are engaged in joint problem solving to accomplish a common goal." All Louisiana assessors are elected by voters in their parish to assess residential, commercial or real property. Despite being generally well educated and aware of the technological challenges they face, the rate at which they adopt innovation varies widely. The graph below shows the percentage of each of the different risk aversion types.

Rogers Bell Curve Showing the Rate of Technology Adoption

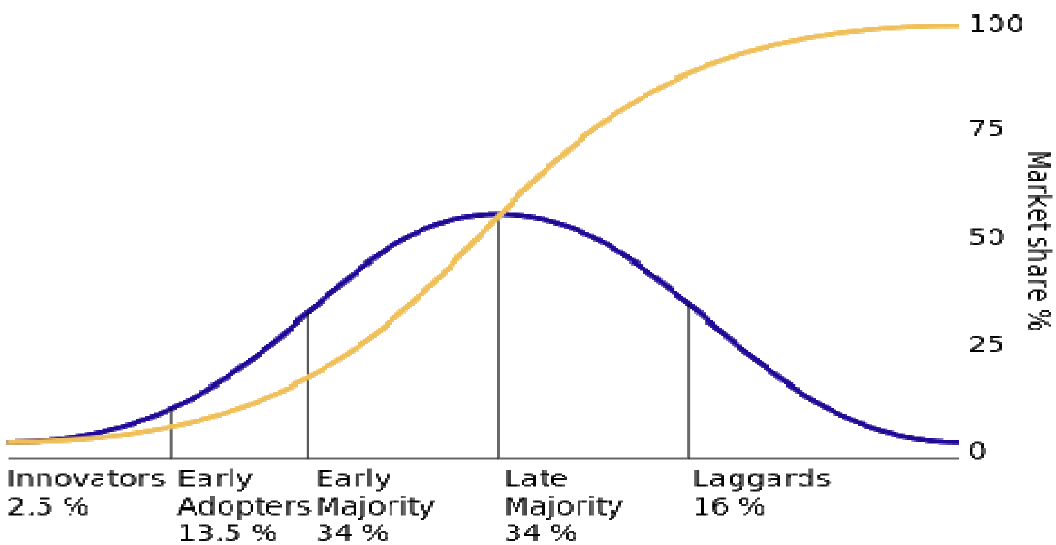


Figure 2. Source: Diffusion of Innovations, Rogers (1995)

Rogers describes the various rates at which individuals adopt an innovation as a bell curve that takes place over an extended period of time, depending on the innovation. He describes those individuals or organizations that adopt an innovation at various times in the process as falling into one of the following categories: innovators, early adopters, early majority, late majority, or laggards. The graph above shows the percentage of each of the different individual types that fall within each of the five categories. The categorization of an individual or organizations as an early adopter or laggard relates specifically to the amount of time it took them to adopt the innovation.

Innovators are the first to adopt an idea or technology from beyond their geographic area. Additionally, they are willing to make a mistake or lose money when an innovation proves to be unsuccessful. They usually have the ability to evaluate complex technical issues and are comfortable with a high degree of uncertainty. Innovators are critical for discovering new ways of thinking or doing and pave the way for the next group in the adoption process, the early adopters. Innovators are a relatively small group totaling less than 3% of the total number of assessors. Louisiana benefited from having two innovators, one in the north, (Assessor Jewette Farley from Lincoln Parish) and one in the south (Assessor Sherel Martin of St. Mary Parish). In person interviews with assessors and other anecdotal evidence leads one to the conclusion that both men, and organizations, were early innovators in adopting geospatial technologies for their assessment offices.

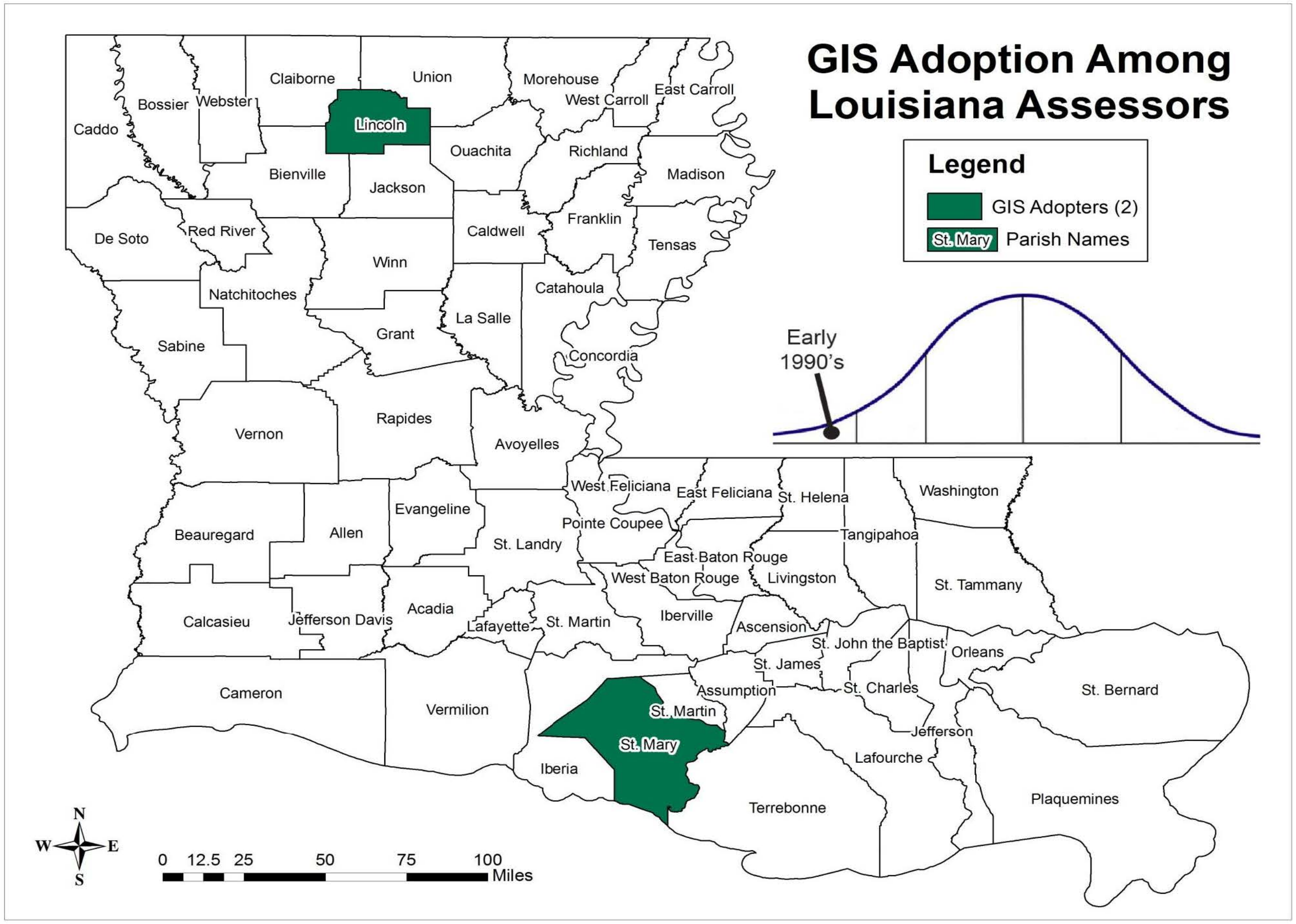


Figure 6

Figure 6: Time Series, GIS Adoption among Louisiana Assessors (Early 1990's)

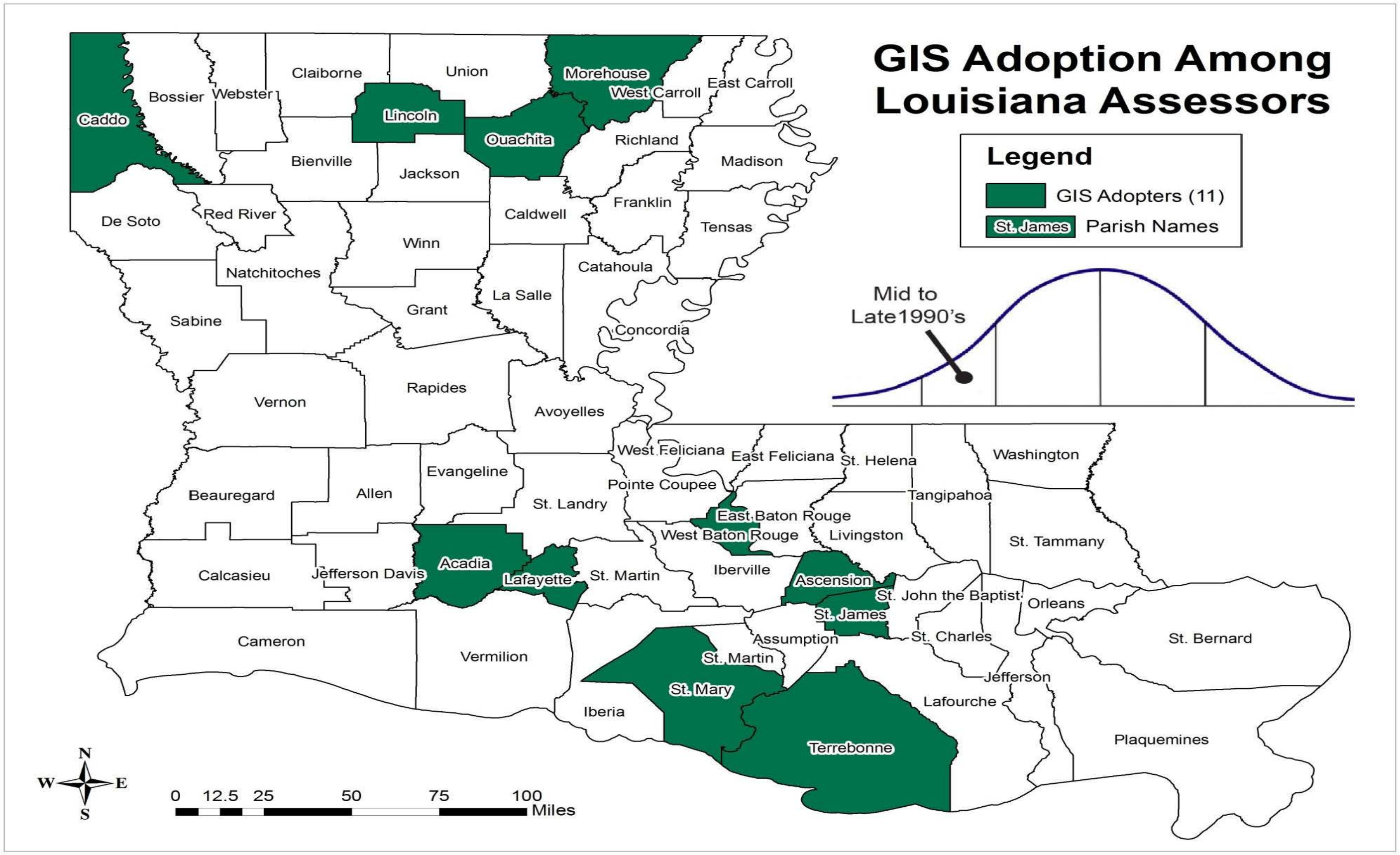


Figure 7

Figure 7: Time Series, GIS Adoption among Louisiana Assessors (Mid to Late 1990's)

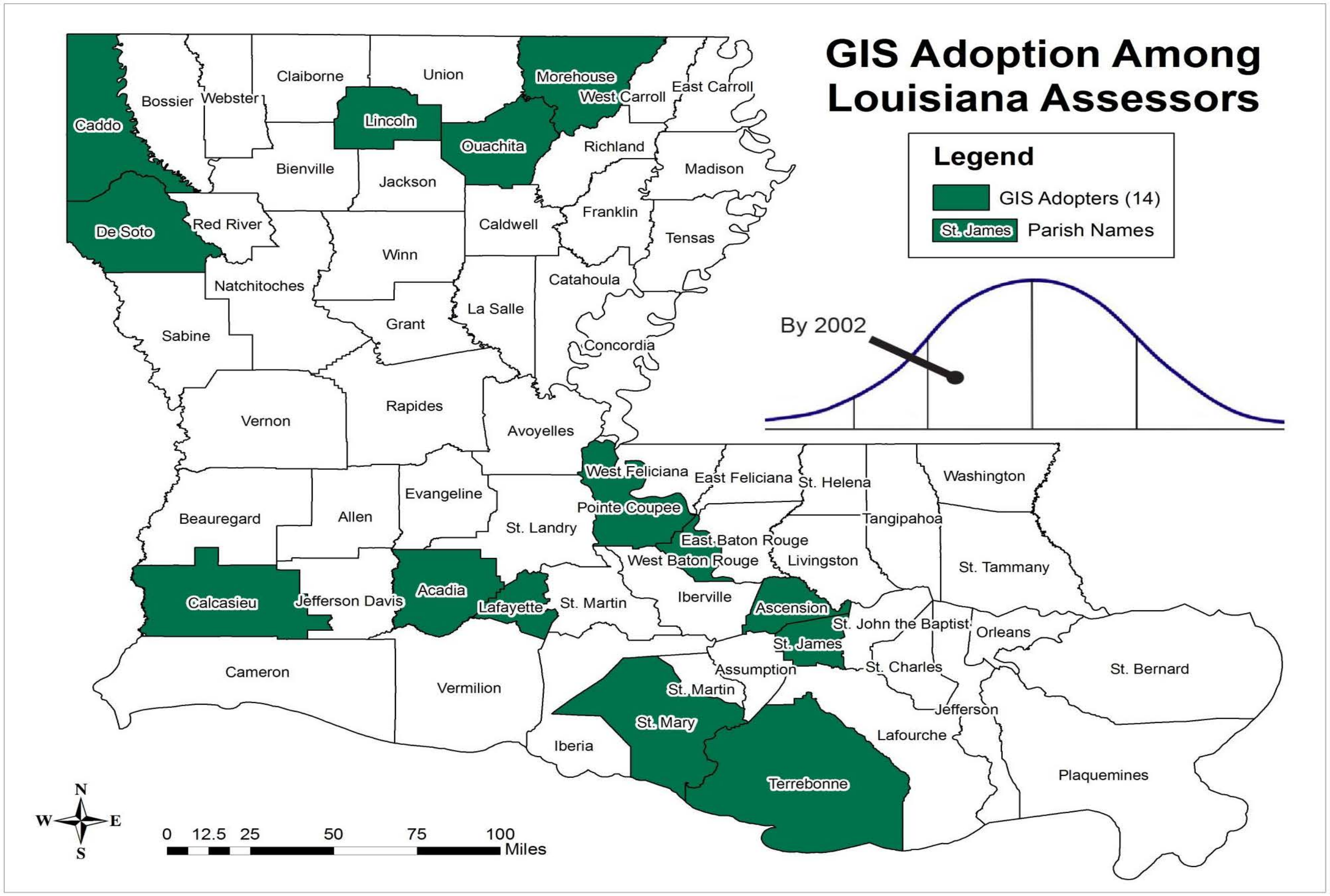


Figure 8

Figure 8: Time Series, GIS Adoption among Louisiana Assessors (2002)

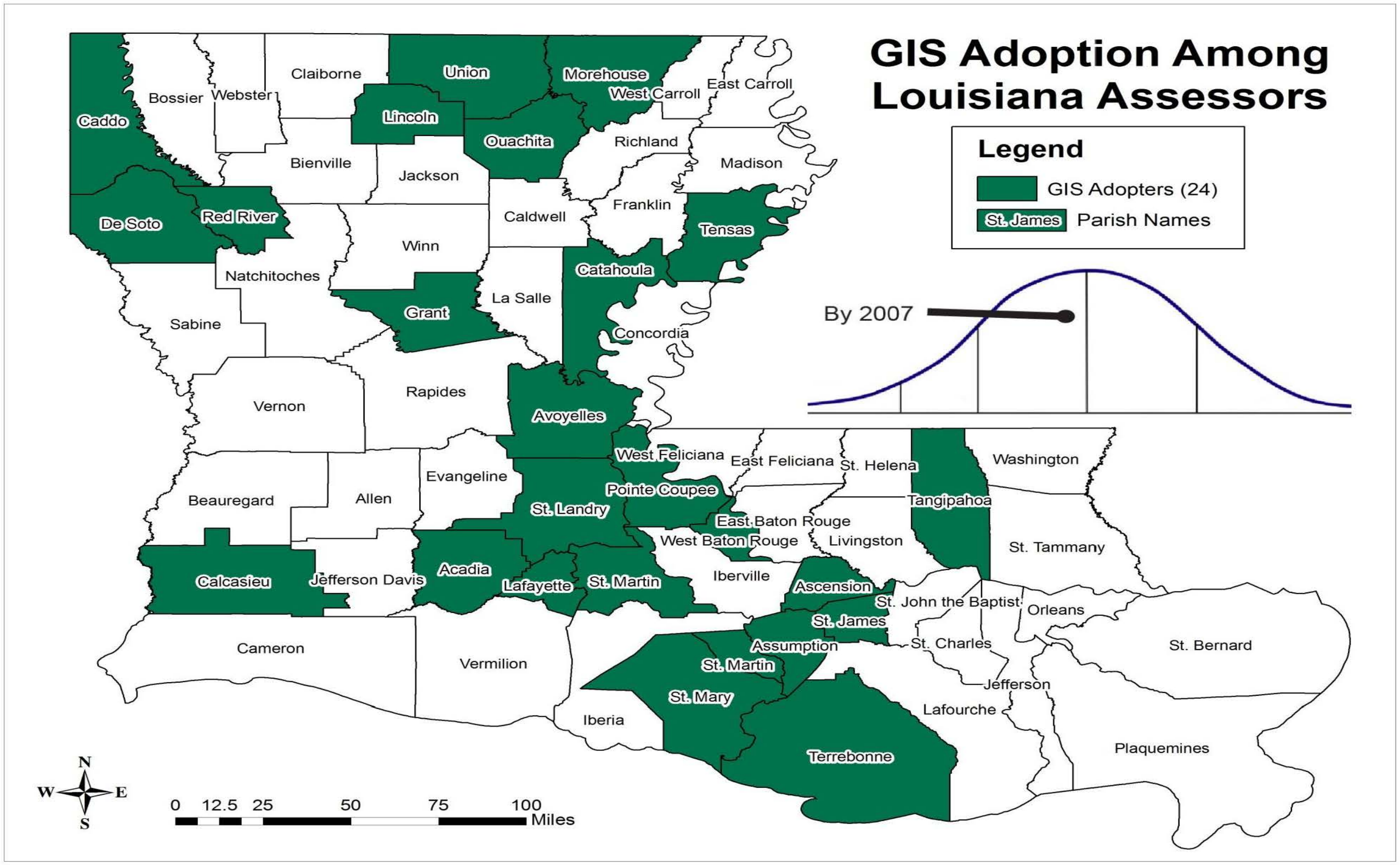


Figure 9

Figure 9: GIS Adoption among Louisiana Assessors (2007)

