Geographic Information Systems and the Nonprofit Sector: The Last Frontier?

Sidne Ward
Bloch School of Management, University of Missouri - Kansas City, Kansas City, MO, United States., wards@umkc.edu

Brent Never
Bloch School of Management, University of Missouri - Kansas City, Kansas City, MO, United States., neverb@umkc.edu

Geographic Information Systems and the Nonprofit Sector: The Last Frontier?

Sidne G. Ward
University of Missouri – Kansas City
wards@umkc.edu

Brent Never
University of Missouri – Kansas City
neverb@umkc.edu

ABSTRACT

This is an exploratory study examining the predictors of geographic information systems (GIS) adoption among nonprofit organizations. A variety of organization, system, and environment characteristics are measured via a survey administered to 72 managers of nonprofit organizations. Comparisons are made between GIS and website adoption by these organizations. Results indicate that nonprofit managers view characteristics related to GIS differently than characteristics related to websites. GIS adoption is also related to the size of the information systems (IS) staff, risk propensity, and ability to predict changes in demand.

Keywords (Required)

GIS, spatial technologies, nonprofit organizations, technology adoption

INTRODUCTION

Geographic information systems (GIS) are a type of decision support system (DSS) that displays data spatially (Pick, 2004). The costs and benefits of GIS differ from those of non-spatial information systems (IS). Many benefits of GIS use for decision support such as visualization are difficult to quantify (Pick, 2004). The difficulty in performing cost/benefit analysis may contribute to the early preponderance of GIS deployments in the government sector. Only more recently has the use of GIS spread into the private sector. This study explores determinants of adoption of GIS in the nonprofit sector, perhaps the last frontier for spatial technologies.

THE STATE OF GIS RESEARCH

Research to date on GIS and spatial technologies is primarily case studies. Pick (2006) examined the costs and benefits of GIS through a case study of fourteen businesses. The results identified the most important costs as people, hardware, software, and data and the most significant benefits as mapping quality, speed of mapping, better decision-making, increased productivity, enhanced reports and proposals, competitive edge, locating assets quickly, and improving efficiencies. While large firms exhibited a relationship between perceived benefits of GIS and higher strategic level for spatial, no similar association was detected for small and medium-sized firms.

Another study employing case studies to develop an evolutionary framework to examine the use of GIS in business with three dimensions: extent to which spatial technologies are customer-facing, extent to which spatial technologies are available enterprise-wide and integrated into a web platform, and extent of geography in the business (Pick, 2007). Size of firm exhibited no association with the firm's position in an evolutionary framework indicating that organizational size is not a significant barrier to entry to GIS adoption. Extent of geography in the business and a spatially-enabled enterprise-wide web integration platform are related to the strategic level of spatial technologies. Nevertheless, the use of customer-facing GIS technologies is not related to strategic level of spatial technologies.

THE NATURE OF THE NONPROFIT SECTOR

The nonprofit sector is large and diverse, almost to the point of defying classification. In 2011, close to 1.1 million public charities registered with the Internal Revenue Service; in this number are organizations that serve a charitable purpose, receive charitable tax exemptions and deductions, and are not affiliated with a religious congregation. In addition, there are over 500,000 nonprofit organizations that do not have charitable status (National Center for Charitable Statistics, 2012); oftentimes these are professional associations, fraternal organizations, or advocacy organizations. The most important fact about the nonprofit sector is that its heterogeneity can range from multi-billion dollar hospital and university systems to the church-basement food pantries that typically come to Americans' minds when thinking of nonprofit organizations. The

integrative element of the sector is that the IRS bestows upon it a charitable tax deduction in acknowledgement of the organizations' contribution to public benefit.

Even though nonprofits range from the arts to health, education to human services, research on the nonprofit sector has consistently found that organizational size is one of the most important explanatory variables (Trussel, 2002). There are two variations of argument as to why size matters in the nonprofit sector. First, size can be highly correlated with the resources necessary to buffer an organization's core processes from the environment; those resources can be marshaled to acquire the technology necessary to shield core processes (Thompson, 1967). Second, nonprofit organizations, in particular, are embedded in dense fields of institutional norms (DiMaggio and Powell, 1983; Meyer and Rowan, 1977), where the ability to invest in new, cutting-edge technology is encouraged in large field leaders. Only over a period of time, does the process of mimetic isomorphism allow for small organizations to adopt technology.

