The Influence of Perceived Characteristics of Innovating on e-Government Adoption

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Abstract: Government agencies around the world are making their services available online. The success of e-Government initiatives is contingent upon citizens' willingness to adopt these Web-enabled services. This study uses Moore and Benbasat's (1991) perceived characteristics of innovating constructs to identify factors that influence citizen adoption of e-Government initiatives. To pilot test our adoption model we administered a survey to 140 undergraduate students at an accredited research university. This paper discusses the results of the study and their implications for research and practice.

Keywords: e-Government, electronic government services, diffusion of innovation, adoption

1. Introduction

e-Government is the use of information technology, especially telecommunications, to enable and improve the efficiency with which government services and information are provided to citizens, employees, businesses, and government agencies. The United States federal, state and local government agencies have implemented numerous e-Government initiatives to enable the purchase of goods and services, the distribution of information and forms, and the submission of bids and proposals. There are predictions of more than $600 billion of government fees and taxes to be processed through the Web by 2006 (James 2000). In the U.S., federal government spending is predicted to reach $2.33 billion in 2005 (Gartner 2002).

While there seems to be substantial growth in the development of e-Government initiatives, it is not clear that citizens will embrace the use of such services. The success and acceptance of e-Government initiatives, such as online voting and license renewal, are contingent upon citizens' willingness to adopt these services. Numerous studies have analyzed user adoption of electronic commerce (Gefen & Straub 2000; Gefen et al. 2003; McKnight et al. 2002; Pavlou 2003). Yet, to date, few studies have explored the core factors that influence citizen adoption of e-Government services. According to a survey conducted by the International City/County Management Association (ICMA) administered to chief administrative officers (CAO) at government agencies, 74.2 % of CAOs reported that their government agency had a Web site. However, 90.5 % of these agencies have not conducted a survey to see what online services citizens and businesses actually want (ICMA 2002).

This study uses Moore and Benbasat's (1991) perceived characteristics of innovating (PCI) to identify fundamental elements of e-Government adoption[1]. These constructs have been used in IT research (Karahanna et al. 1999; Moon & Kim 2001; Pavlou 2003) and e-Commerce research (Van Slyke et al. 2004). Based on similarities between e-Commerce and e-Government, PCI constructs are proposed as useful indicators of e-Government adoption.

2. Theoretical foundations

2.1 e-Commerce and e-Government

2.1.1 Similarities

e-Commerce and e-Government are both based on Internet technology designed to facilitate the exchange of goods, services and information between two or more parties. e-Commerce refers to the commercial use of Internet technology to sell and purchase goods or services. Laudon and Laudon (2003) identify three major electronic commerce categories: business-to-consumer (B2C), business-to-business (B2B), and customer-to-customer (C2C). B2C commerce refers to the retailing of products or services from businesses to individual shoppers. B2B commerce is the sale of goods and

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services among businesses. In C2C commerce, consumers sell goods and services to other consumers online.

Comparable categories for electronic government - government-to-citizen (G2C), government-to-employee (G2E), government-to-government (G2G), and government-to-business (G2B) - each of which uses Internet technology to provide government services online, have been identified (General Accounting Office 2001). G2C government allows citizens to retrieve information and complete government transactions, such as license renewal, online. G2E government takes advantage of Internet technology by allowing government agencies to interact with their employees online. G2G government supports online communication and interaction among government agencies. G2B government allows businesses to retrieve timely government information and complete transactions with government agencies, such as bid submission, online. Other agencies and studies have identified variations on these categories (Hiller & Belanger 2001; Office of Management and Budget, 2002).

Not only are e-Commerce and e-Government categorized in similar ways, but they also provide similar services to individuals and organizations. Both e-Commerce and e-Government systems support the electronic mediation of transactions over potentially great distances. Both services also require consumer or citizen trust (Belanger et al. 2002; McKnight et al. 2002; Pavlou 2003; Van Slyke et al. 2004; Warkentin et al. 2002) due to the absence of face-to-face interaction.

2.1.2 Differences

Jorgenson and Cable (2002) identify three major differences between e-Commerce and e-Government: access, structure and accountability. In e-Commerce , businesses are allowed to choose their customers; however, in e-Government, agencies are responsible for providing access to information and services to the entire eligible population, including individuals with lower incomes and disabilities. The digital divide makes this task of providing universally accessible online government services challenging. Also, the structure of businesses in the

private sector is different from the structure of agencies in the public sector. Decision-making authority is less centralized in government agencies than in other businesses. This dispersion of authority impedes the development and implementation of new government services. The third difference between e-Commerce and e-Government identified by Jorgensen and Cable (2002) is accountability. In a democratic government, public sector agencies are constrained by the requirement to allocate resources and provide services that are "in the best interest of the public" (Jorgenson & Cable 2002).