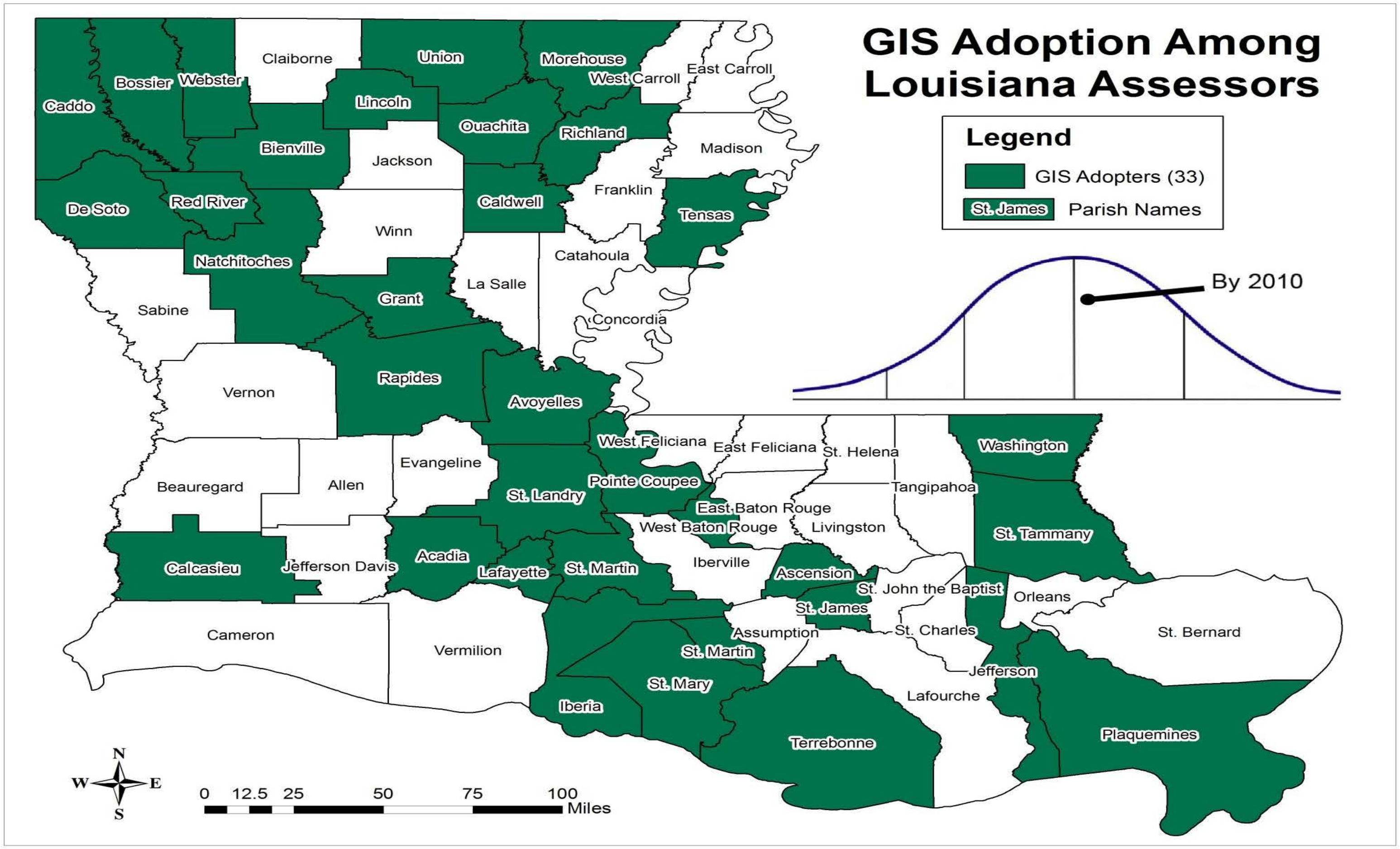


Figure 10

Figure 10: Time Series GIS Adoption among Louisiana Assessors (2010)

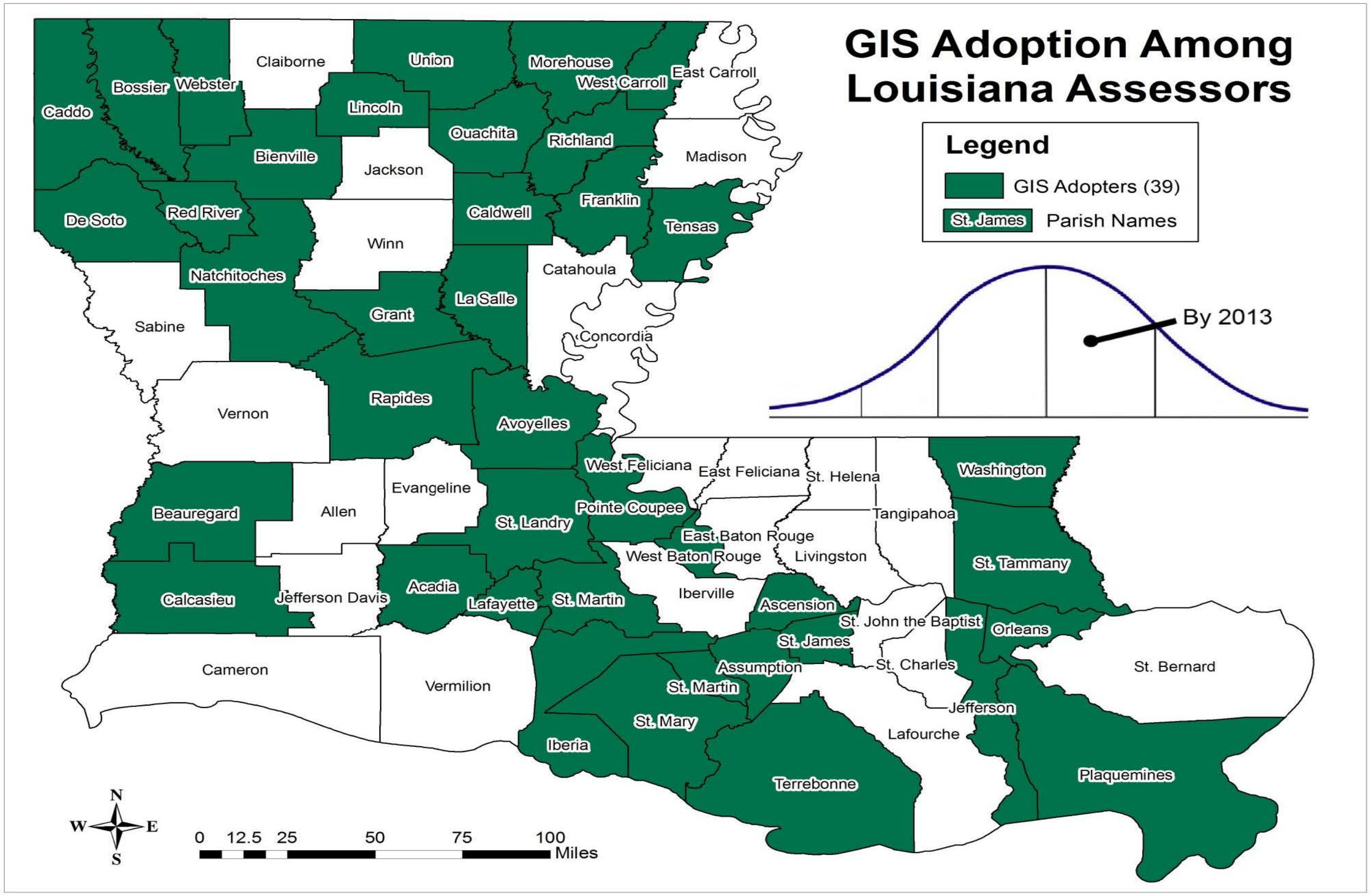


Figure 11

Figure 11: Time Series, GIS Adoption among Louisiana Assessors (Early 2013)

Early adopters are the opinion leaders; they drive the eventual acceptance, or rejection, Of an innovation by those that follow. Early adopters are more risk adverse than are Innovators as their status is based on their ability to correctly select the future technology winners. Their promotion of an innovation is a sign to those who follow that The innovation is sustainable. This category makes up about 13% of the total number of assessors. In North Louisiana, Rich Bailey in Ouachita Parish, Mike Wooden in Morehouse and Charles Huntington in Caddo were among the early adopters. In South Louisiana, Gene Bonvillain in Terrebonne Parish and Russell Benoit in Acadia Parish were two early adopters.

The *early majority* may take their time in deciding whether to adopt a technology, but they are an important part of the adoption process because they interact with both the early adopters and the larger group of non-users. The early majority is not leaders, but their decision to implement a technology has a great effect on the remaining half of the social system that have yet to make up their mind to accept an innovation. The early majority make up about 34% of the total number of assessors.

The *late majority* consists of those who have fewer resources and thus more to lose if they make a mistake. They tend to wait until the majority of their peers have already implemented the innovation and virtually all of the risk of implementing it has been eliminated. They compose about 34% of the total members of their social system.

Laggards are the last group in a social system to adopt an innovation. Laggards are the most provincial of all the groups and reveal the least amount of social networking. Because they are skeptical of innovations, their decision process can be quite lengthy. Laggards have the most to lose if an innovation fails because they have the least amount of resources of any member of the social system.

Rogers and others have examined the characteristics of adopter categories including the most likely socioeconomic status, personality values, and communication behavior of the different groups from innovators to laggards. Louisiana assessors are categorized as one of the five types of adopter categories (Rogers 1995). Among Louisiana assessors, adopter categories are determined by the role each assessor plays in the diffusion of geospatial technology among his/her colleagues. Those assessors who were among the first to adopt geospatial technology are categorized as innovators. According to Rogers, innovators tend to be young, willing to take risks, have greater financial resources, and are very social. They tend to communicate with a large network of other innovators and their willingness to take risks means that they accept the possibility of failure. Rogers' theory relies on each adopter category laying the groundwork for the following adopter category. The next category of assessors, early adopters, are opinion leaders who are generally younger, socially prominent, well educated, financially secure, yet a little more risk adverse than the innovators. Their central position in the communication of innovations lies in their ability to pick the winners. According to Rogers, early adopters strongly influence the early majority who follow them in the progression of groups that adopt innovations. The early majority generally wait much longer than the innovators or the early adopters to adopt a new technology. They generally have above average social status and stay in touch with the early adopters, but they are not considered to be opinion leaders. Early majority assessors tend to be more risk averse than early adopters. The next group of adopters is the late majority. Assessors in this group tend to be very skeptical of new technology and will adopt it only after the majority of other assessors have tried it. They tend to be in a lower socio-economic status, and generally are not opinion leaders. They also tend to be socially isolated from other assessors. "Laggards" are the last group to adopt an innovation; they tend to be older, more socially isolated, and extremely risk adverse. They will wait until most other assessors have adopted GIS or CAMA technology before they will invest in new technology. They tend to have the least amount of financial resources so they also have the most to lose if the technology doesn't work as planned. The five categories of adopters fall along a bell curve starting with "innovators" and ending with laggards.

Communication Channels among Louisiana Assessors

Particularly useful to this research is Rogers' work on communication channels by which information passes from one individual to another. He argues that mass media (television, radio, and internet) are very effective at promoting awareness of an innovation, but concludes that person-to-person contact is much more effective at changing opinions about a technology or forming new ones. He states that most individuals make their decision to adopt technology not from reading articles or attending conferences but from listening to an individual they know describe their experiences in adopting that innovation (2005).

The innovation-decision process is a series of five steps taken by those considering whether to adopt, or to reject, an innovation. The first step is the *knowledge stage* when the potential adopter first learns about the innovation and how

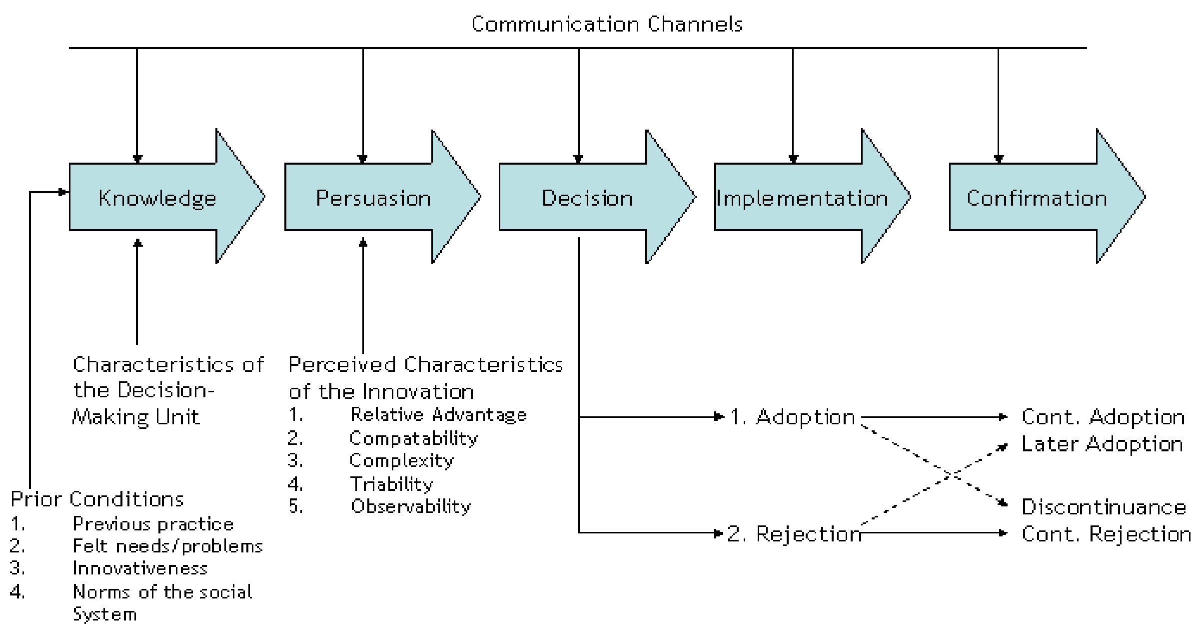


Figure 3: Innovation Decision Process
Source: Diffusion of Innovation, Rogers (1995)

this innovation operates. The second step, *persuasion*, helps the potential adopter decide for, or against, the innovation dependent on five attributes (or Perceived

Characteristics): relative advantage, compatibility, complexity, triability and observability. The data collected in the online survey shows that those assessors who were more likely to visit a neighboring assessor to take a firsthand look at their technology use were more likely to adopt it.

Attributes of Innovation

The first of the five attributes of innovations, *relative advantage*, is determined by whether an innovation is perceived to be significantly better than the current method. In other words, the better the innovation performs relative to the current method or technology, the greater the likelihood that it will be adopted. The second attribute is *compatibility*. Does the innovation work with the existing business process or will the current processes have to be redesigned? If the user believes the innovation to be an incremental improvement, it will be adopted more quickly. The third attribute *complexity* is the degree to which an innovation is imagined to be difficult to understand. The more complex the innovation, the less likely the innovation will be adopted. The fourth attribute is *trialability*. Can the innovation be taken for a "test drive"? If the innovation can be successfully tested, it is more likely to be adopted. The fifth and final attribute is *observability*. How easy is it for others to see the benefits of the innovation? The more obvious the benefits are to everyone, the more likely that the innovation will be adopted.

The decision step is the point at which the individual or group agrees to whether they will adopt or reject an innovation. That step is followed by the implementation of the innovation if it is adopted. The confirmation step occurs after an innovation has been implemented and the decision maker wants to know how well the innovation has been incorporated into the business process. At this point, the decision maker may decide to continue the implementation process or reverse it depending on the responses they receive from the users.

The Assessor's Role as a Technology Champion

Louisiana assessors are asked to provide an ever-increasing variety of public services to their communities. They are expected to compile and disseminate a variety of data sets from the valuation of agricultural land to oil and gas production equipment. The need to overlay different data sets for the same geographic area is what has driven assessors to implement geospatial technologies. Additional data requests are driven by the needs and wants of citizens in their respective parishes as well as state and local mandates. State tax incentive programs can also impact local assessors when they require that property, or other assets, be reassessed. The cost and complexity of new information systems has forced assessors to partner with other local government agencies to share in the costs and benefits of these new technologies. However, the decision of Louisiana assessors to use, or not use, geospatial technologies to meet these demands are dependent on a number of factors.

Among the factors that affect the adoption of technology is awareness of various technological solutions. The Internet has made it possible for even the most rural assessors to research solutions and find out how others are solving these technical challenges. An assessor interested in using the most cost-effective tools could attend conferences and workshops, request demonstrations from vendors, and contact other assessors using similar technologies. Regardless of how aware assessors might be of the benefits of using the appropriate technological solution to improve the work process, they may not have the financial resources to implement the necessary technology. Innovations may result in future savings but there are still many upfront costs including installation costs, downtime, required software, and hardware upgrades, consulting fees and training for staff members. One of the largest, and most substantial, costs involves the conversion of legacy databases from an older computer system to a newer one. Synchronizing a CAMA database with a GIS database is one example of a potentially large data conversion cost. Assessing offices are faced with competing needs and limited resources that can result in pressures to reduce funding in lieu of adopting new technologies.

For the most part, Louisiana assessors are still self-sustaining entities. The salary of an assessor is paid by the state, but most other expenses are covered by a set percentage of the ad valorem taxes collected. Louisiana Tax Commission involvement with cadastral mapping is very limited. The Commission is the state agency that regulates the work of parish assessors. Assessors provide the Commission a yearly tax roll which lists the taxes paid on every property (both real and movable) and lists the millage rates for every special district granted authority to levy a millage. The Tax Commission provides legal advice to assessors and promulgates rules as to how taxes are levied, appealed and collected. Until 2012, the salaries of assessors and the legal assistance provided by the Commission were the extent of state support for Louisiana assessors. In 2012, the Louisiana Legislature passed a law (RS 74:1906) that created an expense fund that assessors could use to cover a set amount for supplies and equipment. This same law allowed assessors to move funds from one budget year to the next, a process that they were not allowed to do previously. Assessors also can receive assistance from their parish government for utilities, office space, and office equipment (LA RS 47:1925.2). Some assessors have argued, citing LA R.S. 33:4713 that parish governments should pay for the development of a cadastral base map that benefits both parish government and the assessor. The St. Tammany Parish Assessor was the first to successfully argue to the State Attorney General that GIS technologies should be included as a basic infrastructure expense whose cost should be shared with parish government (Louisiana AG OPINION # 05-0332). Some assessors are reluctant to request that their local government share the cost of geospatial technologies because their parish government may be facing difficult budget issues of its own.

The effective use of GIS technologies and other Computer Aided Mass Appraisal Systems (CAMA) requires a skilled and adaptable workforce. Long term maintenance of the GIS requires access to technical assistance in addition to software and hardware upgrades. An issue raised by Louisiana assessors in an online survey (LAGIC 2007) was the difficulty in retaining skilled staff members due to the high demand of computer professionals in the area of information science and GIS. Local governments may have difficulty competing with the compensation offered by the private sector to hire or maintain these employees. However, the public sector can offer some other advantages, such as training opportunities and better benefits.

Just as awareness can spark innovation, lack of interest or limited knowledge about the process can lead to poor decision making during the acquisition of technology. Assessors who lack an understanding of the basic concepts of geospatial technology or have not conducted a thorough needs analysis may choose systems that are overly complex or will not meet their long term needs. Performing due diligence prior to acquisition will make it more likely that an assessor will make a more informed decision when purchasing hardware, software and services from consultants and contractors. Rogers (1993) noted that the early adopters and early majority are more likely to seek out the opinions of others and ask about "best practices."