Success in the nonprofit sector is measured quite differently from in the private sector. While private organizations can turn to financial measures, and ultimately the ability to create a profit, nonprofits often times have ambiguous measures of success (Herman and Renz, 1999). Measures such as net revenue can be viewed as at the price of serving more clients. It follows that the institutional environment has a strong effect on how stakeholders, competitors, and funders view a nonprofit organization. Removing profit, and replacing it with conformity to norms, greatly changes how organizations can innovate by adopting new technology.

Zhang, Gutierrez, and Mathieson (2010) decry the paucity of research on IS-related issues in the nonprofit sector and call for an increase in these efforts. They present a multi-layered conceptual framework for organizing IS research efforts in the nonprofit sector. The layers include the social environment within which the organization operates, the organizational environment, and a core focused on fit among the workers, tasks, and technologies.

IS ADOPTION

Numerous studies have examined the adoption of a variety of IS at the organizational level. Jeyaraj, Rottman, and Lacity (2006) reviewed 51 studies on IT adoption by organizations published between 1992 and 2003.The best predictors of organizational adoption of IT were identified as external pressure, professionalism of the IS unit, external information sources, top management support, and organizational size.

Outside the private sector IS adoption has been less well-studied, particularly in the U.S. Chan, Thong, Venkatesh, Brown, Hu and Tam (2010) did examine the mandatory adoption of smart cards by citizens to access e-government services in Hong Kong. Relevant to the current study, they found that performance expectancy and facilitating conditions influenced satisfaction with the mandate.

TECHNOLOGY ADOPTION IN THE NONPROFIT SECTOR

Given the power of institutional conformity, or isomorphism, in the nonprofit sector, there is the risk that the adoption of a technology is only loosely tied to organizational effectiveness or financial measures (such as net revenue). A particular example prevalent in human service organizations is the adoption of social media strategies to connect with stakeholders. Nonprofits are encouraged to develop a robust social media presence, yet the evidence is mixed as to whether this presence is improving organizational effectiveness. The practitioner literature is replete of examples of best practices, serving to reinforce the institutional norms towards conformity.

The funding model in the sector varies widely, yet the reliance on public contracts and private philanthropy permeates. A challenge for nonprofit leaders comes from the demands of funders to adopt particular technologies (Brown and Brudney, 1998). These demands can both be informal, for example when a foundation learns that an organization is not using an accounting software and intones that it would be a good idea to get one, and formal. Particularly in the cases of federal grants and contracts, where program evaluation and financial software is dictated by the funding agency, nonprofits continually must develop competencies in new technologies. In its most egregious forms, nonprofit organizations are forced to use a patchwork of technologies that duplicate or complicate the management of day-to-day operations (Cortés and Rafter, 2007).

Technology transfer does occur between sectors. When considering the nonprofit sector, this transfer takes different forms dependent on the linkage to for-profit or government organizations. Nonprofit organizations are connected to for-profit organizations in two respects. First, in fields where nonprofit and for-profit organizations compete for the same resources- such as hospitals, higher education, or even daycare- adoption of technology occurs as a means of retaining a competitive edge. Nonprofit and for-profit hospitals have used technologies to integrate patient records with billing and collection functions. Second, in fields where there is less direct competition (youth development, for example), technology transfer

from the private sector can occur through the influence of stakeholders such as board members. Typically nonprofit organizations seek out business professionals in order to provide oversight in particular content areas: accounting, finance, law. Board members can influence the transfer of technology from business to nonprofit applications.

Given the strong linkage, particularly in human services and health organizations, to the public sector, some technology can transfer. As funding bodies, public agencies have the most leverage in pushing nonprofits to adopt certain technologies (Cortés and Rafter, 2007). In addition, the interdisciplinary nature of public problems leads to collaboration amongst human service providers both in the public and nonprofit sectors. Healthcare providers use public databases of Medicaid and Medicare records, regardless of the sector. At the same time, adoption of GIS has been slow to migrate from public agencies to nonprofit organizations.