Warkentin et al. (2002) recognize the political nature of government agencies as a distinguishing feature of e-Government from e-Commerce . They also note mandatory relationships exist only in e-Government. For instance, legislation, such as the Government Paperwork Elimination Act of 1998, obligates government agencies to "give persons who are required to maintain, submit, or disclose information the option of doing so electronically, when practicable, by October 21, 2003" (Fletcher 2002).

2.1.3 Constructs

Previous research has found that PCI factors play a role in user acceptance of electronic commerce in the private sector (Gefen et al. 2003; Van Slyke et al. 2004). In the public sector, citizen adoption of e-Government should be subject to similar factors (Warkentin et al. 2002). Therefore, considering the similarities between electronic commerce and electronic government, we use these constructs in our study of e-Government adoption.

2.2 Perceived Characteristics of Innovating (PCI)

Moore and Benbasat's (1991) perceived characteristics of innovating (PCI) are based on Rogers' (1995) Diffusion of Innovation Theory (DOI), which is used frequently in information systems research to explain user adoption of technological innovations. Diffusion refers to "the process by which an innovation is communicated through certain channels over time among the members of a social society (Rogers 1995)." An innovation is "an idea, practice or object that is perceived as new by an individual or other

unit of adoption (Rogers 1995)." Moore and Benbasat (1991) identify eight PCI factors that influence the diffusion of an innovation: relative advantage, compatibility, ease of use, result demonstrability, image, visibility, trialability, and voluntariness.

Based on previous research (Karahanna 1999; Moore & Benbasat 1991; Plouffe et al. 2001; Tornatzky & Klein 1982; Van Slyke et al. 2004) we study the effects of relative advantage, compatibility, ease of use and image on citizen intention to use a state e-Government service. Tornatzky and Klein (1982) suggest that relative advantage, compatibility, and ease of use are the most relevant constructs to adoption research, thus we include these three constructs in our study. Relative advantage is "the degree to which an innovation is seen as being superior to its

predecessor"; Compatibility refers to "the degree to which an innovation is seen to be compatible with existing values, beliefs, experiences and needs of adopters"; and perceived ease of use is "the degree to which a person believes that using a particular system would be free of effort (Davis 1989)." Given the amount of coverage Web-based systems have received in the popular press, we also include image in our model. Image refers to the "degree to which the use of the innovation is seen as enhancing to an individual's image or social status" (Van Slyke et al. 2004).

3. Research model

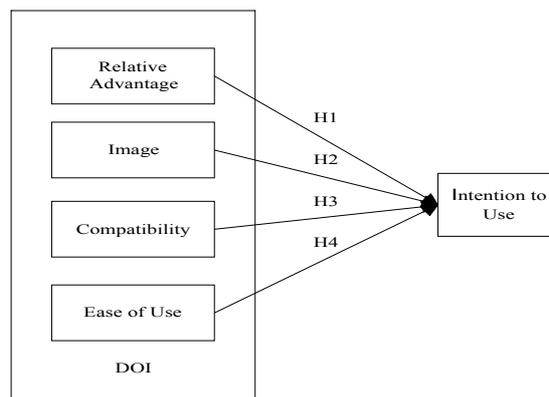Figure 1 presents a high-level research model that summarizes the constructs discussed above.

Figure 1: DOI and e-Government adoption

4. Hypotheses

In prior technology adoption literature (Karahanna et al. 1999; Moon & Kim 2001; Trinkle 2001) the factors illustrated in Figure 1 all demonstrate a positive relationship with use intentions. We expect

the nature of these relationships to remain the same in the context of electronic government. Therefore, based on prior research in e-Commerce and information technology adoption, four hypotheses are posited (Table 1).