According to the 2007 Louisiana Geographic Information Center (LAGIC) Survey, another critical issue assessor's face is the lack of training opportunities for their staff. Utilizing geospatial technology requires that, at a minimum, staff be adequately trained on the software. Providing staff members with geospatial training opportunities increases their knowledge and proficiency. Only a handful of universities in Louisiana provide a concentration in GIS and of those that do, only a couple have on-campus opportunities to work as a graduate assistant on GIS projects. Unfortunately, in Louisiana, training and education in the use of geospatial technology is very unevenly distributed. Assessors in rural areas have less access to state-of–the–art training workshops, to experts in the field, and to those GIS programs that provide potential employees. Besides pointing to the lack of training, the LAGIC Survey (2007) also revealed a shortage of technical experts for hardware or software support and the building of custom interfaces. Although the Internet has reduced the scope of this problem by making technical information more readily available, GIS user groups and online help cannot substitute for a lack of professional expertise.

Critical to the successful adoption of geospatial technology, in any organization, is a culture that rewards innovation. Local governments that discourage innovation due to poor management or inadequate funding will not be able to retain their technical talent or attract new talent. More work should be done to upgrade job descriptions so that mid-level IT staffs are compensated adequately. Providing GIS staff training opportunities and recognition for accomplishments has proven to be effective motivators (Budic 1996).

The Louisiana Assessors Association provides International Association of Assessing Officers (IAAO) certified training sessions in cadastral mapping twice a year. These courses are not software specific but cover general digital mapping standards and guidelines. They are taught by IAAO Certified instructors and use IAAO Training Manuals. Staff members of local assessor offices who need more hands-on GIS training would benefit from taking courses in particular GIS software programs used in their offices. Some states assist their assessors by sponsoring GIS training programs. In addition to training, colleges and universities provide technical expertise that is critical during the early startup phase of GIS development. Assessors who do not have technical support from their local university may have to rely on the conflicting advice of vendors or consulting firms. An alternative is for universities to provide student workers, a move that would be beneficial to for the students in terms of gaining experience and the assessor in terms of employing trained, albeit part-time, staff. However, students must be trained and managed which can overtax already understaffed assessment offices. In addition, students rarely stay in student worker positions for more than a year so there is constant turnover

Although the private sector often has a wealth of knowledge and experience, its recommendations can be biased towards proprietary or services that may not easily be integrated into other municipal data or mapping systems. In his research, Rogers (year) discusses the importance of communication channels for making decisions to adopt, or not adopt, a given technology. Those assessors who communicate more often with other assessors regarding best practices are better able to evaluate their options and make better decisions.

What is Cadastral Mapping?

According to Webster's Dictionary, a cadaster (also spelled cadastre), whether using a cadastral survey or a cadastral map, is an official register of the quantity, value, and ownership of real estate used in apportioning taxes. A cadaster commonly includes details of the ownership, tenure, precise location (some include GPS coordinates), and the dimensions (and area). A cadaster may include types of crops (if rural), auxiliary buildings, and the value of individual parcels of land. Currently, cadastral mapping involves the development of a computer-generated map showing the boundaries of real properties which is a graphic representation of the actual boundaries. If these boundaries are created in a GIS, they can be tied to databases that contain the attributes of that property including ownership, acreage, assessed value, title documents, and other relevant data. In most countries, legal systems have developed around the original administrative systems and use cadasters to define the dimensions and location of land parcels described in legal documentation. Assessors realized that they needed a system that would allow them to tie their parcel maps to the data that they collect for each parcel, hence the use of Geographic Information Systems (GIS) in the assessment field starting in the early 1990s. They also needed a way to analyze the property data that they collected to ensure fair and equitable taxation through uniform valuations. The Computer Aided Mass Appraisal systems that were developed in the late 1990s allowed assessors to analyze their data in a variety of ways. These two systems, GIS and CAMA, were developed separately for different purposes but soon enough users realized the data systems both could be merged if the data models were built to the same specifications. A "Best Practice" for assessors today is a GIS that links to their CAMA system and allows for complete data exchange in both directions.

How Other States Support Cadastral Mapping

There are other state governments in the U.S. that assist their assessors in different ways. To illustrate this, I describe three examples of state-sponsored programs for assessors are provided by Arkansas, Montana and Florida. The State of Arkansas created the *County Assessor Mapping Program* (CAMP) which is housed within the Arkansas Geographic Information Office (http://www.gis.state.ar.us/Programs/camp.html) to provide digital mapping capabilities. Assistance to local assessors is provided to those counties that agree to share their cadastral data with the state and comply with nationally recognized standards for creating digital parcel data. The parcel data is housed on a state website where it can easily be accessed. This website also acts as an emergency data backup center.

The State of Montana creates digital parcel data for those counties lacking the resources to buy GIS hardware and software or for attracting technically competent staff (http://giscoordination.mt.gov/cadastral/msdi.asp). The state then compiles the data into one common data format and provides quality assurance and data distribution. Montana's efforts ensure that a robust set of cadastral data from every county is posted to their state website.

The state of Florida emphasizes regional training programs in cadastral mapping for local assessors to insure that the staff of every county assessor's office meets the minimum educational requirements for mapping parcel data. The staff of a Florida assessor's office must be certified by the state to practice cadastral mapping and maintain that certification through continuing education credits. The Florida Association of Cadastral Mappers (http://www.facm.org/), run by the Department of Revenue, enforces those data standards and training requirements.

These three states place great value on the creation of a complete, accurate and timely statewide cadastral data layer for planning, economic development and emergency preparedness. These three programs demonstrate the importance that many states place on the expertise of their tax assessors. However, these programs are not the only state cadastral initiatives: other states such as Alabama, Arizona, North Carolina, Oregon, Tennessee and Wisconsin are also committed to the completion of a statewide parcel system, although they are all in different stages of development (National Research Council, 2007).

In addition to state assistance, there are national professional organizations that assist with cadastral mapping. As mentioned previously, the IAAO provides technical assistance, training courses, and conferences to keep their members apprised of integrated valuation technology, including GIS and CAMA technologies. The Louisiana Assessors Association (LAA) hosts regularly scheduled IAAO training programs in Cadastral Mapping and various Assessment Practices. There are also professional organizations such as the Urban Regional Information Systems Association (URISA) and the Public Technology Institute (PTI) that conduct workshops on various geospatial issues and provide technical assistance.

At the national level, the Federal Geographic Data Committee (FGDC) has a sub-committee that provides cadastral data standards, a national cadastral inventory and funding to help states create parcel data management plans. The FGDC emphasizes common data standards and the important role that cadastral data plays as an essential framework layer (FGDC).

Chapter II: Literature Review

Introduction

The preceding chapter focused on identifying the obstacles to adopting Geographic Information Systems (GIS) technologies among Louisiana assessors and the factors that may increase the likelihood of successful implementation. This chapter will examine issues that relate to the adoption of technology by Louisiana assessors. To understand the constraints that assessor's face, the state legislation that created Louisiana Assessor offices and has specified their duties and determined how they would be compensated (La. R.S. 47:1997) will be examined. It is essential to understand the financial and legislative limitations that Louisiana assessors face in order to develop strategies for overcoming any obstacles to integrating these technologies. Secondly, the organizational challenges facing assessors who are interested in employing geospatial technologies will be examined. Finally, national surveys of local government use of geospatial technologies that identify where Louisiana fits within the spectrum of technology use will be evaluated.

Geographic Information Systems operating on a personal computer (PC) using Microsoft Windows is a relatively recent phenomenon that first made its appearance in the late 1980s; however, it was not widely adopted by local governments until the mid to late 1990s. As the acceptance of personal computers by local government increased and the price of a PC decreased, with more software applications available, increased data storage, and improved graphics, PC-based computing made the process of integration easier. Hence, the literature on the acceptance of GIS among local governments is relatively recent, primarily found in various journal articles and surveys conducted by professional organizations like the Urban Regional Information Systems Association (URISA), National Association of Counties (NACO) and International City Management Association (ICMA). However, there is a wide variety of research that examines the acceptance of new technologies by (non-governmental?) organizations.

Human Factors that Affect the Acceptance of GIS Technology

Although the primary focus of this section is on organizational factors that affect the acceptance of new technologies, understanding how individuals react to new technologies has been beneficial to this research. The field of Management Information Systems, or Management Information Science, has encouraged the study of methods for improving the acceptance of new technologies. One of the most widely used methods described in business journal articles, by academics and practitioners, is the *Technology Acceptance Model* developed by Dr. Fred Davis (1989) that considers the psychological factors that affect a person's ability to accept change. A fuller description of Davis's work can be found on page 19. Research in technology acceptance is rooted in the study of behavior. The primary construct is that an individual's decision to embrace technology, or reject it, is a conscious act that can be understood and studied (Ajzen 1980). The Technology Acceptance Model (TAM) defines those factors that motivate individuals to adopt change. As a prediction model, TAM has proven to be very effective for evaluating the potential acceptance of a given software package or new technology. Validation of the model stems from numerous researchers who have tested the model with different user groups (Hendrickson & Latte 1996; Samna 1996) or cultures (Straub 1994). Other researchers in the Organizational Field have tested the TAM with various software programs (Samna, 1994) (Keil 1995) and found it to be a valid method for predicting the acceptance of technology. Their findings point to this: before an individual or an organization can accept or reject a new technology, they must become aware of its presence.

One of the most widely adopted theories on innovation—*the Diffusion of Innovations* by Dr. Everett M. Rogers–has been refined by hundreds of other researchers over a forty year span. Although Rogers was rural sociologist and communications scholar at Iowa State University, many of the scholars who have refined his work conduct research in Business Management and Information Systems. A more complete description of Roger's theory can be found on Page 18.

In the late 1990s and early 2000s, researchers have focused on other human factors that are critical to the decision to adopt GIS technology. Zorica Nedovic-Budic (1996) has developed a series of eight factors that are considered critical in determining individual decisions about adopting technology. These factors build upon the work of Rogers, including his ideas of relative advantage, complexity, compatibility and trialability, but extending them by incorporating the effects of interpersonal communications between co-workers. Budic (1994) conducted a case study of four departments within Cumberland County in North Carolina to determine if the results matched, or conflicted, with the eight factors mentioned by other researchers looking at acceptance of new technologies. The most critical factor regarding an individual's adoption of GIS technology was personal benefits. The users noted that personal satisfaction and professional prestige were important to them, but salary increases and advancement in position were the two most important personal benefits.

Budic (1994) noted that another important determinant of who would adopt GIS technology is communication. Successful users communicated more frequently among their co-workers, with their management, with technical experts supplied by the software vendor and with others who could provide assistance. Results were compiled by the researcher through in-person surveys before and after implementation of the GIS.

The third factor found to be predictive of GIS adoption was exposure to the technology, i.e., the ability to try the innovation before using it. This could take the form of a hands-on workshop, a live demonstration of the product or loaning of the software to a county for a specified amount of time. Many GIS vendors will allow a potential customer a fully functioning copy of the software for trial use (usually ninety days).

Based on the results of Budic (1994), the single most effective method for adoption of geospatial technologies is that the manager promotes department use of GIS and provides staff use incentives. The use of tangible benefits, salary, and position advancement upon completion of training are the most effective methods. Intangible benefits such as awards, title changes, and other forms of recognition are also important. Software training also encourages use among staff in addition to involving staff in the implementation process.

As I have noted, all three theorists (Budic, Davis, and Rogers) define the role of acceptance and diffusion in individual reactions to technological changes. The next section describes how technological change occurs within the organization and what organizational obstacles affect the adoption of GIS technologies.

Organizational Factors that Affect the Adoption of Geospatial Technology

Any new technology presents an organization with a host of new challenges. The implementation of a new (technology-based) information system can require wholesale changes in business processes and staff members to learn a different mix of skill sets (Somers 1994). New technologies can result in organizational conflicts over staff and resources, which can cause serious implementation problems. Fortunately, there is a substantial literature on successful technical change in organizations that are primarily found in business management journals and information technology publications (Ammons 1985).

An assessor's office is very similar to a small business in terms of its interaction with the public. In Louisiana, assessors are similar to small business owners in that they can hire or fire their own staff, use contractors when necessary, and make decisions on their own. Thus, the constraints placed on Louisiana assessors are more likely to be financial rather than organizational. This is an important point in determining why Louisiana assessors adopt geospatial technologies because they are able to run their offices quite independently and have to answer to voters only every four years. Additionally, because multi departmental GIS implementations can involve unclear lines of authority, mixed levels of support among management and turf battles can occur between departments. In those cases, organizational issues rather than technical ones often determine the outcome of the adoption of geospatial technologies.

Initial implementations of GIS technologies among local governments are generally in the form of mapping tools that support a simple geospatial inventory or allow for simple data queries. As government employees include more sophisticated GIS users, they learn to use the technology for a variety of management tasks including enterprise data sharing, modeling, routing, and complex analysis. For managers, barriers to effective GIS implementation may take two forms: institutional and organizational barriers and technical issues.

In this research, many of the organizational and institutional barriers that assessors face as they adopt and implement GIS technology will be summarized. In the previous sections, I have described some of the challenges of GIS implementation from a manager's point of view. Governmental managers often exercise considerable freedom in the selection and implementation of new technologies (Feller 1980). GIS implementation can provide significant service improvements, such as more equitable assessments and access of property information to the public through the Internet. However, service improvements can rarely be justified as an immediate cost reduction because it generally requires additional staff, equipment, and budget. However, in the long term there are significant cost efficiencies in using geospatial technologies. Some organizational issues that GIS presents are providing secured funding, maintaining a well-trained staff, educating the users, and changing business processes to take advantage of new analytic capabilities provided by the system. Harlan Onsrud and Jeffrey Pinto (1991) explain other factors that improve the organizational acceptance of GIS technology in local governments such as increasing the "relative advantage" for the intended users. If the innovation makes employees' jobs easier or quickly identifies errors that could be blamed on the users if not identified, then there is a greater possibility that the innovation will be accepted. There are a number of other studies that also point to a direct correlation between active management involvement and support and its relation to successful GIS implementation (Campbell and Masser 1991; Croswell 1991; French & Wiggins 1990). In addition, GIS managers must be aware of resistance to the implementation caused by failed geospatial implementation plans that have resulted in additional costs, dissatisfied customers, and technical difficulties.

Among other institutional issues that implementing GIS creates are economic, legal and intergovernmental relations that must be managed effectively. To provide high quality services, it is essential to build a long-term stable funding mechanism that can support or maintain GIS services over time. Maps, aerial photographs, and other digital data products can also present intellectual property issues that managers should be aware. Data sharing often requires intergovernmental agreements to protect both the public and the agency. Institutional issues will play a larger part in GIS implementation as citizens learn to expect more efficient services from local and state government, thus geospatial and other technologies will change the way government business is conducted (Dueker 1987; Chrisman 1987).

Existing Surveys on the Use of GIS by Government Agencies

Fortunately, there have been three national surveys carried out by professional organizations about the GIS capability of their members; the National Association of Counties (NACO) survey in 2004, the International City Management Association (ICMA) survey in 2003, and the Urban Regional Information Systems Association (URISA) survey in 1998. All have conducted national surveys of local government GIS use that will provide useful yardsticks to measure the rate of adoption of geospatial technologies among local government in Louisiana as well as nationwide.

In 2003, the International City Management Association (ICMA), in coordination with Public Technology Inc., surveyed city and county governments throughout the country to determine the current degree of GIS technology usage. In addition to GIS usage, ICMA was interested in knowing what barriers existed that prevented the use of geospatial technology, what geospatial applications were currently implemented, and what policy issues local governments face when sharing geospatial data. According to the results of the 1,100 city and county governments surveyed, the major obstacles to GIS implementation are the following: funding (64%), technical expertise (42%) and appropriate training opportunities for their staff (68%). The ICMA survey represented approximately 12% of the 9,000 city and county managers throughout the United States (2003).

In 2004, the National Association of Counties (NACO) in coordination with Public Technology Inc. (PTI) received responses from 714 counties/parishes (23%), out of a possible 3,068 throughout the nation, to determine the level of Internet and e-commerce usage among local governments. One of the questions in the survey was, "Which of the following transactions are currently and/or will be supported from your website?" Under the transaction entitled "Web mapping/GIS," 8% of the 714 survey respondents indicated that they have that capability now, 39% indicated that they will have that capability in the future. Counties were asked to identify what software applications they currently used. Approximately 56% of the counties currently used Mapping/GIS software for a variety of county functions. When the county governments were asked what major obstacles prevented implementation of computer technologies, the answers were similar to the ICMA Survey: 70% noted a lack of funding and 46%, a lack of trained staff (NACO 2004).

In 1997, the Urban and Regional Information Systems Association (URISA) in cooperation with American Forests surveyed URISA members in 200 cities and counties nationwide to understand the use of geographic information technology among local governments. This was the first nationwide survey of GIS capability at the local government level (URISA1997). The survey respondents noted that the leading obstacles to GIS implementation were funding (45%), staffing (33%), and institutional impediments (20%). The results were similar to the earlier studies by NACO and ICMA.

Beside the national surveys of GIS capability there have been four surveys taken of Louisiana assessors. The Louisiana Geographic Information Center (LAGIC) at

Louisiana State University conducted surveys of GIS usage among members of the Louisiana Assessors' Association in 2002 (67% response rate) and 2007 (95% response rate). In 2010, the Louisiana Assessors Association (LAA) hired a Baton Rouge consulting firm to conduct an online survey, the results of which (81% responded) were used in this research. A survey of Louisiana assessors in January 2013 was developed specifically for this study. A comparison of the speed with which GIS has been adopted is provided, derived from the results of these four surveys, that span a total of eleven years. The results of the 2007 LAGIC Survey of Louisiana Assessors appeared to confirm earlier findings from the three national polls of GIS capability that funding and staffing issues are the largest impediments to GIS adoption.

In summary, the conclusions drawn from the four surveys were remarkably similar even though they were not worded exactly the same. In addition, two earlier surveys (2002 and 2007) focused on GIS capability versus two later surveys (2010 and 2013) that focused on GIS adoption. Nevertheless, the resources required for adopting geospatial technologies are significant and financial resources are only part of that equation. As these studies, show, human resources are equally important.

Similarly, a number of early studies focused on the challenges of implementing information system technologies (Stevens & McGowan 1985; Lang 1990) have concluded the need for financial resources. Studies (French & Wiggins 1990; Croswell 1991) have also looked at the human resources question posed by adopting new technologies. Those studies have concluded that implementing a new information system requires a well-trained and motivated staff.

The 2013 LAA Survey and the three national surveys (ICMA, NACO and URISA) shared similar observations that GIS is more likely to be implemented in counties with larger jurisdictions. Rural areas were slower to implement geospatial technologies and took longer to fully implement. These findings were also noted in a 1990 survey of GIS usage among four southeastern states (Budic 1993). This finding may be a result of a lack of financial resources, an inability to attract and retain skilled staff, and/or issues related to communication. Rogers (1995) notes that the more socially isolated an individual, the less likely he/she will communicate with a wide variety of other professionals in a chosen field. Moreover, it is more likely that they will be late to adopt new technologies and will proceed slowly when they do adopt.

Gaps in the Literature

There exists a large amount of research on the barriers to individual acceptance of GIS technology (Ammons 1985) as well as the organizational challenges of providing geospatial services. Earlier studies have looked at management issues in GIS implementation (Budic 1994). In addition, there is the benefit of being able to review the numerous GIS capability surveys that have been conducted with local governments in Louisiana and throughout the country. However, none of the literature reviewed thus far focuses on what factors make it more likely that a parish will successfully adopt geospatial technologies.

Most of the literature on geospatial implementation studies local governments with an already functioning GIS system. Few studies specifically examine the obstacles to GIS implementation among assessors and the issues they face when merging GIS and CAMA data. This study focuses on both the revenue that is available to each assessment office and its financial constraints. In this study, financial obstacles that parishes with a small tax base face and limited ways of raising additional revenue are identified. Furthermore, this research looks at the number of technical staff and contractors that are being employed in Louisiana assessor offices and the mix of in-house to contract employees. Lastly, Louisiana assessors were asked what factors contributed to their successful implementations.