A survey of nonprofit organizations in the U.K. revealed that these organizations are often slow to adopt various information and communications technologies and approach such adoption decisions with caution. Nevertheless, findings also indicate that these technologies may hold great potential for stimulating organizational change (Burt and Taylor, 2000).

O'Hanlon and Chang (2007) investigated the adoption of internet technologies by nonprofit organizations in Australia. They found pressure by donors, the organization's technical capacity, organization budget, proportion of paid employees to volunteers, compatibility with organizational practices, and the level of internal support influenced adoption.

The results of a survey of nonprofit organizations in New Zealand indicate that peer organization practice, adequacy of IT support, organizational budget, perceived leadership in the field, accountability to external constituents, management knowledge of IT, professionalism of the organization and staff, and competitor scanning are all significant predictors of website adoption (Zorn, Flanagin, Shoham, 2011).

THE NATURE OF NONPROFITS' ADOPTION OF GIS

GIS potentially have great value for nonprofit organizations. With that said, there are numerous hurdles to their use. Here we review the literature on Public Participation GIS (PPGIS), with a particular emphasis on the disconnect between the value of this technology and the capacities of nonprofit organizations to harness it for better management decisions.

Whether arts organizations reliant on state arts funding or youth development organizations dependent on Head Start subsidies, nonprofit organizations have the potential to use GIS to both better understand their clients as well as to communicate their unique position to provide services to external stakeholders. The literature on PPGIS signals the incredible benefits of GIS for small “grassroots” organizations (Sieber, 2006; Lin and Ghose, 2008; Bishop, 2010). Organizations would be able to either use the technology themselves, or through thoughtful intermediaries (Sieber, 2000) in order to give power back to the powerless.

GIS can be used to “confirm and legitimize existing experiential knowledge” or to “generate new information based on their own experiential knowledge” (Lin and Ghose, 2008, 33). The GIS applications can seem to be limitless, particularly to GIS scholars and practitioners, yet there may be very little knowledge in nonprofit organizations about what a GIS is, or more importantly, why it would be useful. Lin and Ghose consider the experience of one intermediary organization in Milwaukee, while Bishop (2010) explores the use of GIS in nine organizations in Missouri. There has been little large-*n* study of how nonprofit organizations might approach using GIS.

Although there has been little research in the area of use of GIS by non-profits, Pick, Gollakota, Falatoon and Greene (2008) examined small enterprise GIS readiness. The study results indicated that small enterprise lack readiness for GIS. Several important barriers to using GIS were identified including cost, training, lack of management knowledge of GIS, and lack of a skilled workforce. They also found small enterprises lacked time to make use of GIS, and lacked conviction regarding the importance of GIS compared to other key objectives. As many non-profits are small organizations with relatively limited resources, the lessons may be applicable

RESEARCH QUESTIONS

GIS are a unique class of DSS which employ and display spatial data. Nonprofit organizations are often late-adopters of technology. The unusual nature of both the technology and the adopting entity may lead to a distinctive set of facilitators and barriers to adoption. The current research is an exploratory study of those determinants in three categories.

1. What organizational characteristics and attitudes towards the technology determine the adoption of GIS by nonprofit organizations?
2. What system characteristics of the technology determine the adoption of GIS by nonprofit organizations?

3. What characteristics of the organization's external environment determine the adoption of GIS by nonprofit organizations?

The proposed research model based on these questions is presented in Figure 1.