Chapter III: Research Design and Methods

This research benefited from data compiled from two early online surveys of Louisiana assessors conducted in 2002 and 2007 by the Louisiana Geographic Information Center. Those surveys set a baseline from which to measure how far and how quickly parish assessors have improved their implementing of GIS technologies over the last decade. This research focuses on the results of the 2010 Louisiana Assessors Association (LAA) Survey and the 2013 Survey of LAA members that were conducted to support this research effort. As both surveys are very recent, they are especially relevant to current issues raised in this study and the 2013 survey was designed to answer some questions raised by Everett Rogers (1995).

One of the primary uses of the data collected during the 2010 Surveys will be to determine how Louisiana assessors fund their offices. Some assessors are using alternate funding mechanisms to support their geospatial data efforts. The 2010 Survey asked assessors if they were part of a multi-agency GIS, and if so, what other parish entities were contributing financially to that effort. In addition to the possibility of multi-agency funding, the survey asked assessors if they charged for information posted to the internet or for data created by their CAMA system. Furthermore, the survey asked if any of the assessors had received grant funds for geospatial development. The 2010 Louisiana Assessors Association Survey was conducted by LEO Ltd., a Baton Rouge Consulting firm, for the Louisiana Assessor Association (LAA). Among the questions that parish assessors were asked in the 2010 Survey regarding their technical capabilities was:

Question #5: Do you have computerized maps?

Question #15: Do you use a Computer Aided Mass Appraisal System (CAMA)?

Question #19: Is your CAMA information merged with your map data for analysis?

The answers from these three survey questions provided useful indicators of the level geospatial technical capabilities of the fifty-two assessors who completed that survey in 2010.

The 2013 LAA Survey was designed to examine GIS and CAMA capability and to determine what additional steps were required to integrate the two systems. Staffing and contracting were also analyzed to consider whether assessment offices were sufficiently staffed to create the conditions for successful geospatial deployment. This survey also contains questions developed from Rogers' *Theory on the Diffusion of Innovation* such as:

Question #1: How did you first obtain information about GIS technology?

Question #2: When was GIS first implemented in your office?

Question #5: When was CAMA technology first implemented in your office?

Forty-six assessors, or 72% of all Louisiana assessors, responded to the 2013 survey. Forty-six of them completed surveys that represent a proportionate number of the metropolitan (72%), micropolitan (72%), and rural parishes (71%) surveyed.

Demographics

Like many other states, Louisiana has a mix of large cities, smaller cities and less populated rural areas. For demographic analysis, the U.S. Office Management and Budget (OMB) schema was used to divide the nation's counties and parishes into one of three categories: metropolitan (urbanized areas), micropolitan (smaller cities that act as regional hubs), and neither (rural) area. A more detailed description of the characteristics of each area can be found here: http://www.census.gov/population/metro . The OMB has labeled twenty-nine Louisiana Parishes as metropolitan (metro), eighteen as micropolitan (micro), and seventeen as neither. Twenty-two of the twenty-nine OMB designated metropolitan parishes are located in South Louisiana. The OMB defines a metropolitan area as one with a core urban area of 50,000 people. The eighteen micropolitan parishes are scattered throughout the state and all have at least one small city with a population of more than 10,000 persons but less than 50,000. These micropolitan areas act as regional hubs for retail trade, medical facilities, and in some cases support a university. An example of a micropolitan parish would be Tangipahoa Parish, with the City of Hammond providing a retail hub, regional medical center and home for Southeastern Louisiana University. There are seventeen parishes designated as neither, which I have re-labeled as "rural" for the purposes of this study. In Louisiana, the economy of these rural parishes has been traditionally based on agriculture or forest products and these parishes are concentrated in the northern part of the state. Agriculture is found throughout the state, but some of the highest value crops are found in the northeastern corner of the state in the fertile Mississippi Delta region. Commercial logging also occurs throughout the state; however, the largest holdings are in the northern half of the state. A list of the three types of parishes, as designated by OMB, and the names of the major cities and towns within them can be found in Table #1 Eighteen Metropolitan Parishes.

Using the OMB designations, Louisiana parishes can be categorized in the following manner: twenty-nine metropolitan (metro) parishes comprise 45% of the total number of parishes; eighteen micropolitan (micro) parishes comprise 28%, and seventeen rural parishes comprise 27%. This study employs the OMB classification scheme to ensure that a representative group of parishes is surveyed. The study consists of compiled surveys for forty six assessment offices of which twenty one (46% of those parishes surveyed) are from metro parishes, thirteen (28% of those parishes surveyed) from micro parishes, and the remaining twelve (26%) from rural parishes. A map (see p. 44) shows all of the parishes in Louisiana and their OMB designation.

The economies of the metro, micro and rural parishes are measurably different from each other. According to the 2010 US Census, the twenty-nine metropolitan parishes, which constitute 75% of all Louisiana households, have significantly higher median household incomes ($46,767 average) , and a lower percentage of households in poverty (16.5 % average) than micropolitan or rural areas in the state. As these parishes represent 75% of the total number of state households, the total number of people in poverty living in metro parishes is higher, even if the percentage is lower. The eighteen micropolitan parishes, which comprise 18.4% of the state population, have an average median income of $37,692 and a poverty rate of 21.9%. The

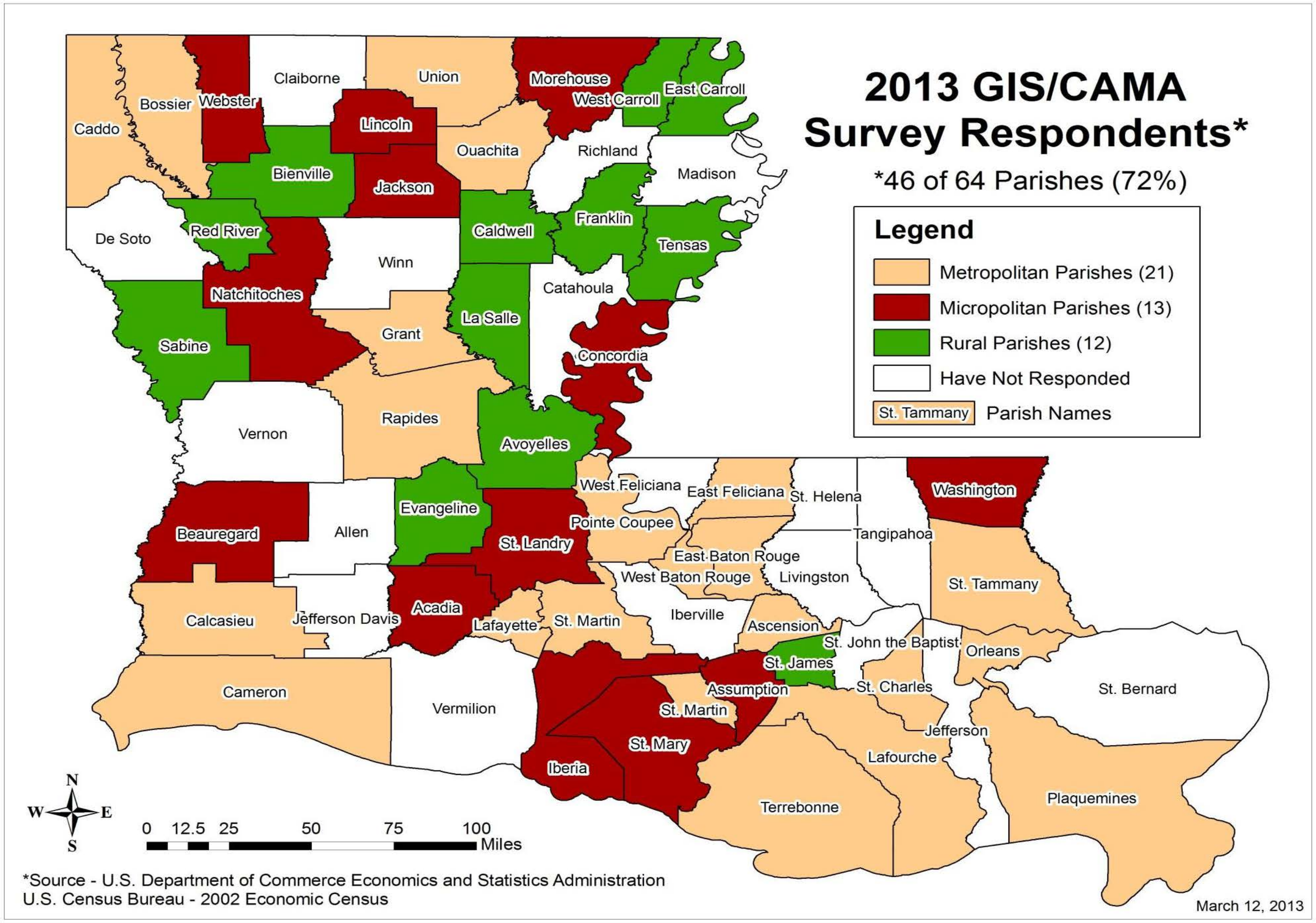


Figure 5

Figure 5: 2013 GIS/CAMA Survey Respondents

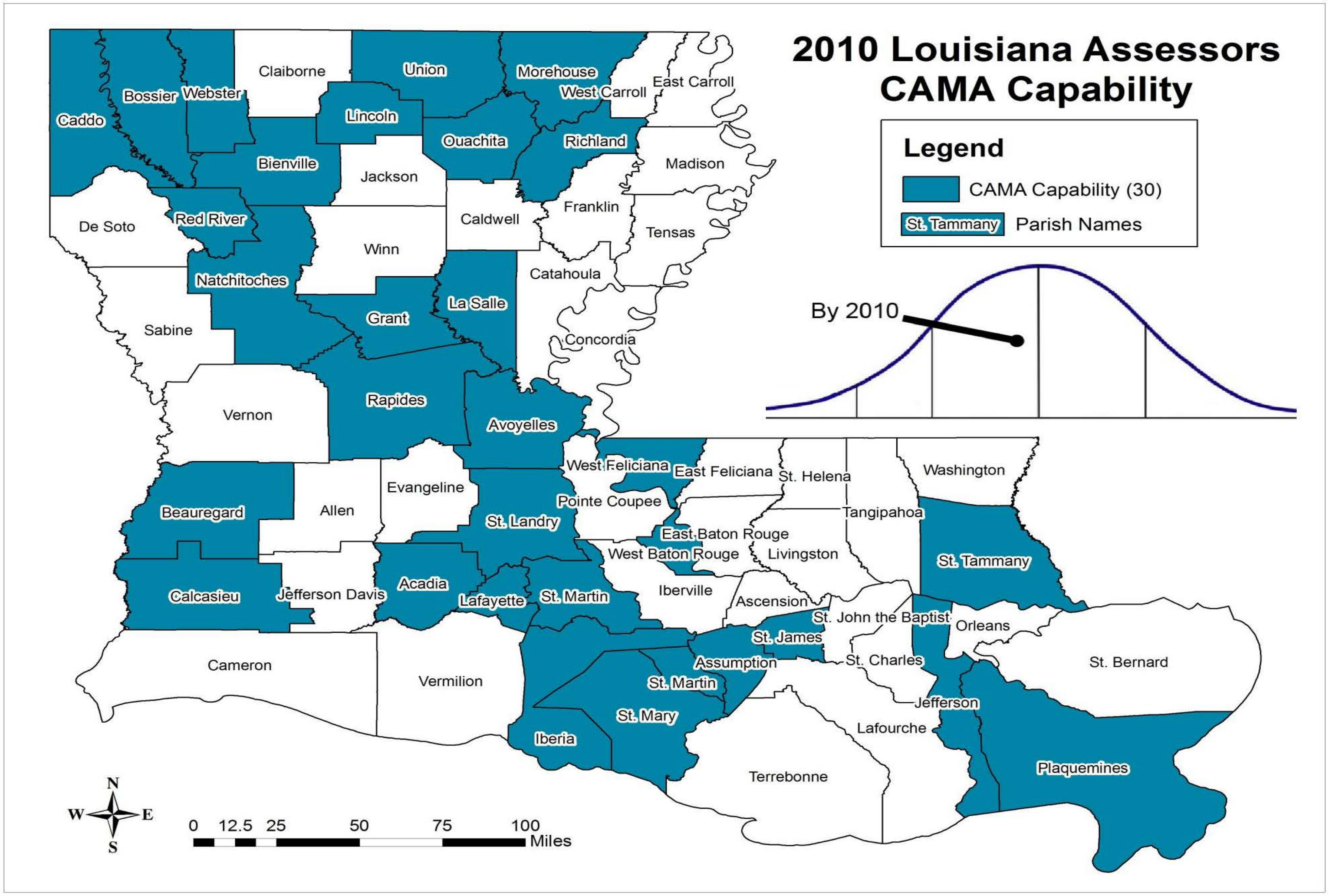


Figure 12

Figure 12: 2010 Louisiana Assessors CAMA Capability

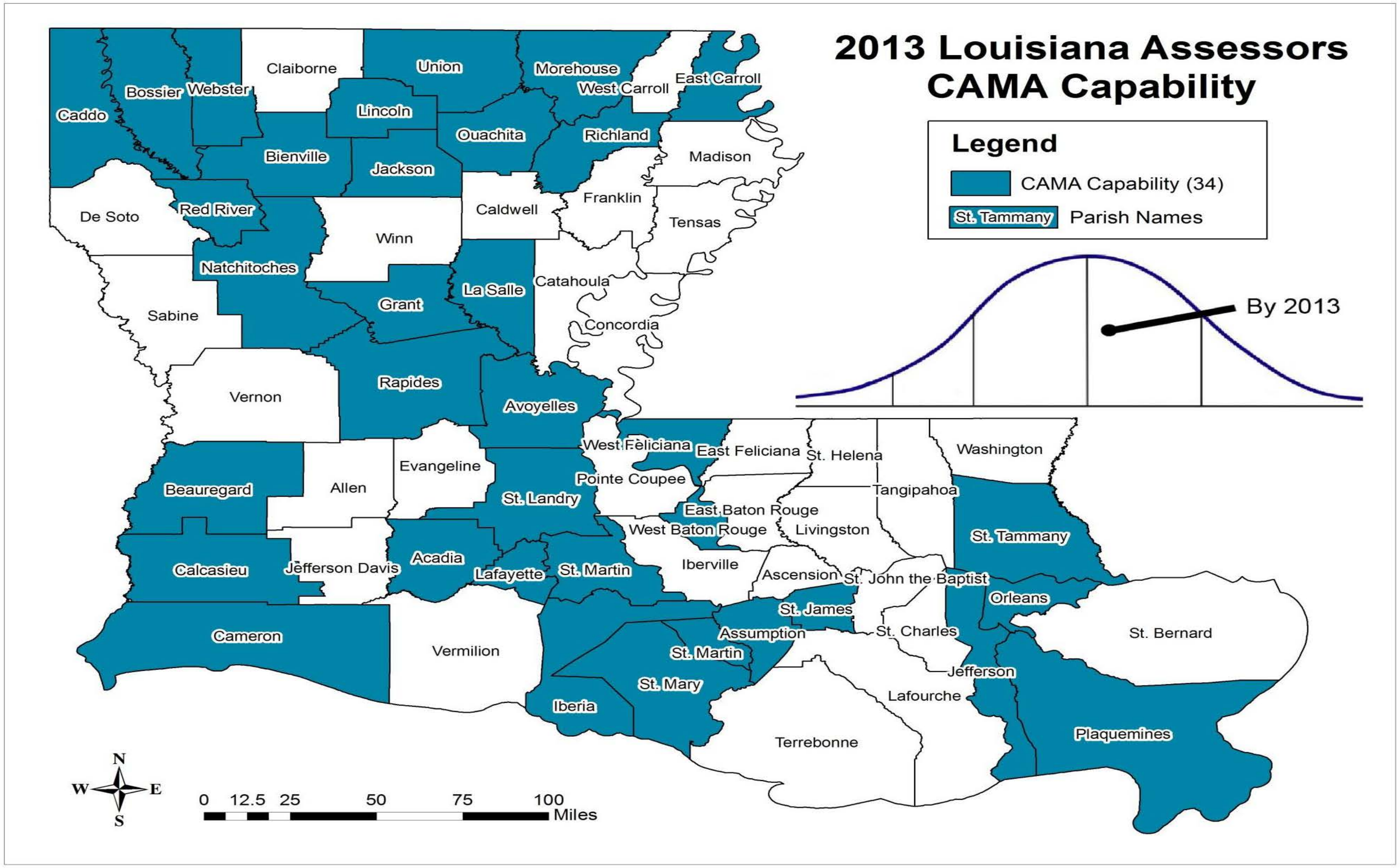


Figure 13

Figure 13: 2013 Louisiana Assessors CAMA Capability

seventeen rural parishes that constitute the remaining 6.6% of Louisiana households have an average median income of $34,703 and a poverty rate of 23.6%. A chart showing the population, median income and poverty rates for all Louisiana parishes can be found in Table 2 in the Appendices.

Metropolitan Areas

According to the OMB and the US Census, Louisiana has eight metropolitan areas (MA's), composed of one or more parishes, which act as the economic, cultural and transportation hubs of their regions. These regions are:

1) *Alexandria* (includes the parishes of Grant and Rapides)
2) *Baton Rouge – Pierre Part* (includes the parishes of Ascension, Assumption, East Baton Rouge, East Feliciana, Iberville, Livingston, Pointe Coupee, St. Helena and West Feliciana).
3) *Lake Charles – Jennings* (includes the parishes of Calcasieu, Cameron and Jefferson Davis).
4) *New Orleans – Metairie – Bogalusa* (includes the parishes of Jefferson, Orleans, Plaquemines, St. Bernard, St. Charles, St. John, St. Tammany and Washington).
5) *Shreveport – Bossier City - Minden* (includes the parishes of Caddo, Bossier, Desoto and Webster).
6) *Houma – Bayou Cane – Thibodeaux* (includes the parishes of Lafourche, St. James, St. Mary and Terrebonne).

7) *Lafayette – Acadiana* (includes the parishes of Acadia, Evangeline, Iberia, Lafayette, St. Landry, St. Mary, St. Martin and Vermilion.

8) *Monroe – Bastrop* (includes the parishes of Morehouse, Ouachita and Union).

Louisiana's eight metropolitan areas includes all the parishes OMB defines as metropolitan and some parishes that the OMB defines as micropolitan and rural. This is due to the expansion of metropolitan areas into neighboring micropolitan parishes. The OMB coding scheme of metro, micro and rural parishes does have some drawbacks. For example, parishes included in these Metropolitan Statistical Areas (MSAs) such as Cameron, Grant and Union are generally considered rural; however, many workers commute between these rural parishes and the metro areas of Lake Charles, Alexandria and Monroe respectively, and therefore are classified by the OMB as metro parishes.

Despite these limitations, the ability to classify parishes as being metro, micro or rural assists in comparing assessor practices in urban versus rural areas. The geographies used to describe previous U.S. Census boundaries such as Urbanized Areas (UAs) did not necessarily follow parish boundaries. As Louisiana assessors represent individual parishes, UAs were not the most efficient tool to use for those comparisons. The use of the newer OMB categorization of counties/parishes as metro, micro or neither (rural) provide better "apples to apples" comparisons between the parishes.