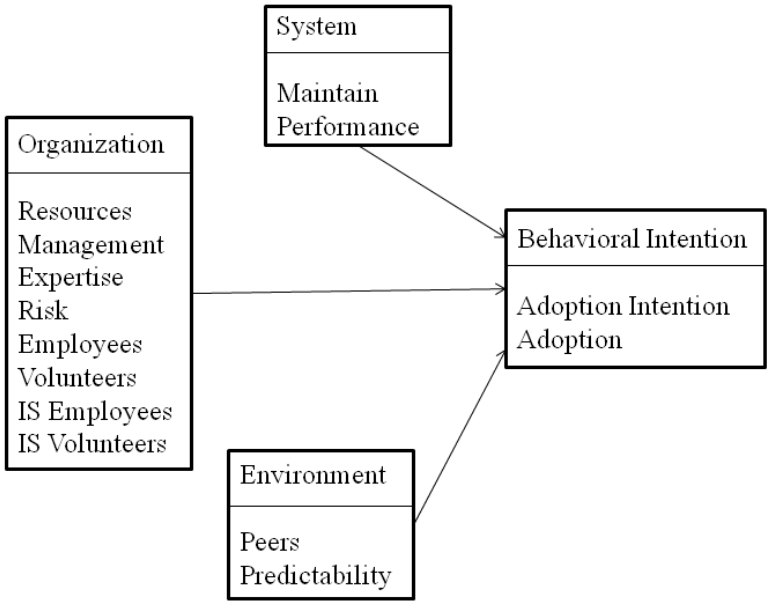

Figure 1. Research Model

MODEL

The initial model for adoption of GIS by nonprofits we propose is an adaptation of the model developed by Li, Troutt, Brandyberry and Wang's study of adoption of online direct sales channels among small and medium-sized enterprises (2011). While this study examines for-profit enterprises, the relatively small size of the organizations surveyed mirrors the resource capabilities of many typical nonprofit organizations. Although the survey in the earlier study included 19 items to measure decision factors related to the adoption decision, the current study did not allow for as extensive a list of items. Constraints in the design and administration of the survey instrument are described in the Methods section later in this paper. The survey items and scales are presented in Table 1.

Construct	Variable	Survey Questions (7-point Likert type: 1 strongly disagree; 7 strongly agree)
Organization	Resource	We have the resources necessary to run GIS/a website. [1]
	Management	Top management is interested in the implementation/use of a GIS/website. [2]
	Expertise	Rate the level of expertise employees in your organization have in GIS/websites. [1] (1= Novice, 4=Competent, 7=Expert)
	Risk	Our organization is usually willing to take risks. [1]
	Employees	Number of paid employees (FTE)
	Volunteers	Number of volunteers (FTE)
	IS Employees	Number of paid employees responsible for the information systems function (FTE)
	IS Volunteers	Number of volunteers responsible for the information systems function (FTE)
System	Maintain	Maintaining GIS/a website is/would be easy for our organization. [1]

	Performance	Using GIS/a website helps/would help our organization perform the way I would like it to perform. [1] [3]
Environment	Peers	Most of our peer organizations use GIS/have a website. [1]
	Predictability	We can predict when demand for our services changes. [4]
Behavioral Intention	Adoption Intention	I predict my organization will start to use GIS/have a website within the next two years. [1]
	Adoption	Is your organization currently using GIS/a website? (Yes/No)
[1] Adapted from Li, Troutt, Brandyberry, and Wang (2011) [2] Adapted from Grover (1993) [3] Wording adapted from Herman and Renz (2004) [4] Adapted from Newkirk and Lederer (2006)		

Table 1. Survey Items and Scales

In order to stay within the constraints of our data collection procedures, we primarily selected the highest loading items from the factors identified in the Li *et al.* (2011) study for the nonprofit organization survey instrument. These include the existence of organizational resources to run the GIS (resource and expertise), the organization's propensity for risk-taking (risk), and the adoption of the technology by similar nonprofit organizations (peers). Resource and expertise are related to the facilitating conditions determinant of satisfaction adoption identified by Chan, Thon, Venkatesh, Brown, Hu and Tan (2010) as well as the technical capacity construct developed by O'Hanlon and Chang. Resource and expertise are costs to the organization in Pick's (2006) analysis and potential barriers to developing and implementing GIS applications (Pick, Gollakota, Falatoon and Greene, 2008). Peer reflects the expected practice predictor and resource and expertise reflect the IT support predictor studied by Zorn, Flanagin, and Shoham (2011).

An additional variable (management) included in the study relates to top management support for the implementation or use of GIS. Top management support can be an important organizational influence on the adoption of IS (Grover, 1993) and is one of the best predictors of IT adoption (Jeyaraj, Rottman and Lacity, 2006). Top management support is indicative of the attitude of key internal stakeholders as examined by O'Hanlon and Chang (2007). As GIS is a relatively unfamiliar technology, determine the extent to which the decision makers in the organization may be aware of the technology as well as their support for it is an important objective.