OMB Designated Metropolitan Parishes

The OMB defines a metropolitan parish/county as containing a core urbanized area of at least 50,000 people. Surrounding parishes that are linked to the metropolitan center by their commute to work are also classified as metropolitan. Using these criteria, twenty-nine parishes in Louisiana can be classified as metropolitan. The survey focused on assessors from twenty-one metropolitan parishes (72% of the forty-six parishes that responded) to determine how they differed from their micropolitan or rural neighbors. The differences are documented in Chapter IV.

The OMB defines a Micropolitan (Micro) area as one with an urban core of at least 10,000 people but less than 50,000. Most of the parishes classified as Micropolitan by the OMB, are regional centers with one small to medium size city. Examples of micropolitan parishes are Lincoln, Natchitoches and St. Mary. They each have a city with a population between 10,000 and 50,000 that are regional centers of distribution and retail activity. Ruston (Lincoln Parish) and Natchitoches (Natchitoches Parish) both are home to state universities (Louisiana Tech and Northwestern) and both act as commercial hubs for their area. Morgan City in St. Mary Parish acts as a regional hub for offshore oil and gas activities in South Central Louisiana.

Micropolitan Parish	Regional Hub (city) within the parish
Acadia	Crowley
Assumption	Napoleonville
Beauregard	Deridder

Iberia	New Iberia
Jackson	Jonesboro
Jefferson Davis	Jennings
Lincoln	Ruston
Madison	Tallulah
Morehouse	Bastrop
Natchitoches	Natchitoches
St. Landry	Opelousas
St. Mary	Morgan City
Tangipahoa	Hammond
Vermillion	Abbeville
Vernon	Leesville
Washington	Bogalusa
Webster	Minden

Table #1 - Eighteen Louisiana Micropolitan areas and Cities serving as regional hubs.

Rural Parishes

The OMB's categorization schema classifies counties/parishes without a city of at least 10,000 people as "neither," metropolitan, or micropolitan. The rules guiding federal grants for solid waste disposal projects for rural communities specify that those grants can be made to "municipalities with a population of five thousand or less, or counties with a population of ten thousand or less, or less than twenty persons per square mile and not within a metropolitan area" (42U.S.C. Ch. 82 Sec. IV § 6949). All of the Louisiana parishes listed as "neither" by the OMB meet at least one of these criteria. Therefore, those parishes not classified as metro or micro will be classified as rural for the purposes of this research.

Core Based Statistical Areas

In addition to the Office of Management and Budget (OMB) categorizing of the U.S. population into *metropolitan*, *micropolitan* and *rural* areas, it also divides the country into Core Based Statistical Areas. According to the latest OMB Circular, Louisiana has seven Core Based Statistical Areas. Under the Core Based Statistical Area (CBSA) schema, the metropolitan, micropolitan and rural parishes are grouped into Combined Statistical Areas. Rapides and Grant parishes form a metropolitan area but not a Combined Statistical Area. The same is true for Terrebonne and Lafourche Parishes. The Parishes of Beauregard and Vernon combined form a CBSA entitled Fort Polk South-De Rider. A map showing the Core Based Statistical Areas can be found in on page 16, Figure 4.

While preparing the online survey, one goal was to have a roughly equal number of parishes from north and south Louisiana participate to account for the cultural and demographic differences between the two parts of the state. Louisiana has sixty-four parishes and each has their own assessor. Figure 5, on page 61, is a map showing the forty-six parishes that participated in the survey.

The online survey was pretested on six assessors with three from north Louisiana and three from the south. The pretest involved in-person interviews with all assessors. Case surveys were originally selected as the best method of teasing out the data from a random selection of assessors. Those assessors who were proudest of their work and farthest ahead in the adoption of GIS and CAMA data were quite willing to volunteer. Unfortunately, none of the assessors struggling to adopt GIS or CAMA were willing to be interviewed. This made it difficult to collect a full spectrum of answers. At this point, a case study approach was abandoned and replaced by requested permission from the Louisiana Assessors Association to send an online survey to all sixty-four Louisiana assessors. Based on past surveys, it seemed feasible that a representative sample from metro, micro and rural parishes could be collected that reflected the views of most assessors. The survey was stopped after collecting forty-six responses out of a possible sixty-four parishes, or 72% of the total number of assessors. A representative sample of the population of assessors, after 72% of the metro parishes, 72% of micro parishes, and 71% of rural parishes completed the survey, was maintained.

Data Collection

According to *Case Study Research, Design and Methods* (Yin 2003), the following steps should be followed prior to survey deployment: prepare for data collection: intensive training sessions for interviewers, the development of investigation protocol, a screening of the nominees and the conducting of a pilot study.

Yin's recommendation for extensive training can best be summarized as "know your subject matter." It is especially difficult to develop meaningful questions about a subject without being intimately familiar. Developing a protocol for the investigation is essential, particularly when interviewing representatives from multiple different assessors' offices. The same set of sixteen questions will be collected from each of the candidates to ensure the reliability and consistency of the survey method. The University of New Orleans (UNO) Institutional Review Board (IRB) regulations have been followed and an IRB form is on file.

Using the results of the LAA 2010 Assessor GIS Capability Survey, only pre-surveyed assessor candidates qualify to serve as test surveys. The pre-survey allowed for sorting the candidates by current GIS technical capacity. Parishes are divided into those with a functional GIS, those with a functional CAMA system, and those with both of these systems in operation.

The pre-surveys will involve a protocol for investigation that includes a set of procedures to follow during the focused interviews and a list of questions that will serve as a starting point for the interviewer. A copy of the survey can be found in Table 5.

Field visits to the case study site will provide an opportunity for direct observations of the parish work environment and technical capabilities. Furthermore, journal articles and trade magazines offer additional sources of information of value to the research effort. When doing a study such as this, investigators should be aware of the great variety of different data sources regarding geospatial data creation. As this field of study is relatively recent, journal articles may be the most relevant source. In general, journal articles about technical issues will appear long before a book about the same subject is released.

Documentation of the observations and documentation of the survey results is essential. Notes should be compiled at the completion of each interview to make it easier to remember the various stages of the survey and preserve any random observations.

In *Qualitative Data Analysis: an Expanded Sourcebook*, Matthew B. Miles and A. Michael Huberman (1994) provide advice on analyzing data collected while carrying out surveys. The authors suggest that visual displays in various arrays allow the researcher to look at the data in a variety of different ways. Additionally, a matrix of categories should be created in order to visualize where the majority of the data falls in relation to other relevant data sets. Finally, flowcharts can also be a valuable tool to identify various stages in the process (Miles & Huberman 1994).

As a general analytic strategy, surveys of parish assessors with these earlier national survey results that used a much larger pool of interviewees will be compared. Although no two cases are exactly alike, there are many similarities among parishes that should allow for some generalization to other parishes with similar resources, governance structures, and success or failure rates in implementing geospatial technologies. However, it will be essential to test the conclusions drawn from generalizing the data to other parishes by checking for validity. Validity will be assured by collecting a large representative sample of the population and providing a discussion on what evidence was considered, or excluded, and that all rival interpretations have been evaluated. Furthermore, the survey questions should specifically address the questions posed in the hypothesis.

The reporting phase brings to a close the research that has been conducted to date. The compositional phase is an opportunity to lace together all the disparate pieces of data that were created during the investigation and make the final argument about the relevance of the work completed. The survey report can generally be understood by non-experts and is an ideal document for reaching policy makers and potential funding sources. As my research involves surveying parishes online, I devote a chapter illustrating each example and generalize from these examples to similar models throughout the state. The Survey Report is very similar to a Business Case report in that it describes all the possible issues, provide analysis, and makes recommendations.

Data Analysis

In addition to the limitations of using online surveys, limitations also exist for using the data for statistical analysis purposes. In this case, as the sample of assessors surveyed is 72% of the entire population of Louisiana assessors, descriptive statistics will suffice. The final chapter will cover the policy questions that the research reveals. Policy recommendations based on the research will be used to define and recommend potential State implementation support including funding strategies. The survey results will be used to describe the factors that contribute to success in some parishes and the survey data will be used to show how prevalent those particular factors are among Louisiana assessors as a whole. The survey research provides a more exhaustive analysis on the obstacles to GIS implementation faced by Louisiana assessors. Using Rogers' Diffusion of Innovation methodology, I have documented the limited resources, lack of communication and the slow innovation decision processes discovered through the survey process.

The Significance and the Limitations of this Research

Significance of the Proposed Study

Many of the data sets that are most critical in an emergency situation such as parcel data, local roads, addresses, and utility infrastructure are the responsibility of local governments. In the case of a hurricane, for example, local government operations often go offline as the storm moves onshore because parish governments do not have GIS technology or critical geospatial data sets needed to respond to disasters such as this. However, those local governments that have critical digital data are not in a position to share critical information and are often without electrical power or telecommunication links. According to a survey conducted by the Louisiana Geographic Information Center (LAGIC 2007), approximately one third of all Louisiana parishes have a functioning GIS and another third are in the planning and development phase. That leaves one third of the parishes with none or limited digital mapping capacity. Unfortunately, many of these parishes are in the Louisiana coastal zone.

Those parishes with GIS capability are able to respond more quickly, in part because they can provide state and federal agencies with accurate damage assessments, provide out of state repair crews with detailed infrastructure maps, and concentrate their limited resources on the areas needing the most assistance. The goal of this research is to determine the impediments to the development of geospatial technology among parish assessors in the state of Louisiana.

State policy makers will benefit from better geospatial data in the following three ways: first, by acquiring a geospatial data inventory that identifies data gaps in critical data coverage, and secondly, implementing the coverage and accuracy of local geospatial data sets that ensures that federal and state emergency response agencies have the best available data in responding to an emergency. This includes better damage estimates, improved response time, and better use of state and federal resources. Lastly, much of the infrastructure repair work that is completed immediately after the disaster is provided by out of state companies with little or no knowledge of the area or the infrastructure that they were/are repairing. Implementing GIS can provide a "common operating picture" to ensure critical and coordinated disaster response.

Limitations of the Online Survey

John Creswell describes the difference between delimitation and a limitation in a dissertation proposal. As he notes, "delimitation narrows the scope of the study such as only evaluating Louisiana assessors, not parish planners, or parish GIS managers (Creswell, 2003)." The obstacles faced by planners, or GIS managers, are different then the obstacles faced by assessors and their staff. The advantage of narrowing the research focus includes the ability to ask assessor-centric questions of the survey participants. In addition, the focused nature of the survey should result in a better understanding of the challenges faced by the subject of the research. Whether or not other local government agencies in Louisiana face the same obstacles is an opportunity for further research. Ultimately, the goal of this research is to have a better understanding of the impediments to geospatial technology adoption among assessors.

Creswell defines limitations as potential weaknesses of the study including the use results of online survey definitions and respondents to categorize parish assessors by their ability to develop digital parcel data. These surveys were conducted over the Internet, without the aid of a professional interviewer; therefore the questions had to be pre-tested to make sure that they would not be confusing or misleading. In this regard, the survey accuracy was entirely dependent on the truthfulness and candidness of each assessor and whether the assessor delegated out the job of responding to the survey. There was no easy way to obtain clarification of their responses as would be possible in a face-to-face interview.

Coverage error in a survey occurs when potential respondents are excluded from the sample (Creswell 2003). This research samples a large enough set of assessors that intend to ensure assessors represent metropolitan, small cities and rural areas in proportion to their numbers in the state. The surveys should be directed to as wide a variety of assessors as possible given the sample size.

Non-response error occurs when assessors or their staff members choose not to participate in the survey. These errors can occur in two ways: failure to answer questions within the survey or failure to respond at all. One reasonable method for dealing with partial survey responses is to calculate the mean answer for the missing question and substitute the mean for the missing answer (Creswell 2003). This can only be used when the overwhelming majority of the surveys contain completed answers for every question. *Interpretation errors* occur when the wording of a survey question is unclear or ambiguous. These surveys will be pre-tested with three or four practicing assessors prior to distribution. This is generally the result of poor survey design (Fink 2003A). The final type of survey error is *sampling error*. This survey will avoid sampling error by surveying a large percentage of Louisiana assessors rather than a sample, or subset. Surveys should be reviewed by a variety of potential participants.

One additional survey problem that has arisen in past surveys of Louisiana Assessors (LAGIC 2007) was a misunderstanding of what constitutes a Geographic Information System. As online surveys are self-reporting, there is the possibility of misinterpretation of the terms used in the survey (Fink 2003B). For example, in an earlier survey, assessors were asked to classify the status of their GIS according to four categories: completed, under construction, in the planning stage or not considering. A number of Louisiana assessors classified their GIS status as completed, when in fact they were using a Computer Aided Design (CAD) program to store their geospatial data rather than a fully functioning GIS. CAD programs do not generally link to data bases nor do they incorporate topology into their data sets. A CAD drawing is better than a hard copy drawing but it does not allow the user to perform spatial queries on the dataset nor does it allow changes in the database to be immediately reflected in the graphics. These misinterpretations were caused by poor survey design which did not adequately define GIS status but were left to the survey respondents to guess which category best described their digital data sets (Ritter 2007). In the most recent survey a glossary of geospatial terminology was distributed to the interviewees before the interview.

Another potential issue posed by enacting online surveys is their validity. It is essential that the questions asked in the survey account for questions posed in the research problem. Questions that are too lengthy, ask two questions at the same time, or are poorly written tend to frustrate survey participants and can result in a poor response rate (Fink 2003B). These are just a few examples that address some of the problems inherent in validating the results of these surveys and how to avoid those problems in this type of research.

Although all sixty-four Louisiana assessors received the online survey, only forty-six assessors fully completed the survey. Forty-six respondents out of a possible sixty-four equal a 72% response rate. Past surveys of Louisiana assessors in 2007 and 2009 resulted in a similar numbers of respondents. The researchers believed that they had collected results from all of the assessors most likely to respond. Fortunately, the mix of metro, micro and rural parishes who responded to the survey exactly mirrored the percentage of metro, micro and rural parishes in the state, and so we have a representative sample.

The original research plan called for in-person case study surveys with three metro, three micro and three rural parishes. The first six parishes that agreed to be surveyed were parishes with fully functioning GIS and CAMA systems that had been successful in merging their GIS and CAMA databases. Regrettably, the next six parishes turned down a request for an interview. The parishes that refused to be interviewed were selected specifically because they had not made much progress in their GIS programs. The research intended to learn as much from a project failure as a project success. The online surveys were more successful at collecting responses from those parish assessors who had not had much success in their GIS or CAMA development.

Data that corroborated our chronology regarding when Louisiana assessors first began implementation of geospatial technology was found. This data could be dated to the early 1990s, in the case of GIS implementation, and a timeline was developed. Unfortunately, because assessors were asked about their CAMA projects from 2010, a similar twenty year timeline could not be constructed to measure progress.

Chapter IV: Survey Results

Introduction

Mirroring the state's population, Louisiana parishes and their parish tax assessors are a very diverse group. The online surveys used to gauge those differences can be crude instruments. However, the 2013 Survey of Louisiana Assessors benefitted from the three previous online surveys of Louisiana assessors. Forty-six, out of a total of sixty-four assessors, provided answers to sixteen questions regarding their use of GIS and CAMA and the ability to integrate these two information systems. In addition, they provided information on their staffing levels and the number and types of consultants they use to keep these information systems running. This chapter will examine the different responses to the survey questions provided by metro, micro and rural areas as well as a summary of the responses. The survey focuses on the obstacles inhibiting greater use of geospatial tools and the progress that has been made in the last three years.

Demographics

Louisiana has a mix of large cities, smaller cities and large sparsely populated rural areas. For demographic analysis, this study relies upon the U.S. Office Management and Budget (OMB) schema which divides the nation into one of three groups; metropolitan (urbanized areas), micropolitan (regional hubs) and neither (rural) area. A more detailed description of the characteristics of each area can be found in the methodology section. The OMB has labeled twenty-nine Louisiana Parishes as metropolitan (metro), eighteen as micropolitan, and seventeen as neither. A list of the three types of parishes, as designated by OMB, and the names of the major cities and towns within them, can also be found in the Methodology Chapter.

The OMB coding scheme of metro, micro and rural parishes, has some limitations in that parishes such as Cameron, Grant and Union are categorized as metropolitan although they are primarily rural; however, many workers commute between these rural parishes and the metro areas of Lake Charles, Alexandria and Monroe respectively. Therefore these parishes are classified by the OMB as metro parishes in the OMB 2010 Standards for Delineating Metropolitan and Micropolitan Statistical areas. Despite these limitations, the ability to classify parishes as either, metro, micro or rural assists in comparing assessor practices in metropolitan parishes versus rural parishes. It also allows us to look at the various outcomes of different practices employed by assessor's offices in similar size metro, micro and rural areas.

Metropolitan Parishes

The OMB's main criteria for classifying a parish as a metro parish, is that it contains a core area at least 50,000 people. Using that criteria, twenty-nine parishes in Louisiana are classified as metropolitan. The survey focused on assessors from twenty-one metropolitan parishes (72% of the total number of metro assessors) to determine how they differed from micropolitan or rural areas. The following key differences stood out:

1) Assessors from Metro Parishes have significantly larger staffs. Nine of the parishes located in metropolitan areas such as Ascension, Caddo, Calcasieu,

Bossier, East Baton Rouge, Lafayette, Orleans, Ouachita, St. Tammany have staffs of seventeen or larger. The average number of staff in a Louisiana Micropolitan Parish is between five and twelve.

2) Assessors from metro parishes are on average more likely to have implemented GIS or CAMA Technology earlier than more rural parishes, often by as much as five years. Assessor were asked when they first initiated GIS technology, and a separate question asked when they initiated CAMA technology in their office

3) Assessors from metro parishes are on average more likely to use a larger variety of consultants. The consultants employed range from web design and programming to GIS, IT support, and CAMA development.

4) Assessors from metro parishes tend to have significantly larger budgets than do their micros or rural assessors. The larger budget is directly correlated with larger tax collections, homes with higher values, and a greater number of commercial and industrial sites than their micropolitan and rural parish neighbors. The larger budget is necessary given the larger population, heavier workload, larger staff size, and the use of consultants.

5) One major benefit that metro parishes have over their micro and rural counterparts is their ability to hire staff that specialize in particular technical skills such as GIS, CAMA, Ratio Studies and other specializations not feasible in smaller assessment offices. The International Association of Assessing Officers recommends that 60% of an assessor's staff should be appraisers along with

skilled technical experts who work on the various GIS and CAMA systems as well as perform ratio studies (IAAO). The metropolitan parishes are more likely to employ these technically skilled individuals.

6) One additional advantage that metro parish assessors have that less populated Louisiana parishes do not is higher home prices. The median price of a home in a Louisiana metro area is higher than either a micro or rural areas of the state (Table 3). Therefore, a much smaller number of homes are eligible for a 100% homestead exception. As a metropolitan parish, St. Tammany Parish contains only 12% of homes that are 100% homestead exempt; therefore, it collects more real estate tax revenues per property then does rural Bienville Parish where 87% of the residents are 100% exempt.

7) Metropolitan areas also benefit by having a more diversified economy than rural areas. They are more likely to have large industrial sites, warehousing, and a larger retail presence, all of which results in greater tax revenues.

    a. Metropolitan assessors have many potential advantages over their smaller, less well funded, counterparts in Louisiana's micro and rural parishes. A map showing the location of the twenty-one metro parishes, thirteen metro parishes and twelve rural parishes that provided surveys for this study can be found on page 61.

Micropolitan Parishes

A micropolitan (micro) area contains an urban core of at least 10,000 (but less than 50,000) population. Most of the parishes that are classified as micropolitan by the OMB are regional centers with at least one small to medium size city. Examples of micropolitan parishes are Lincoln, Natchitoches, and St. Mary. They each have a city of between 10,000 and 50,000 population and are regional centers of retail activity. Lincoln and Natchitoches are both home to state universities; Morgan City in St. Mary Parish is a regional hub for offshore oil and gas activities. A map showing the location of the thirteen micro parishes that provided surveys for this study can be found in the Appendices.

The survey data shows significant differences between metro, micro, and rural parishes detailed in the survey data analysis. In general, micro parishes fall in between metro and rural in that they have smaller staffs than metro assessors but are larger than their rural neighbors. They hire more consultants than their rural counterparts, but do not have quite as many as their metro cohorts. In general, micro parishes have less financial resources than neighboring metro assessors but more resources than the rural assessors next door. Where they differ from their surrounding rural and metropolitan parishes is in their willingness to try innovations like GIS and CAMA technologies. The survey data show that micropolitan parishes are as likely as metro parishes to employ innovative technologies for assessors. When asked which parishes provided technical assistance to their office, Louisiana assessors were as likely to name a micropolitan assessor as a metropolitan one.

Rural Parishes

Not surprisingly, the results of the GIS CAMA survey show that rural parishes have the least amount of resources and consequently the most constraints on adopting GIS and CAMA technologies. They understand the benefits of technical advances to the assessment process but lack the resources to invest in these technologies. One of the reasons rural assessors have less financial resources is that their parishes have a much smaller tax base. Financial issues are exacerbated by less commercial and industrial taxpayers, a high percentage of homes that receive a 100% exemption from property taxes, and a smaller number of taxpayers. Consequently, these parishes provide less in the way of public services and their assessors must ask taxpayers through ballot initiatives for any additional funding they require. Unfortunately, neither the federal government nor the state provide much in the way of support to local assessors so rural assessors have to be much more creative in locating funding. The salary of a parish assessor is paid by the state but all other employees and office expenses are paid by a yearly assessment, or they are paid by grants and/or mutual agreements with other parish entities. The survey showed that only St. James Parish, classified by the OMB as rural, has an enterprise wide GIS system that is used by the parish, the assessor, and five other parish entities.

Online Survey Results

2013 Louisiana Assessor Survey

Section 1. (Questions 1-4) the Decision to Adopt GIS Technology

This section was designed to learn how Louisiana assessors are first introduced to GIS technology and how those experiences lead them to adopt, or not adopt, geospatial technologies. Additionally, the assessors were asked when they implemented GIS in their offices and whether it was earlier or later than their peers. They were also asked if any other assessors provided advice or served as role models

Rogers (1995) notes that, very few individuals make decisions about adopting a new technology from what they learned from reading a book or taking a workshop. Rather, most learn from talking to their peers. According to the survey results, this is true for Louisiana assessors as well.

1) 52% of the metro parishes, 50% of the micro parishes and 58% of the rural parishes first heard about GIS from another assessor.

When assessors were asked when they first implemented GIS, they were given a series of choices: greater than 10 years, between 5 -10, 2-5, less than 2 and not using GIS yet. From a research point of view, the most interesting responses were the more extreme ones from assessors who had a GIS for ten years or more and the ones that have not instituted GIS at all.

2) Overall, 38% of assessors have had a GIS for 10 years or more, 23% from between 5 -10 years. 23% had a GIS for between 5 -1 year, and 17% had not instituted GIS at all. Metro and micro parishes had a larger number of assessors with five or more years of experience in GIS (69%) than did the rural assessors (42%). Rural parishes had a higher percentage of assessors who have not instituted GIS yet (25%) versus 15% for both metro and micro parishes.

   Assessors were then asked whether they perceived themselves as adopting GIS earlier or later than their peers. Their answers ranged from "one of the earliest adopters" to "definitely later than others."

3) Only one assessor from a rural parish said that they were "one of the earliest adopters" (St. James Parish). Three metro (Bossier, Lafayette, Union) parishes and three micro (Lincoln, Natchitoches, St. Mary) parishes stated that they were among the earliest adopters. No rural parishes stated that their assessors were definitely earlier than others, but five metro parishes (Ascension, Caddo, Ouachita, St. Martin, W. Baton Rouge) and four micro parishes (Iberia, Jackson, Morehouse, St. Landry) did. On the other hand, four rural parishes reported that they were definitely later in having a functional GIS (Evangeline, Franklin, Sabine, W. Carroll) as well as two micro parishes (Acadia, Concordia) and four metro parishes (Cameron, Lafourche, St. Charles, St. Tammany).

4) When all the parishes were asked if there were any assessors that provided assistance to them when they were starting up their GIS, the following parishes

were mentioned as being helpful: Acadia, Calcasieu, Lincoln, Morehouse, Ouachita, St. Mary, W. Baton Rouge and W. Feliciana. Almost all of these parishes were early adopters of GIS and some , Lincoln and St. Mary, were the earliest in the state.

Section 2. (Questions 5-8) the Decision to Adopt CAMA Technology

This section was designed to better understand when CAMA Technology was first implemented and how assessors first obtained information about CAMA. In addition the questions asked assessors what they would look for in a CAMA system. The assessors were also asked if they used ratio studies and if so what GIS applications were most important to them.

1) Out of the twelve rural assessors surveyed, six had been using it for five years or more. The other six had not implemented it yet. Of the thirteen micro parishes surveyed, nine had been using it for five years or more and two had not implemented it yet. Of the twenty-one metro parishes surveyed nine had been using it for five or more years and seven had not implemented it yet

2) Overall 44% of the forty-six parishes surveyed first obtained information about their CAMA from a vendor or consultant, 22% first received CAMA information from IAAO, 20% from other assessors and 15% from LAA. Rural and micro parishes were more likely to get their first information from a vendor/consultant or other assessor, whereas metro parishes were more likely to get their first information from IAAO.

In Question #7, assessors were asked what they looked for in a CAMA system. They ranked their choices from 1-4 with 1 being the most important factor and 4 the least.

3) There was very little difference between the rural, micro and metro parishes on this question. The most important criteria for a CAMA system was that they were obtaining a CAMA system that worked with their GIS, followed closely by their interest in being able to customize the CAMA system for their own needs. Purchase price and operating costs were third and ease of use came in last.

In Question 8, assessors were asked about their use of Ratio Studies and whether they used them for improving the accuracy of their appraisals, for when they reassessed, and for improving uniformity within a group of properties or between groups of properties.

4) There was very little difference between the rural, micro and metro parishes on this question. Use for re-assessing properties and improving the accuracy of appraisals were tied for the most important use of ratio studies. Fourteen parishes of the forty-six parishes reported that they have not implemented ratio studies yet. Eight parishes used ratio studies to improve uniformity within a group of parishes. Six parishes used ratio studies to improve uniformity between groups of properties. The twelve rural parishes had the highest percentage (42%) of assessors not using ratio studies.

Section 3. (Questions 9-12) Integrating GIS and CAMA Technology

These four questions were designed to determine the greatest challenges to integrating the two technologies; GIS and CAMA.

1) The first section of Question 9asked, A) do you have a functioning GIS? and B) do you have a functioning CAMA System? Integrating the two systems requires that both systems be operational. Of the forty-six parishes responding to the survey, thirteen did not have a functional GIS and sixteen did not have a functional CAMA system. Eleven of the respondents have both systems operating but they are not integrated and would like advice on how to do that. They understood the benefits of integrating the two systems but each of their systems was bought separately from different vendors. The two assessors who had bought their GIS and CAMA systems from the same vendor or the five assessors who were able to get both vendors to develop a path for integration of the two systems were satisfied with their systems. Ten parishes were using the systems separately, and although they understood the benefits of integrating both of them, they were fine with this arrangement for the immediate future. Overall, 24% of the responding parishes had no GIS, 36% had no CAMA system, 27% wanted to integrate their systems, and 22% were running the systems separately for the immediate future.

2) Question 10 asked survey participants what their greatest challenges have been in integrating GIS and CAMA. Data gathering ranked first in the concerns

of survey participants. CAMA systems can be used most effectively for analysis when the data collected for each residence and property are complete, current and maintained over time. In 2010, Caddo Parish hired twelve summer students and seven part-time workers to collect and input data for their CAMA system. Another challenge has been integrating GIS and CAMA systems from different vendors. There is a need for technically skilled professionals to complete the integration of the two data systems. Lastly, there is a need for training in how best to use the two systems for data analysis.

3) Survey participants were asked if they were currently using GIS and CAMA systems to assist with any of the following tasks: appeals processing, valuation of agricultural land, enhancement of field review and data collection or for highlighting outliers in the valuation process. Of the respondents surveyed, 82% used GIS and CAMA to enhance field review and data collection, 56% used GIS and CAMA to value agricultural lands, and 41% used GIS and CAMA to highlight outliers in the valuation process. Only 23% used GIS and CAMA for appeals processing.

4) This question was similar to Question 4: assessors were asked if there was anyone in particular whom they had asked for advice or guidance as they implemented their GIS and CAMA systems. One assessor named Acadia Parish as a source of information, others mentioned IAAO and LAA.

Section 4. (Questions 13-16) Staffing and Contractor Resources

Human Resources. Full time staff support

This section of the survey focused on the number and types of professionals each assessment office has on staff to deploy and maintain its geospatial technologies.

1) *Numbers of Professionals*. Assessors were asked how many full time professionals they employ, including the assessor and deputy assessors. They were given five choices: 4 or less, 5-8, 9-12, 13-16 and 17 or more. The answers to these questions were very different depending on whether assessors worked in a rural, micro or metro parish. Rural parishes were split between those five parishes that employed 4 or less and the remaining seven parishes that employed 5 – 8 staff members. Micro parishes spanned the range of possible answers with one micro parish having a staff of 4 or less, 6 parishes with 5-8 staff members, 2 parishes with a staff size between 9-12 and three parishes with a staff size of 13-16. Not surprisingly, metro parishes had the largest staffs. Of the twenty one metro parishes that responded to the survey, ten had staffs of 17 or more, three had a staff size between 13-16, six parishes had a staff size between 5-8 and one (Grant Parish) had a staff size of 4 or less.

2) Assessors were asked how many of staff members work in the following areas: Information Technology (IT), GIS, CAMA, and Web programming and design.

a) *Information Technology.* Rural parishes had 13 IT professionals working in 9 different parishes. Micro parishes had 14 IT professionals working in 10 parishes. Metro parishes had 27 IT professionals working in 16 different parishes.

b) *GIS*. Assessors were asked how many of their staff worked on GIS tasks. Rural assessors had a larger percentage of their staff members working on GIS, with a total of twenty-one staff members in eleven parishes. Three of the eleven rural parishes had at least two staff members working with GIS, and three rural parishes (Avoyelles, Red River and W. Carroll) had three or more staff members working on GIS tasks.

Micro parishes had seventeen staff members over eleven parishes working on GIS. Five parishes had one GIS professional and six parishes had two GIS professionals each.

Metro parishes employed thirty three GIS professionals in eighteen parishes, four parishes employed three or more GIS professionals and six parishes had two staff members working on GIS related tasks.

c) *CAMA*. Entering base data into a Computer Aided Mass Appraisal system is a labor intensive task. From collecting field data to data input, assessors using CAMA systems require a large number of staff, especially in the early phases. Rural parishes are less likely to be using CAMA then they would GIS and the survey data appears to confirm that. Of the 12 rural parishes surveyed, only four had one or more staff members doing CAMA tasks. One rural parish, St. James, had four staff members working with CAMA data, but being one of the earliest adopters of geospatial technologies, they are the exception to the rule.

Ten of the thirteen micro parishes surveyed had CAMA staff. Four parishes had a staff of four, five others a staff of two, and one parish had one staff member working with CAMA data.

Thirteen of the twenty-one metro parishes had a total of 41 staff members working on their CAMA systems. Nine of the thirteen metro parishes had four staff members working with the CAMA system. Two metro parishes had two CAMA staff members and two metro parishes had one a piece.

d) *Web Programming and/or Design*. Web programming and design are one of the tasks most likely to be contracted out by rural and micro parishes as only the largest parishes can support a full time staff member to work on web tasks. The survey data supports that conclusion as only two of the twelve rural parishes that completed the survey (Avoyelles and St. James) have one full time person working on web tasks.

The same is true for micro parishes: only three of thirteen micro parishes (Beauregard, St. Landry and Washington) have one full time staff member working on web tasks.

Ten of the twenty-one metro parishes that completed the survey have a full-time person assigned to web development or website management. Only one of the metro parishes (Lafayette) has two staff members working on their website.

Human Resources. Contractor Support

Parish assessors were asked about the number of their contractors who work in the following areas: Information Technology (IT), GIS, CAMA and Web programming and design.

Information Technology. Seven of the twelve rural parishes employ one IT contractor to keep their computer and network systems operational. Three of the four parishes that do not contract for IT support have at least one full-time staff member to provide that service. Even the least populated parishes are willing to pay a full-time staff member or a consultant to ensure internet access and network capability. Eight of the thirteen micro parishes have one contractor providing IT support. Twelve of the twenty-one metro parishes have one contractor providing IT support. One metro parish (Pointe Coupee) has two IT workers on contract.

GIS. Six of the twelve rural parishes surveyed employ one GIS contractor. Five of the thirteen micro parishes employ one GIS contractor. Eighteen of the twenty-one metro parishes surveyed employ one or more GIS Contractors. Eight metro parishes employ just one contractor, six employ two contractors, three employ three contractors and one metro parish (Cameron) employs four contractors.

CAMA. Two of the twelve rural parishes employ one CAMA contractor. Six of the thirteen micro parishes employ one CAMA contractor and thirteen of the twenty-one metro parishes employ one or more CAMA contractors. Specifically, two metro parishes employ only one CAMA contractor, two metro parishes employ two CAMA contractors, and nine metro parishes each employ four CAMA contractors.

Web Programming and/or Design

One of the twelve rural parishes surveyed employs a web contractor. Seven of the thirteen micro parishes employ web contractor and ten of the twenty-one metro parishes employ at least one or more web contractors.

Chapter V
Conclusions

The 2013 Assessor Survey benefited from the ability to compare survey data from 2010 with data from January 2013. Louisiana assessors have made great strides in that three year period. Twenty assessors improved their geospatial capabilities in three years (Figure 15). If Everett Rogers were alive today he might say that "Louisiana assessors are just past the peak of the bell curve," in describing the status of their GIS technology, and nearing the peak for CAMA technology.

The next challenge will be to help assessors integrate GIS and CAMA so that they can benefit fully from their capabilities. The power of CAMA is greatly enhanced when it is paired with GIS. The survey showed that there are only eight assessors in the state that have managed to accomplish that task. The surveys also revealed a need for training programs for the assessors' staff to use CAMA systems more effectively and for technical assistance to integrate the two information systems. The number of staff and consultants being hired to develop the data layers needed for Louisiana CAMA systems shows that assessors understand the importance of current and accurate CAMA data.

One example of a "Best Practice" in the development of geospatial technology for assessors is the "GIS Taxing District" that Lincoln Parish created to protect the budget of the Lincoln Parish GIS Commission from cuts that could result from an overly cost conscious parish administrator that was not aware of the benefits the GIS Commission provides to the parish. The GIS Commission has not found it necessary to

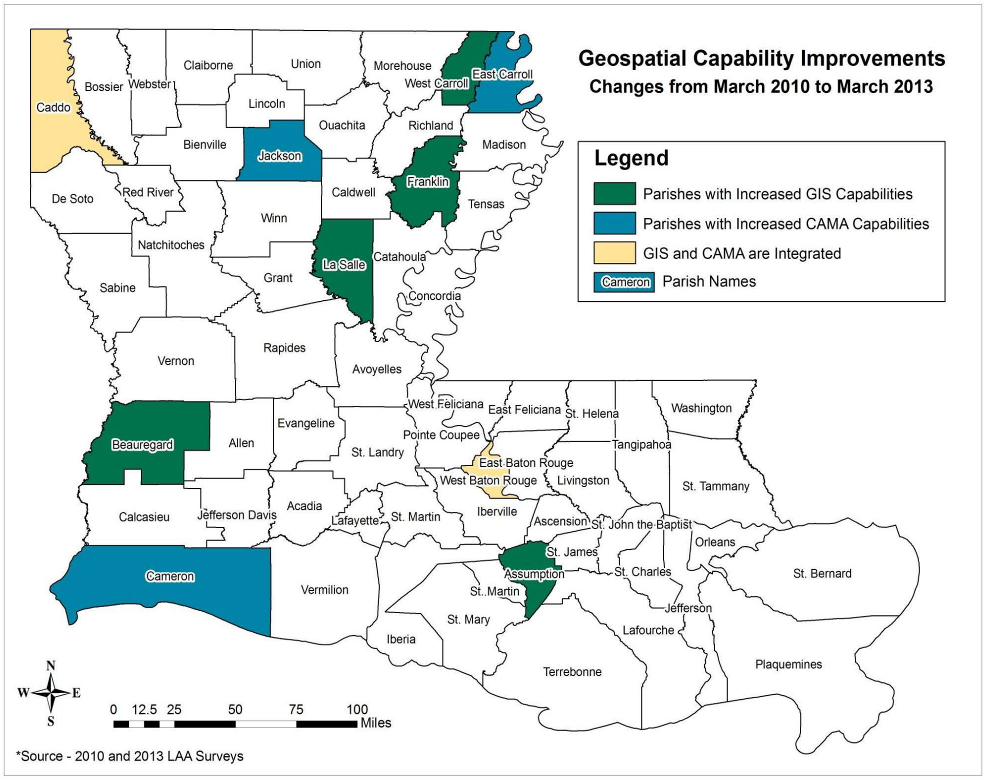


Figure 15

Figure 15: Geospatial Capability Improvements (2010 and 2013 LAA Surveys)

implement the Taxing District, but it was created to ensure that the GIS Commission had some options at hand.

The Lincoln Parish GIS Commission itself is an example of a “Best Practice” in that they include eight different parish agencies in their multi-agency organization. Each agency member contributes a set amount of yearly funding for GIS development. The Commission meets regularly and prioritizes the building of GIS base data layers.

The survey also revealed that there are now twenty multi-agency GIS entities throughout the state and that assessors play a critical role, often a leading role, in each of these partnerships. A multi-agency GIS requires a significant amount of cooperation and coordination. Although there are now twenty different parishes with multi-agency GIS initiatives, none have been in operation as long, or developed as complex a governance structure as has Lincoln Parish Their GIS Commission is an example of a "Best Practice" in geospatial technology. The number of multi-agency projects is a sign that Louisiana assessors recognize the need to share the burden of base map development with other local government agencies. Ten years ago there were only a half dozen multi agency GIS entities. Interestingly, the survey data showed that seven of the eight parishes that had undertaken successful multi-agency GIS initiatives had also successfully merged their GIS and CAMA data.