One more item measuring one aspect of environmental uncertainty, the organization's ability to predict demand in changes for their services, was included. Environmental uncertainty has been investigated as a potential influence on IS planning (Teo and King, 1997; Newkirk and Lederer, 2006). Jeyaraj, Rottman and Lacity (2006) identify environmental instability as a promising predictor of IT adoption by organizations. Nonprofit organizations that expend greater efforts and, therefore, exhibit superior abilities to predict changes in demand, may be more likely to adopt IS as part of those efforts.

Organizational size is another of the top predictors of adoption of IS (Jeyaraj, Rottman and Lacity, 2006). In the nonprofit arena, measuring organizational size by profits or revenue is relatively meaningless. O'Hanlon and Chang examined the proportion of volunteers to total staff as a determinant of adoption. For the current study, organizational size was operationalized as total number of paid employees and volunteers and number of employees and volunteers responsible for the IS function.

The variables comprising the environmental construct (peers and predictability) correspond to the social environment as presented in Zhang, Gutierrez, and Mathieson's conceptual framework for IS effectiveness in nonprofit organizations (2010). Similarly, the organization variables (resource, management, expertise, risk, employees, volunteers, IS employees and IS Volunteers) roughly correspond to the framework's organizational environment. Finally, the system variables (maintain and performance) reflect aspects of the framework's core, the fit among workers, tasks, and technologies.

In order to measure the perceived benefits of GIS for these nonprofit organizations, the questionnaire item used in the for-profit sector needed to be reworded from using this technology "…will increase our overall sales revenues" (Li, Troutt, Brandyberry and Wang, 2011, p. 28). We adopted the definition of nonprofit organizational effectiveness employed by Herman and Renz (2004) as adapted from Tsui (1984) for the performance variable. This item is related to the performance expectancy determinant of satisfaction adoption as identified by Chan, Thon, Venkatesh, Brown, Hu and Tam (2010) and would be a benefit in Pick's (2006) study.

METHODS

Variables

As described in Figure 1 and Table 1, the dependent variable measures are adoption intention, and adoption. For purposes of comparison, nonprofit organizations indicating an intention to adopt GIS within the next two years (by selecting 5 or higher on the 7 point Likert scale for adoption intention) were combined with those nonprofit organizations which have already adopted GIS into a single dependent variable, adopt.

Independent variables include characteristics of the nonprofit organization such as resource, management, expertise, risk, employees, volunteers, IS employees, and IS volunteers. Independent variables corresponding to benefits and costs directly related to the system include maintain and performance. Finally, independent variables reflecting the external environment in which the organization operates include peers and predictability.

In order to determine whether the organization finds adoption of information technologies difficult in general, we also included items related to an additional technology adoption. We selected use adoption of a website for this purpose. Our intention was to select a relatively ubiquitous technology that requires a relatively high level of expertise and other resources to implement and manage. If the nonprofit organizations in the sample are able to implement and manage websites, they have a demonstrated ability to develop and deploy at least one type of sophisticated technology. The comparison of organization, environment, and system characteristics for GIS versus website adoption may lead to an improved understanding of the facilitators and barriers of GIS adoption.

Data Collection

The survey, comprised of items presented in Table 1 as well as a question regarding the type of nonprofit organization the respondent represented was administered to a group of nonprofit managers during a community leadership program. Completion of the survey was voluntary. 72 surveys were returned. No identifying information was collected. Timing constraints in the program schedule necessitated an abbreviated questionnaire comprised of a small number of items.

As GIS is a relatively unfamiliar technology among the general population, a short definition was included on the questionnaire "Geographic Information Systems (GIS) access spatial and attribute information, analyze it, and produce outputs with mapping and visual displays" (Pick, 2004). Types of nonprofits included human services, health, education, arts, culture and the humanities, religion-related and other. Number of workers is presented in Table 2. The organizations are relatively small. The median number of all employees was 17.5. The median number of IS employees was only 1. More than 10% of the organizations had no paid employees.

	Descriptive Statistics				
	Mean	Median	Minimum	Maximum	N
Employees	52.086 (89.983)	17.5	0	400	64
Volunteers	385.293 (962.672)	50	0	5000	58
IS Employees	1.734 (1.750)	1	0	9	63
IS Volunteers	0.472 (0.876)	0	0	3	64

Table 2. Human Resource Availability

Data Analysis

Data were analyzed using SAS statistical software.

A comparison of the current adoption status for GIS versus websites reveals apparent differences. See Table 3. While 97.18% of all responding organizations have a website currently, only 18.46% are currently using GIS. Another 9.23% predict they will use GIS within two years. Barriers to adoption of GIS by the nonprofits in this sample clearly exist.

Technology	Current Adoption Status		
	Currently Using	Predict Use Within 2 Years	Total
GIS (n = 65)	18.46% 12	9.23% 6	27.69% 18

Website (n = 71)	97.18% 69	0.00% 0	97.18% 69

Table 3. Adoption Status for GIS and Websites

Paired t-tests were performed to determine if differences in the organization's views of their organization characteristics, the characteristics of the technology, and the environment are significant between GIS-related characteristics and website-related ones. See Table 4. Every characteristic is viewed significantly differently. The nonprofits view their resource capabilities to run GIS as significantly lower than their capabilities to run websites. They believe management has less interest in GIS and their employees have less expertise in GIS than in websites. They believe their peers use of websites is higher than of GIS. They also believe that websites help their organizations' performance more than GIS would. Nevertheless, they did agree on average that GIS would help the organization to perform well (4.351 on a 7.0 scale).

Construct	Variable	Information System		*t*	*df*
		GIS	Website		
Organization	Resource	2.750 (1.724)	4.683 (1.834)	-8.677***	59
	Management	3.534 (1.993)	6.000 (1.578	-9.505***	57
	Expertise	2.035 (1.569)	4.175 (1.670)	-9.780***	56
System	Maintain	2.885 (1.664)	4.656 (1.721)	-9.513***	60
	Performance	4.351 (1.876)	5.982 (1.433)	-6.169***	56
Environment	Peers	2.722 (1.595)	5.907 (1.418)	-10.817***	53
*** p < .0001					

Table 4. Paired t-Tests: GIS versus Website

In order to examine the proposed research model, we performed additional t-tests comparing GIS adopters versus non-adopters. See Table 5. With the exception of a few of the human resource variables, significant differences were observed. The number of paid IS employees is significantly higher for organizations which have or plan to adopt GIS than for those which do not. Nevertheless, no difference was detected in number of employees, number of volunteers, or number of volunteers responsible for the IS function between adopters and non-adopters.

Adopters of GIS indicated their organizations have the resources, expertise, and management support for GIS to a greater extent than non-adopters. Their organizations were more likely to take risks than non-adopters. GIS adopters believed their ability to predict changes in demand for their services was higher than non-adopters. Organization, system, and environment variables all distinguish between GIS adopters and non-adopters.

Construct	Variable	Overall Mean	GIS Adopters	GIS Non-Adopters	*t*	*df*
Organization	Resources	2.750 (1.723) n = 60	4.875 (1.408) n = 16	2.000 (1.047) n = 43	-8.52***	57
	Management	3.542 (1.977) n = 59	5.588 (1.623) n = 17	2.714 (1.436) n = 42	-6.71***	57
	Expertise	2.085 (1.633) n = 59	4.177 (1.590) n = 17	1.238 (0.484) n = 42	-7.48***	17.21
	Risk	4.739 (1.462) n = 69	5.500 (1.317)) n = 16	4.553 (1.411) n = 47	-2.36*	61
	Employees	52.086 (89.983) n = 64	39.346 (44.501) n = 13	60.056 (103.57) n = 45	1.048 (n.s.)	47.33

	Volunteers	385.293 (962.672) n = 58	436.692 (1372.500) n = 13	318.625 (761.880) n = 40	-0.296 (n.s.)	14.48
	IS Employees	1.734 (1.750) n = 63	3.269 (2.403) n = 13	1.416 (1.302) n = 44	-2.67**	14.14
	IS Volunteers	0.472 (0.876) n = 64	0.600 (0.986) n = 15	0.377 (0.763) n = 43	-0.903 (n.s.)	56
System	Maintain	2.885 (1.664) n = 61	4.824 (1.237) n = 17	2.163 (1.111) n = 43	-8.100***	58
	Performance	4.379 (1.872) n = 58	5.882 (1.327) n = 17	3.825 (1.678) n = 40	-4.49***	55
Environment	Peers	2.691 (1.597) n = 55	4.333 (1.543) n = 15	2.075 (1.118) n = 40	-5.99***	53
	Predictability	4.449 (1.345) n = 69	5.188 (1.1673) n = 16	4.213 (1.284) n = 47	-2.680**	61
	* $p < 0.05$, ** $p < 0.01$, ***$p < 0.001$					