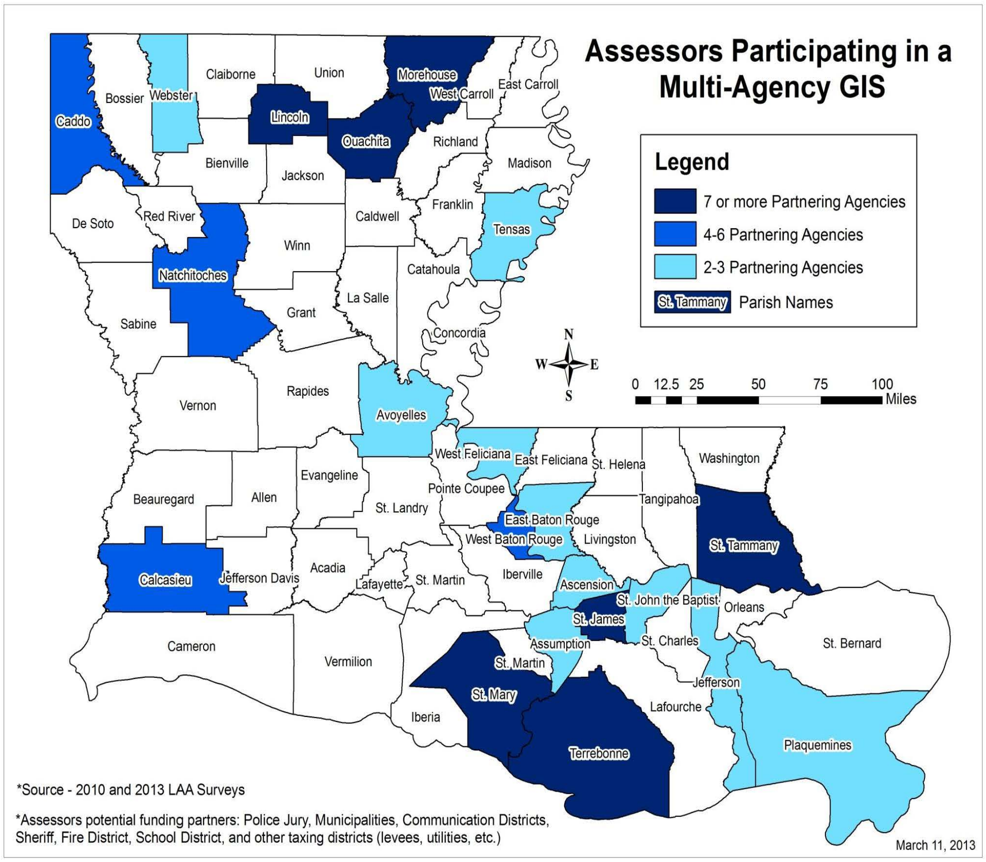


Figure 17

Figure 17: Parishes with Multi-Agency GIS

In 2012, the Louisiana Legislature filed a bill (RS 47: 1906) that gives every assessment office in the state permission to use funding collected through their millage for clerical and other expenses. In addition, assessors can now move funds to next year's budget rather than being forced to close out their budget at the end of the fiscal year. This is especially important for assessors who are investing in geospatial technologies as they can combine funds from two consecutive years to purchase new GIS or CAMA systems.

These new laws will improve the likelihood that parishes, especially poorly funded rural parishes, will consider adopting geospatial technologies.

One of the surprises that occurred while analyzing the survey data is that although the metro parishes have the most resources, micro parishes tend to be the most innovative. The first two parishes in the state to develop a GIS were both micro parishes (Lincoln and St. Mary). Of the eight multi-agency GIS initiatives in the state, four of them were developed by micro parishes (Lincoln, Morehouse, St. Mary and Webster). The development of a GIS Taxing District to support GIS development in Lincoln Parish is an example of an innovative idea that started with a micro parish. Micro parishes may have less in the way of resources than metro parishes, but they appear to have learned to do well with the resources at their disposal.

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Answering the Research Questions

1) The first research question related to financial resources available to assessors and how that affects their ability to purchase, maintain, and upgrade geospatial technology. Rogers (1995) noted that a lack of financial resources can be an impediment to the diffusion of technology, especially among those who have fewer resources. Among Louisiana assessors, this is primarily, but not exclusively, the rural parishes. Rogers admits that new technologies can often increase disparities rather than reduce them.

   The questions from the 2010 online survey showed that only seven Louisiana assessors received grants for GIS development and those that did received relatively small amounts. Although seven assessors charged for information available on their website, it was primarily for large data users on a monthly subscription basis. Only two assessors charged for CAMA data. Grants and data charges are not a significant factor for assessors in financing geospatial technologies.

In 2010, fifteen parishes were partners in a multi-agency GIS. By 2013, that number had risen to twenty. Unfortunately, this survey did not ask respondents to estimate the financial contribution provided by multi-agency GIS different for every parish. The fact that the number of multi-agency GIS initiatives continues to grow leads one to conclude that assessors consider these relationships to be valuable.

Louisiana assessors received ortho-imagery of their parishes from the Governor's Office of Homeland Security in 2012. This high resolution imagery was invaluable as the cost of collecting and processing imagery at that scale for one parish could vary from a high of $90,000 to a low of $40,000, depending on the size of the parish. However, the largest single financial contribution to assessors came from the Louisiana Legislature in the form of a law (47: 1908), passed in 2012 but not effective until 2013, that allows assessors to keep a larger share of the *ad valorum* taxes collected in their parish for clerical and other expenses.

The law also allows assessors to roll unspent funds from this account over from one year's budget to the next. Assessors could accumulate funds to pay for a major technology upgrade or a large data collection effort. This law could expand the number of parishes implementing geospatial technologies in the next couple years. However, this law on its own will not eliminate all financial obstacles to assessor GIS development, but it could convince some of the more risk adverse assessors to begin the implementation process.

2) The second research question involved questioning the role of communications channels between assessors. Rogers (1995) notes that a lack of communication between professionals can slow the diffusion of technologies because assessors who are not communicating with other assessors will be more reluctant to implement a new technology. Assessors learn about technology from a variety of sources including their professional organizations such as IAAO and LAA as well as through vendors and consultants. The survey data showed that over half (56%) of the assessors first heard about GIS technology from another assessor. On the other hand, assessors were not the main conduit for information about CAMA technology. Survey respondents named vendors and consultants as their primary source (44%) of information on CAMA technology. The only organizational outreach program available to Louisiana assessors is through the regular monthly meetings of the Louisiana Assessors Association, but those meetings are held in Baton Rouge, although the annual LAA Conference is held at different locations throughout the state. This is an area where more outreach may be necessary to reach those rural parishes that are not currently attending LAA meetings. It would be helpful to

survey the members to know why they do not attend and what circumstances would encourage them to participate.

3) The third research questions relates to a slow innovation decision process. According to Rogers (1995), a slow innovation decision process could be caused by risk avoidance, poor communication with other assessors, lack of financial resources or all three. This is a question that is difficult to answer with an online survey and would require a follow-up interview. The slow innovation process was most evident in the responses to the question regarding the merging of GIS and CAMA data. The survey respondents were aware that merging the two data sets had value and it was the next step for those that had a functioning GIS and a functioning CAMA system, over 50% of the assessors. Yet, many were unsure exactly how to proceed. In this situation, the most useful tool would be to have a set of "Best Practices," which would be examples of what other assessors have done to resolve this issue, and a contact list of Louisiana assessors that have faced this problem.

4) The fourth research question relates to staffing. The online survey queried the number and type of staff whose primary task is GIS, CAMA, Information Technology (computers, servers, networking) and personnel working on Web programming, design or maintenance. This is not a subject that Rogers (1995) covers but it is a critical resource that can impact the speed of implementation.

The number of full time staff varied from a low of 4 or fewer to a high of 17 or more. All of the large metropolitan areas of the state had staffs of 17 or more. The state average was 5 – 8 full time staff members.

Among the geospatial support positions, GIS led with the largest number of full time employees (46) state wide, and those positions were evenly disbursed among metro, micro and rural assessors. Most assessors have one GIS professional in their office and more assessors have a full-time GIS person on staff than any other technical position. In general, GIS maintenance is handled by one full-time staff person, while application development and special projects are provided by contractors.

Those assessors who are collecting or inputting CAMA data use a large number of staff members on that one task (sometimes four or more). Building a CAMA system requires a large staff to collect and process the data. CAMA data development is less likely to be contracted out.

IT support was often provided or contracted out by the parish. Typically, IT support was contracted out more often than any other position followed by web design or web programming. Some parishes provide their assessor with parish IT Support negating the need to hire a contractor. Many assessors are physically located in the Courthouse building where other parish government agencies are found.

Policy Recommendations

1) The most promising development revealed by the survey was the number of multi-parish GIS initiatives across the state that now stands at twenty Many of these initiatives involve five or more parish entities. Those assessors have realized the benefits of coordinating GIS data collection with others is good news for both assessors and parish government. This may be a result of the recent recession resulting in lower tax revenues, or it might simply reflect the recognition that multi-agency coordination may save the parish money in the long run. Whatever the reason, multi-parish GIS coordination will result in less duplication of effort when developing essential base data layers.

2) There are a large number of GIS and CAMA development projects currently underway across the state. These projects involve a combination of internal staff and consultants. Depending on the number of parcels and structures in each parish, these efforts will most likely be multi-year projects. It would be very helpful to assessors in general, to track these projects to understand how long it takes to complete them and what problems occur during implementation.

3) There are approximately seven or eight rural parishes that have very small staffs (4 or less). They will have difficulty hiring the technical people they need to build a GIS or CAMA System. It would be helpful for these assessors to have a list of approved vendors and their specialties. This would be especially useful to

new assessors who may not have hired a GIS or CAMA vendor before. This year twenty-three new assessors took the oath of office in January (Figure 16).

4) A number of parishes acquired the 2010 high resolution aerial ortho-imagery from the Governor's Office of Homeland Security to use as a base map and as an aid to building planimetric features for their GIS. The collection and processing of aerial imagery for just one parish is much more expensive per square mile than the cost for an entire state on a per square mile basis. The imagery acquired by GOHSEP in January of 2010 is now over three years old.

    One way that the state could help local government (including assessors) is if the state collected statewide imagery every four or five years at a scale sufficient to be used for planimetric mapping and distributed it, at no cost, to state agencies and local government. The state could then insist that any planimetric data produced using state imagery meet certain minimum specifications. The state would benefit by having a common base map that met the minimum specifications and local government would have a reliable source of imagery that they could use for data development. The state should also provide a state contract pricing agreement for GIS and CAMA software since it would cost the state very little, but would save local governments a great deal.

5) Rogers (1995) describes those who are last to adopt an innovation as *laggards*. He later admitted that he has a bias towards innovation and admitted that some laggards have good reasons for not adopting new technologies. The GIS/CAMA survey revealed huge difference in resources between the metro/micro parishes versus rural or laggards in Louisiana. After looking at the numbers of staff members per parish, one can see why the rural parishes are so far behind their metro and micro parish neighbors. The Louisiana Assessors Association (LAA) should help reduce some of these disparities by conducting in-person interviews with the assessors to find out what they need in the way of assistance from LAA. These interviews would be designed to help LAA understand what issues these assessors are facing and what services LAA could reasonably provide them, such as technical assistance, arranging site visits to other assessors or information on "best practices."

6) Multi-parish GIS initiatives are a relatively recent phenomenon. Understanding how they function, what conditions are necessary for them to be successful, what problems they must overcome, as well as which agencies make the best partners and which do not. The challenges of multi-agency governance in Louisiana would be an excellent subject for further research.

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Appendices

A. Cadastral GIS Glossary

B. Demographic Data by Parish and OMB Classification

C. Homestead Exemption Data by Parish and OMB Classification

D. Assessor Resources by Parish and OMB Classification

E. Survey Instrument

Appendix A. Cadastral GIS Glossary

Cadastral GIS Glossary

Accuracy
The degree of conformity within a standard. Accuracy relates to the quality of a result and is distinguished from precision which relates to the quality of the operation by which the result is obtained.

Ad Valorem Taxes (Latin for "according to value")
Taxes based on the value of real estate or personal property. It is more common than a specific tax, a tax based on the quantity of an item, such as cents per kilogram, regardless of *price.*

Attribute
Nonspatial information about a geographic feature in a GIS, usually stored in a table and linked to the feature by a unique identifier. For example, attributes of a river might include its name, length, and sediment load at a gauging station.

Basemap
A map on which information may be placed for purposes of comparison or geographical correlation. The term "base map" was at one time applied to a class of maps now known as outline maps. It may be applied to topographic maps, also termed "mother maps" that are used in the construction of other types of maps by the addition of particular data.

Benchmark
Relatively permanent material object, natural or artificial, bearing a marked point whose elevation above or below an adopted datum is known.

Boundary Survey
Survey made to establish or to reestablish a boundary line on the ground, or to obtain data for constructing a map or plat showing a boundary line. A 'Western' version of the operationalization might be a legally specified procedure, performed by a chartered surveyor, supported by statements from neighbors and pertinent documents, and resulting in official recording in the cadastre as well as boundary markings in the field.

Cadastral Map
A map showing the boundaries of subdivisions of land, often with the bearings and lengths thereof and the areas of individual tracts, for purposes of describing and recording ownership. It may also show culture, drainage, and other features relating to land use and value.

Cadastral Survey
Survey relating to land boundaries, made to create units suitable for title transfer or to define the limitations of title. Derived from "cadastre" meaning a register of land quantities, values, and ownership used levying taxes, the term may properly be applied to surveys of a similar nature outside the public lands, and such surveys are more commonly called "land surveys or property surveys."

Cartography
Science and art of making maps and charts. The term may be taken broadly as comprising all the steps needed to produce a map: planning, aerial photography, field surveys, photogrammetry, editing, color separation, and multicolor printing. Mapmakers, however, tend to limit use of the term to the map-finishing operations, in which the master manuscript is edit and color separation plates are prepared for lithographic printing.

Control Mapping
Points of established position or elevation, or both, which are used to fix references in positioning and correlating map features. Fundamental control is provided by stations in the national networks of triangulation and traverse (horizontal control) and leveling (vertical control). Usually it is necessary to extend geodetic surveys, based on fundamental stations, over the area to be mapped, to provide a suitable density and distribution of control points. Supplemental control points are those needed to relate the aerial photographs used for mapping with the system of ground control. These points must be positively photo identified; that is, the points must be positively correlated with their images on the photographs.

Database Management System
A set of software applications used to create and maintain databases according to a schema. Database management systems provide tools for adding, storing, changing, deleting, and retrieving data.

Data Dictionary
A catalog or table containing information about the datasets stored in a database. In a GIS, a data dictionary might contain the full names of attributes, meanings of codes, scale of source data, accuracy of locations, and map projections used.

Data Element
The smallest unit of information used to describe a particular characteristic of a spatial dataset. A data element is a logically primitive description that cannot be further subdivided.

Diffusion
The process of appropriating a technology and putting it to use for one's own purposes; the act by an individual, organization, or community of choosing a technology and putting it into effect.

Ecological Fallacy
The assumption that an individual from a specific group or area will exhibit a trait that is predominant in the group as a whole.

Enterprise Geodatabase
A geodatabase managed in an RDBMS server by ArcSDE. Multiuser geodatabases can be very large and support multiple concurrent editors. They are supported on a variety of commercial RDBMS, including IBM DB2, IBM Informix, Oracle, Microsoft SQL Server, and PostgreSQL.

Enterprise GIS
A Geographic Information System that is integrated through an entire organization so that a large number of users can manage, share, and use spatial data and related information to address a variety of needs, including data creation, modification, visualization, analysis, and dissemination.

Fabric
In Survey Analyst - Cadastral Editor, a network of connected parcels. Parcels are represented by parcel line features, parcel point features, and parcel polygon features, referred to in aggregate as parcel features. Parcel topology in the cadastral fabric is stored explicitly through shared or common parcel point features.

Feature
A representation of a real-world object on a map.

Function
An operation. In GIS, functions include data input, editing, and management; data query, analysis, and visualization; and output operations.

Geographic Data
Information describing the location and attributes of things, including their shapes and representation. Geographic data is the composite of spatial data and attribute data.

Geographic Information System
An integrated collection of computer software and data used to view and manage information about geographic places, analyze spatial relationships, and model spatial processes. A GIS provides a framework for gathering and organizing spatial data and related information so that it can be displayed and analyzed.

Geoprocessing
A GIS operation used to manipulate GIS data. A typical geoprocessing operation takes an input dataset, performs an operation on that dataset, and returns the result of the operation as an output dataset. Common geoprocessing operations include geographic feature overlay, feature selection and analysis, topology processing, raster processing, and data conversion. Geo-processing allows for definition, management, and analysis of information used to form decisions.

Hierarchal Database
A database that stores related information in a tree-like structure, where records can be traced to parent records, which in turn can be traced to a root record.

Image Data
Data produced by scanning a surface with an optical or electronic device. Common examples include scanned documents, remotely sensed data (for example, satellite images), and aerial photographs. An image is stored as a raster dataset of binary or integer values that represent the intensity of reflected light, heat, or other range of values on the electromagnetic spectrum.

Joined Parcel
In Survey Analyst - Cadastral Editor, a parcel that is connected to the cadastral fabric, and shares common points with neighboring parcels.

Key
An attribute or set of attributes in a database that uniquely identifies each record.

Land Cover
The classification of land according to the vegetation or material that covers most of its surface; for example, pine forest, grassland, ice, water, or sand.

Land Information System
A Geographic Information System for cadastral and land-use mapping, typically used by local governments.

Land Use
The classification of land according to what activities take place on it or how humans occupy it; for example, agricultural, industrial, residential, urban, rural, or commercial.

Map
A graphic representation of the spatial relationships of entities within an area.

Map Topology
A temporary set of topological relationships between coincident parts of simple features on a map, used to edit shared parts of multiple features.

Metropolitan Area
A geographic entity defined by the U.S. Office of Management and Budget (OMB) for use by federal statistical agencies, including the U.S. Census Bureau. A metropolitan area is based on the concept of a core area with a large population nucleus, plus adjacent communities having a high degree of economic and social integration with that core area. According to the 1990 standards, to qualify as a metropolitan area, the area must include at least one city or urbanized area with 50,000 or more inhabitants and a total metropolitan population of at least 100,000 (75,000 in New England).

Micropolitan Area
A geographic region containing at least one urban area with a population between 10,000 and 50,000, defined by the U.S. Office of Management and Budget for use by federal statistical agencies, including the U.S. Census Bureau. Micropolitan areas include adjacent communities having a high degree of economic and social integration with the core area.

Nominal Data
Data divided into classes within which all elements are assumed to be equal to each other, and in which no class comes before another in sequence or importance; for example, a group of polygons colored to represent different soil types.

Normal Distribution
A theoretical frequency distribution of a dataset in which the distribution of values can be graphically represented as a symmetrical bell curve. Normal distributions are typically characterized by a clustering of values near the mean, with few values departing radically from the mean. There are as many values on the left side of the curve as on the right, so the mean and median values for the distribution are the same. Sixty-eight percent of the values are plus or minus one standard deviation from the mean; 95 percent of the values are plus or minus two standard deviations; and 99 percent of the values are plus or minus three standard deviations.

Ordinal Data
Data classified by comparative value; for example, a group of polygons colored lighter to darker to represent less to more densely populated areas.

Parcel
A piece or unit of land, defined by a series of measured straight or curved lines that connect to form a polygon.

Rural Parish
A parish that is not defined by the Office of Management and Budget as either Metropolitan or Micropolitan.

Standard Deviation
A statistical measure of the spread of values from their mean, calculated as the square root of the sum of the squared deviations from the mean value, divided by the number of elements minus one. The standard deviation for a distribution is the square root of the variance.

Topographic Map
The study and mapping of land surfaces, including relief (relative positions and elevations) and the position of natural and constructed features.

Unjoined Parcel
In Survey Analyst - Cadastral Editor, a parcel that has not been connected to the cadastral fabric, and that has its own local coordinate system.

Variable
A symbol or placeholder that represents a changeable value or a value that has not yet been assigned.

Web Service
A software component accessible over the World Wide Web for use in other applications. Web services are built using industry standards such as XML and SOAP, and thus are not dependent on any particular operating system or programming language, allowing access to them through a wide range of applications.