Table 5. t-Tests: GIS Adopters versus Non-Adopters

DISCUSSION

The adoption of GIS by nonprofit organizations surveyed for this study is significantly less than the adoption level of another technology, websites. The organization characteristics related to GIS adoption such as resource, management, and expertise are all rated significantly lower than the corresponding characteristics related to website adoption. System characteristics including maintain and performance are also rated lower for GIS than for websites. The environment characteristic, peers is rated lower for GIS as well. The nonprofit organizations in this study do not have high confidence in their ability to run or maintain GIS, they do not believe top management supports GIS use or that their peer organizations use GIS. Although they rated the predicted contribution of GIS to their organization's performance lower than the contribution of websites, the mean rating for predicted contribution of GIS was positive. Many of these organizations believe GIS could assist them in performing better, but do not believe they have the resources to acquire and deploy this spatial technology effectively.

Adopters of GIS have a greater number of paid IS employees than non-adopters. One important resource likely necessary for GIS adoption is a professional and sufficient IS staff.

Nonprofits adopting GIS are more willing to take risks than non-adopters. Perhaps GIS is viewed as a risky technology by nonprofits. Only those organizations with greater propensity for risks are willing to adopt at this stage in the development of GIS.

Adopters are more confident in their abilities to predict changes in demands for their services than non-adopters. GIS use may assist in predicting changes in demand. Spatial analysis and visualization may improve monitoring and decision making for nonprofits.

FUTURE RESEARCH

While the results of this exploratory research point to a number of predictors of GIS adoption by nonprofit organizations, only a few components of these predictors were examined. Future research should employ complete multi-item scales to measure these predictors and include a larger sample of nonprofit organizations to validate and better understand the results. In addition, a larger sample would allow stratification by organization size to control for possible effects.

Future research should examine the extent of geography in the nonprofit organization to determine if Pick's (2007) findings in the private sector hold true for the nonprofit sector. Examining additional nonprofit characteristics such as the structure of the organizations and the sectors in which they operate as well as the extent to which geographic and spatial-related tasks comprise their activities leading to better task-technology fit may be related to intent to adopt GIS.

The current study examined the adoption of GIS in general. Examining adoption of specific GIS technologies such as Google Earth or ArcGIS would likely reveal differences in attitudes regarding the necessary resources and predicted benefits of the technology.

Finally, the relationship between GIS adoption and the organization's ability to predict changes in demand should be explored.

CONTRIBUTIONS

Much of the research on the use of GIS and spatial technologies in organizations to date has been case studies. The current research employs a survey with items adapted from previously published research to examine the use of these technologies in an empirical manner. This exploratory study provides evidence of predictors of GIS use.

The existing research on IS-related issues in the nonprofit sector is scant (Zhang, Gutierrez, and Mathieson, 2010). The current study is one attempt to rectify the situation.

REFERENCES

1. Bishop, S. (2010) Building programmatic capacity at the grassroots level: The reaction of local nonprofit organizations to public participation geographic information systems, *Nonprofit and Voluntary Sector Quarterly*, 39, 6, 991-1013.

2. Brown, B., and Brudney, J. (1998) A "smarter, better, and cheaper" government: Contracting and Geographical Information Systems, *Public Administration Review*, 58, 4, 335-345.

3. Burt, E. and Taylor, J. A. (2000) Information and communication technologies: Reshaping voluntary organizations?, *Nonprofit Management & Leadership*, 11, 2, 131-143.

4. Chan, F. K. Y., Thong, J. Y. L., Brown, S. A., Hu, P. J and Tam, K. Y. (2010) Modeling citizen satisfaction with mandatory adoption of an e-government technology, *Journal of the Association for Information Systems*, 11, 10 519-549.

5. Cortés, M., and Rafter, K. (2007) Introductionin, Michael Cortés and Kevin Rafter (Eds.) Nonprofits and technology: Emerging research for usable knowledge, Lyceum Books, Chicago.

6. DiMaggio, P., and Powell, W. (1983) The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields, *American Sociological Review*, 48, 2, 147-160.

7. Grover, V. (1993) An empirically derived model for the adoption of customer-based interorganizational systems, *Decision Sciences*, 24, 3, 603-640.

8. Herman, R., and Renz, D. (1999). Theses on nonprofit organizational effectiveness. *Nonprofit and Voluntary Sector Quarterly*, 28, 2, 107-126.

9. Herman, R. D. and Renz, D. O. (2004) Doing things right: Effectiveness in local nonprofit organizations, A panel study, *Public Administration Review*, 64, 6, 694-704.

10. Jeyaraj, A., Rottman, J. W. and Lacity, M. C. (2006) A review of the predictors, linkages, and biases in IT innovation adoption research, *Journal of Information Technology*, 21, 1-23.

11. Li, X., Troutt, M. D., Brandyberry, A. and Wang, T. (2011) Decision factors for the adoption and continued use of online direct sales channels among SMEs, *Journal of the Association for Information Systems*, 12, 1, 1-31.

12. Lin, W., and Ghose, R. (2008) Complexities in sustainable provision of GIS for urban grassroots organizations, *Cartographica*, 43, 1, 31-44.

13. Meyer, J., and Rowan, B. (1977) Institutionalized organizations: Formal structure as myth and ceremony, *The American Journal of Sociology*, 83, 2, 340-363.

14. National Center for Charitable Statistics. (2012) Business Master Files. Retrieved from: http://nccsdataweb.urban.org/PubApps/dd2.php?close=1&form=BMF+12/2011+501c3, February 29, 2012.

15. Newkirk, H. E. and Lederer, A. L. (2006) The effectiveness of strategic information systems planning under environmental uncertainty, *Information & Management*, 43, 481-501.

16. O'Hanlon, R. and Chang, V. (2007) Towards a model of internet technology adoption for not-for-profit organizations in *Proceedings of the Eighteenth Australasian Conference on Information Systems*, December 5-7, Toowoomba, Queensland, Australia, 266-276.

17. Pick J. (2004) Geographic Information Systems: A Tutorial and Introduction, *Communications of the Association for Information Systems*, 14, article 16.

18. Pick, J. (2006) A Case-Study Analysis of Costs and Benefits of Geographic Information Systems: Relationships to Firm Size and Strategy in *Proceedings of the Twelfth Americas Conference on Information Systems*, August 4-6, Acapulco, Mexico, 1616-1623.

19. Pick, J. (2007) Spatial technologies: An evolutionary framework and case study analysis of company strategies in *Proceedings of the Thirteenth Americas Conference on Information Systems*, August 9-12, Keystone, Colorado, USA, paper 362.

20. Pick, J. B., Gollakota, K., Falatoon, H. and Greene, R. (2008) Readiness of small enterprises for GIS: The question of strategy in *Proceedings of the Fourteenth Americas Conference on Information Systems*, August 14-17, Toronto, Ontario, Canada, paper 244.

21. Sieber, R. (2000) GIS implementation in the grassroots, *Urban and Regional Information Systems Association (URISA) Journal*, 12, 1, 15-29.

22. Teo, T. S. H. and King, W. R. (1997) Integration between business planning and information systems planning, *Journal of Management Information Systems*, 14, 1, 185-214.

23. Thompson, J. (1967) Organizations in action: Social science bases of administrative theory, McGraw Hill, New York.
24. Trussel, J. (2002) Revisiting the prediction of financial vulnerability, *Nonprofit Management & Leadership*, 13, 1, 17-31.

25. Tsui, A. S. (1984) A role set analysis of managerial reputation, *Organizational Behavior & Human Performance*, 34, 1, 64-96.

26. Zhang, W., Gutierrez, O. and Mathieson, K. (2010) Information systems research in the nonprofit context: Challenges and opportunities, *Communications of the Association for Information Systems*, 27, 1, 1-12.

27. Zorn, T. E., Flanagin, A. J. and Shoham M. D. (2011) Institutional and noninstitutional influences on information and communication technology adoption and use among nonprofit organizations, *Human Communication Research*, 37, 1-33.