XML (Extensible Markup Language)
Developed by the W3C, a standardized general purpose markup language for designing text formats that facilitates the interchange of data between computer applications. XML is a set of rules for creating standard information formats using customized tags and sharing both the format and the data across applications.

Appendix B. Demographic Data by Parish and OMB Classification

DEMOGRAPHIC DATA by PARISH AND OMB CLASSIFICATION

OMB Cat.	Parish Name	2010 Census Households Number of	2010 Census Households Median Income	2010 Census Households % in poverty
Metro	ASCENSION	36,456	$66,173	11.1
Metro	BOSSIER	43,962	$51,771	13.9
Metro	CADDO	98,270	$39,086	20.1
Metro	CALCASIEU	72,061	$43,614	17.1
Metro	CAMERON	2,461	$61,679	9.5
Metro	DESOTO	10,326	$39,213	19.6
Metro	E. BATON ROUGE	167,150	$46,838	18.3
Metro	EAST FELICIANA	6,978	$37,403	20.9
Metro	GRANT	7,231	$39,988	16.4
Metro	IBERVILLE	11,040	$43,195	17.9
Metro	JEFFERSON	165,404	$48,374	15.1
Metro	LAFAYETTE	84,594	$48,591	16.1
Metro	LAFOURCHE	34,474	$49,262	15.5
Metro	LIVINGSTON	44,166	$57,254	11.0
Metro	ORLEANS	134,342	$37,325	25.7
Metro	OUACHITA	56,390	$39,724	21.9
Metro	PLAQUEMINES	8,198	$55,301	9.4
Metro	PT. COUPEE	8,903	$43,030	17.1
Metro	RAPIDES	47,418	$40,470	18.8
Metro	ST. BERNARD	12,247	$40,450	14.6
Metro	ST. CHARLES	18,569	$60,207	12.9
Metro	ST. HELENA	4,142	$29,632	24.3
Metro	ST. JOHN	15,775	$49,671	15.2
Metro	ST. MARTIN	18,825	$40,358	18.1
Metro	ST. TAMMANY	86,374	$61,442	10.1
Metro	TERREBONNE	39,040	$48,166	17.3
Metro	UNION	8,344	$37,426	23.0
Metro	W. BATON ROUGE	8,510	$49,929	15.2
Metro	W. FELICIANA	4,112	$50,685	13.2
Metro Totals		**1,255,762**	**$46,767**	**16.5**

OMB	Parish Name	2010 Census Households Number of	2010 Census Households Median Income	2010 Census Households % in poverty
Micro	ACADIA	22,083	$37,970	20.2
Micro	ASSUMPTION	8,590	$46,699	18.0
Micro	BEAUREGARD	12,853	$45,113	14.3
Micro	CONCORDIA	7,710	$28,705	31.4
Micro	IBERIA	26,370	$42,989	20.3
Micro	JACKSON	6,037	$39,809	15.9
Micro	JEFFERSON DAVIS	11,878	$43,585	17.4
Micro	LINCOLN	16,594	$34,152	17.7
Micro	MADISON	3,938	$26,178	32.8
Micro	MOREHOUSE	10,264	$31,269	28.4
Micro	NATCHITOCHES	15,044	$31,830	28.4
Micro	ST. LANDRY	30,381	$34,350	27.4
Micro	ST. MARY	20,148	$40,171	20.1
Micro	TANGIPAHOA	43,518	$40,214	22.1
Micro	VERMILION	21,737	$43,349	17.8
Micro	VERNON	18,024	$45,292	14.0
Micro	WASHINGTON	17,444	$30,554	27.4
Micro	WEBSTER	16,412	$36,225	21.3
Totals		**309,025**	**$37,692**	**21.9**
Rural	ALLEN	8,257	$39,007	16.8
Rural	AVOYELLES	15,801	$32,321	23.9
Rural	BIENVILLE	5,571	$18,691	26.4
Rural	CALDWELL	3,834	$38,606	19.7
Rural	CATAHOULA	3,750	$37,115	25.9
Rural	CLAIBORNE	5,702	$32,972	28.0
Rural	EAST CARROLL	2,525	$25,267	40.8
Rural	EVANGELINE	12,165	$34,848	21.5
Rural	FRANKLIN	7,965	$34,105	28.1
Rural	LASALLE	5,547	$42,066	12.3
Rural	RED RIVER	3,174	$37,159	20.1
Rural	RICHLAND	7,287	$38,469	20.4
Rural	SABINE	9,414	$36,959	21.0
Rural	ST. JAMES	7,578	$52,887	14.7
Rural	TENSAS	2,205	$28,090	32.4
Rural	WEST CARROLL	4,070	$30,446	25.5
Rural	WINN	5,375	$30,938	23.2
Totals		**110,220**	**$34,703**	**23.6**

2010	**Louisiana Demographics**			
	Total Louisiana Households	**1,675,007**		
	Louisiana Median Income		**$44,086**	
	Percent of Total Louisiana Households in Poverty			**18.4**

2010	**US Demographics**			
	Total US Households	**114,761,359**		
	US Median Income		**$52,762**	
	Percent of Total U.S. Households in Poverty			**14.3**

2010 Population Summary by Demographic Categories (Metro/Micro/Rural)

29 Metropolitan Parishes contain 75.0% of Louisiana households
Total Households: 1,255,762
Median Income: $46,767
% Households in Poverty: 16.5

18 Micropolitan Parishes contain 18.4% of Louisiana households
Total Households: 309,025
Median Income: $37,692
% Households in Poverty: 21.9

17 Rural Parishes contain 6.6% of Louisiana households
Total Households: 110,220
Median Income: $34,703
% Households in Poverty: 23.6

Appendix C. Homestead Exemption Data by Parish and OMB Classification

Parish	100% EXEMPT HOMESTEAD	PERCENTAGE OF 100% EXEMPT HOMESTEAD	MEDIAN VALUE OF OWNER OCCUPIED HOMES, 2007-2011 (in thousands)
Ascension	11,065	36%	167
Bossier	8,807	31%	139
Caddo	24,753	43%	118
Calcasieu	27,381	55%	117
Cameron	2,834	85%	119
Desoto	7,243	79%	83
E Baton Rouge	26,857	26%	162
E. Feliciana	3,147	50%	102
Grant	5,525	77%	81
Iberville	4,649	58%	89
Jefferson	18,149	17%	177
Lafayette	14,650	27%	157
Lafourche	14,785	51%	120
Livingston	13,385	39%	153
Orleans	11,110	21%	184
Ouachita	16,510	45%	117
Plaquemines	2,326	44%	203
Pointe Coupee	3,992	54%	109
Rapides	21,637	60%	114
St. Bernard	4,124	49%	131
St. Charles	3,466	24%	175
St. Helena	3,071	84%	77
St. John	4,821	36%	149
St. Martin	8,906	57%	88
St. Tammany	8,319	12%	202
Terrebonne	12,415	44%	124
Union	4,413	63%	79
W Baton Rouge	1,862	32%	132
W Feliciana	740	29%	163
Metro Average		**45%**	**132**
Micro Parishes			
Acadia	9,916	59%	91
Assumption	3,527	55%	89
Beauregard	6,969	68%	85
Concordia	4,827	73%	78
Iberia	12,311	57%	103

Jackson	3,092	67%	73
Jefferson Davis	5,528	66%	85
Lincoln	4,084	41%	110
Madison	2,110	85%	70
Morehouse	5,354	64%	76
Natchitoches	5,960	59%	95
St. Landry	13,608	59%	85
St. Mary	8,450	59%	87
Tangipahoa	13,817	46%	140
Vermillion	9,223	56%	95
Vernon	9,268	78%	88
Washington	9,449	68%	83
Webster	9,605	74%	80
Micro Average		**63%**	**90**
Rural Parishes			
Allen	6,320	86%	78
Avoyelles	9,423	70%	85
Bienville	3,942	87%	56
Caldwell	3,331	84%	72
Catahoula	3,160	79%	68
Claiborne	3,605	74%	66
East Carroll	1,260	77%	46
Evangeline	6,967	71%	82
Franklin	5,603	79%	76
LaSalle	3,933	79%	74
Red River	2,241	83%	74
Richland	4,843	73%	70
Sabine	5,872	75%	79
St James	3,340	50%	114
Tensas	1,432	83%	67
West Carroll	3,020	80%	76
Winn	3,678	82%	61
Rural Average		**77%**	**73**

Appendix D. Assessor Resources by Parish and by OMB Classification

Assessor Resources by Parish and Metro/Micro/Rural Categorization

OMB	Parish	2010 Assessment	2012 Expense Fund	Total Income
Metro	Ascension	$1,521,400	250000	$1,771,400
Metro	Bossier	2,853,304.14	$425,440	$3,278,744
Metro	Caddo	$3,514,984	$1,260,000	$4,774,984
Metro	Calcasieu	$2,040,524	$455,000	$2,495,524
Metro	Cameron	$609,589	$158,000	$767,589
Metro	De Soto	$1,834,589	$90,000	$1,924,589
Metro	East Baton Rouge	$4,607,547	$1,600,000	$6,207,547
Metro	East Feliciana	$766,876	$206,036	$972,912
Metro	Grant	$304,154	$110,000	$414,154
Metro	Iberville	$849,116	$348,000	$1,197,116
Metro	Jefferson	$0	$4,320,856	$4,320,856
Metro	Lafayette	$2,541,916	$476,277	$3,018,193
Metro	Lafourche	$1,834,952	$350,000	$2,184,952
Metro	Livingston	$3,148,654	$278,500	$3,427,154
Metro	Orleans	$0	$0	$0
Metro	Ouachita	$1,599,255	$450,000	$2,049,255
Metro	Plaquemines	$1,082,114	$332,000	$1,414,114
Metro	Pointe Coupee	$918,573	$200,000	$1,118,573
Metro	Rapides	$1,275,810	$308,000	$1,583,810
Metro	St. Bernard	$538,750	$160,000	$698,750
Metro	St. Charles	$2,427,201	$254,184	$2,681,385
Metro	St. Helena	$301,724	$145,000	$446,724
Metro	St. John the Baptist	$1,060,339	$165,000	$1,225,339
Metro	St. Martin	$942,529	$190,000	$1,132,529
Metro	St. Tammany	$429,631	$397,650	$827,281
Metro	Terrebonne	$1,453,912	$480,000	$1,933,912
Metro	Union	$783,887	$175,000	$958,887
Metro	West Baton Rouge	$518,960	$175,000	$693,960
Metro	West Feliciana	$487,929	$80,641	$568,570
				$1,868,479

OMB	Parish	Assessment	Expense Fund	Total Income
Micro	Acadia	$1,074,987	$258,386	$1,333,373
Micro	Assumption	$646,539	$188,500	$835,039
Micro	Beauregard	$837,808	$200,000	$1,037,808
Micro	Concordia	$379,400	$150,000	$529,400

Micro	Iberia	$1,665,232	$719,750	$2,384,982
Micro	Jackson	$1,155,418	$170,000	$1,325,418
Micro	Jefferson Davis	$437,144	$115,000	$552,144
Micro	Lincoln	$784,208	$150,000	$934,208
Micro	Madison	$936,295	$76,000	$1,012,295
Micro	Morehouse	$465,862	$169,800	$635,662
Micro	Natchitoches	$774,777	$172,000	$946,777
Micro	St. Landry	$1,006,190	$276,280	$1,282,470
Micro	St. Mary	$1,593,043	$365,321	$1,958,364
Micro	Tangipahoa	$2,292,106	$368,000	$2,660,106
Micro	Vernon	$494,096	$150,000	$644,096
Micro	Washington	$863,494	$230,000	$1,093,494
Micro	Webster	$1,753,379	$170,000	$1,923,379
Micro	Vermilion	$798,826	$251,170	$1,049,996
				$1,229,945

OMB	Parish	Assessment	Expense Fund	Total Income
Rural	Allen	$384,142	$158,000	$542,142
Rural	Avoyelles	$549,006	$187,000	$736,006
Rural	Bienville	$655,969	$139,600	$795,569
Rural	Caldwell	$323,600	$72,904	$396,504
Rural	Catahoula	$274,878	$100,000	$374,878
Rural	Claiborne	$509,756	$160,000	$669,756
Rural	East Carroll	$303,739	$64,000	$367,739
Rural	Evangeline	$632,354	$178,000	$810,354
Rural	Franklin	$548,625	$200,000	$748,625
Rural	LaSalle	$588,262	$130,000	$718,262
Rural	Red River	$1,039,075	$250,000	$1,289,075
Rural	Richland	$1,086,354	$176,472	$1,262,826
Rural	Sabine	$620,432	$200,000	$820,432
Rural	St. James	$1,339,535	$107,000	$1,446,535
Rural	Tensas	$250,796	$52,000	$302,796
Rural	West Carroll	$254,768	$52,000	$306,768
Rural	Winn	$352,848	$100,000	$452,848
				$708,301

Sources: Louisiana Tax Commission Annual Report 2010
Assessor Expense Fund , RS 47: 1908

Appendix E. 2013 Louisiana Assessor Survey Sample

Louisiana Assessors and the Implementation of Geospatial Technologies

Section #1: Geographic Information Systems (GIS) Technology

This section was designed to provide an opportunity to describe your first experience with GIS technology, and how that experience affected your decision to incorporate (or not incorporate) this technology in your work flow. Individual responses are confidential, however a summary of the results will be provided to every Assessor that completes the survey.

1. How did you first obtain information about computer mapping or GIS technology and their use in the Assessment profession? Choose one.

- I first heard about GIS technology from another Assessor
- I first heard about GIS technology in a trade magazine
- I first heard about GIS technology through the International Assoc.of Assessing Officers (IAAO)
- I first heard about GIS technology through the Louisiana Assessors Association (LAA)

Other (please specify)

2. When was GIS first implemented in your office? Choose one.

- We have not implemented GIS yet
- Within the last two years
- Between two and five years ago
- Between five and ten years ago
- More than ten years ago

3. If you were to describe the point at which your office began implementation of GIS technology in comparison to other Louisiana assessors. Would you describe your implementation as... Choose one.

- Among the earliest adopters in the state
- Definitely a lot earlier than others
- Slightly earlier than others
- Slightly later than others
- Definitely later than others

4. When you first considered using GIS technology, were their any other other assessors that provided your office with useful advice on implementing GIS technology?

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Appendix F.

Current Status of GIS and CAMA

Capabilities in Louisiana by Parish

A Comparison of the 2010 and 2013 Surveys

Functional GIS/CAMA (Yes/No)

Parish name	**2010 LAA Survey**			**2013 LAA Survey**		
Metro Parishes	**Functional GIS**	**Functional CAMA**	**GIS & CAMA Merged**	**Functional GIS**	**Functional CAMA**	**GIS & CAMA Merged**
Ascension	Yes	No	No	Yes	No	No
Bossier	Yes	Yes	No	Yes	Yes	No
Caddo	Yes	Yes	No	Yes	Yes	Yes
Calcasieu	Yes	Yes	No	Yes	Yes	No
Cameron	No	No	No	No	Yes	No
DeSoto	Yes	No	No			
E Baton Rouge	No	No	No	No	No	No
E. Feliciana				No	No	No
Grant	Yes	Yes	No	No	Yes	No
Jefferson	Yes	Yes	No			
Lafayette	Yes	Yes	No	Yes	Yes	No
Lafourche				No	No	No
Orleans				Yes	Yes	No
Ouachita	Yes	Yes	Yes	Yes	Yes	Yes
Plaquemines	Yes	Yes	No	Yes	Yes	No
Pointe Coupee	Yes	No	No	Yes	No	No
Rapides	Yes	Yes	Yes	No	No	No
St. Bernard	No	No	No			---
St. Charles	No	No	No	No	No	No
St. John	No	No	No			
St. Martin	Yes	Yes	Yes	Yes	Yes	Yes
St. Tammany	Yes	Yes	No	No	Yes	No
Terrebonne	Yes	No	No	Yes	No	No
Union	Yes	Yes	No	Yes	Yes	No
W Baton Rouge	Yes	Yes	No	Yes	Yes	Yes
W Feliciana	Yes	Yes	No			
2010 Survey 29 (-6 N/A) = 23	18 yes, 5 no	15 yes, 8 no	3 yes, 20 no			
2013 Survey 29 (-8 N/A) = 21				13 yes, 8 no	13 yes, 8 no	4 yes, 17 no
The following Metro Parishes didn’t participate in the 2010, or the 2013 survey; Iberville, Livingston and St. Helena.						

Functional GIS/CAMA (Yes/No) continued						
Parish Name	**2010 LAA Survey**			**2013 LAA Survey**		
Micro Parishes	**Functional GIS**	**Functional CAMA**	**GIS & CAMA Merged**	**Functional GIS**	**Functional CAMA**	**GIS & CAMA Merged**
Acadia	Yes	Yes	No	Yes	Yes	No
Assumption	No	Yes	No	Yes	Yes	No
Beauregard	No	Yes	No	Yes	Yes	No
Concordia	No	No	No	No	No	No
Iberia	Yes	Yes	No	Yes	Yes	No
Jackson	No	No	No	No	Yes	No
Jefferson Davis	No	No	No			
Lincoln	Yes	Yes	Yes	Yes	Yes	YES
Morehouse	Yes	Yes	Yes	Yes	Yes	Yes
Natchitoches	Yes	Yes	No	Yes	Yes	No
St. Landry	Yes	Yes	No	Yes	Yes	No
St. Mary	Yes	Yes	Yes	Yes	Yes	Yes
Vermillion	No	No	No			
Washington	Yes	No	No	Yes	No	No
Webster	Yes	Yes	Yes	Yes	Yes	Yes
2010 Survey	9 yes, 6 no	10 yes, 5 no	4 yes, 11 no			
2013 Survey				11 yes, 2 no	11 yes, 2 no	4 yes, 9 no
The following Micro Parishes did not participate in the 2010, or the 2013 Survey; Madison, Tangipahoa and Vernon						
Rural Parishes						
Allen	No	No	No	N/A	N/A	N/A
Avoyelles	Yes	Yes	No	Yes	Yes	No
Bienville	Yes	Yes	No	Yes	No	No
Caldwell	Yes	No	No	Yes	No	No
Claiborne	No	No	No			
East Carroll	No	No	No	No	Yes	No
Evangeline				No	No	No
Franklin	No	No	No	Yes	No	No
LaSalle	No	Yes	No	Yes	Yes	No
Red River	Yes	Yes	No	Yes	Yes	No
Richland	Yes	Yes	No			
Sabine				No	No	No
St. James	Yes	Yes	No	Yes	Yes	No
Tensas	Yes	No	No	Yes	No	No
West Carroll	No	No	No	Yes	No	No
Winn	No	No	No			
2010 Surveys	7 yes, 7 no	6 yes, 8 no	14 no			
2013 Surveys				9 yes, 3 no	5 yes, 7 no	12 no
The following parish did not participate in the 2010 or 2013 surveys; Catahoula						

VITA

The author was born in Boston, Massachusetts and has lived in New Orleans since 1974. He obtained his Bachelor of Science Degree in Business from the University of New Orleans in 1988. He joined the University of New Orleans Urban Studies graduate program in 1990 and graduated in 1994 with a Masters in Urban & Regional Planning. He has been Director of the Louisiana Geographic Information Center at Louisiana State University since 2000. He is a member of the American Institute of Certified Planners (AICP), and he represents Louisiana on the National States Geographic Information Council (NSGIC). He entered the PhD program in Urban Studies at the University of New Orleans in 2006.