Table 1: Hypotheses

Name	Hypothesis	Construct
H1.	Higher levels of perceived relative advantage will be positively related to higher levels of intention to use a state e-Government service.	Relative Advantage (RA)
H2.	Higher levels of perceived image will be positively related to higher levels of intention to use a state e-Government service.	Image (IM)
H3.	Higher levels of perceived compatibility will be positively related to higher levels of intention to use a state e-Government service.	Compatibility (CT)
H4.	Higher levels of perceived ease of use will be positively related to higher levels of intention to use a state e-Government service.	Ease of Use (EOU)

5. Methodology

5.1 Sample

To pilot test our model, we administered a survey instrument to 140 undergraduate students at a southeastern research university. Of the 140 surveys administered, 136 were complete and used in the analyses. The subjects had an average of 9 years of experience using a computer; the average age was 19; and, 63% were male. 98% of the sample uses the Web everyday; however, the majority (52%) use the Web to gather information about or from the government less than once a month, and 32 % have never used the Web to gather information about or from the government. Also, 89% have never used the Web to complete a government transaction, such as a license renewal.

5.2 Instrument development

The items used in this survey were adapted from previous studies. The measures of compatibility, relative advantage, and image were adapted from Van Slyke et al. (2004). Ease of use was measured using items adapted from Davis' TAM model (Davis 1989). The items used to measure use intentions were adapted from Pavlou (2003) and Gefen and Straub (2000). A list of the items is provided in the appendix. Each item is rated on a scale of 1 to 7 (Strongly Disagree to Neutral to Strongly Agree).

The reliability of the items was evaluated using Cronbach's alpha (Cronbach 1970). Table 2 presents the results of the reliability analysis, demonstrating acceptable reliabilities (above 0.70) for all scales.

Table 2: Reliability Analysis

Construct	**# of Items**	**Reliability**
Relative Advantage (RA)	5	.7773
Image (IM)	4*	.7824
Compatibility (CT)	4	.7469
Ease of Use (EOU)	4*	.7222
* Originally this construct was measured with five items. One reverse worded item was dropped to improve reliability.		

Factor analysis using principle components with Promax rotation was used to evaluate construct validity. As shown in Table 3, most items loaded properly on their expected factors. However, relative advantage items and compatibility items loaded together.

Table 3: Factor Analysis

Item	Factor Loading			
	USE	RA/CT	IM	EOU
USE1	.754			
USE2	.833			
USE3	.778			
USE5	.723			
RA1		.796		
RA2		.836		
RA4		.842		
RA5		.765		
IM1			.832	
IM2			.400	
IM3			.837	
IM5			.828	
CT1		.713		
CT2		.537		
CT3	.741			
CT4		.510		
EOU1				.701
EOU3				.697
EOU4				.680
EOU5				.697

Relative advantage and compatibility items also loaded together in other IT adoption research (Karahanna et al. 1999; Moore & Benbasat's 1991) study. Moore and Benbasat conducted a rigorous study using multiple judges and multiple sorting rounds to develop reliable measures of diffusion of innovation constructs (Rogers 1995). Although the items for RA and CT were identified separately by the judges and sorters, all the items for these two constructs loaded together. Moore and Benbasat concluded, "this may mean that, while conceptually different, they are being viewed identically by respondents, or that there is a causal relationship between the two (Moore & Benbasat 1991). " For example, "it is unlikely that respondents would perceive the various advantages of using [state e-Government services], if its use were in fact not compatible with the respondents' experience or [life] style (Moore & Benbasat 1991)."

In summary, model and hypotheses testing was conducted with four independent variables - perceived relative advantage, perceived image, perceived compatibility and perceived ease of use -

and one dependent variable – use intentions. The basic characteristics of these variables are presented in Table 4.

Table 4: Final Regression Variables

Variable	# Items	Mean	Stand. Dev.
RA	4	5.0821	0.9240
IM	3	2.9333	1.1686
CT	2	4.6000	1.0217
EOU	2	5.6179	1.0047
Use	3	4.8714	1.0492

6. Results

The data were analyzed using multiple linear regression analysis. The purpose of a regression analysis is to relate a dependent variable to a set of independent variables (Mendenhal & Sincich 1993). Regression analysis was seen as the most appropriate analytical technique since the goal of this study was to determine the relationship between use intention (dependent variable) and citizen perceptions of state e-Government initiatives (independent variables).

Assumptions of multivariate normal distribution, independence of errors, and equality of variance were first tested. There were no violations of these assumptions. Multicollinearity was not a concern with this data set as confirmed by the main effect regression models with variance inflation factors (VIF range from 1.012 to 2.310). Outlier influential observations were identified with leverage, studentized residuals, and Cook's D-statistic. This analysis indicated that there were no problems with respect to influential outliers.

The model explains 50 percent of the variance in citizen adoption of e-Government; adjusted R Square is .500, F=35.714, p<.0001. Three of the four adoption factors - relative advantage, image and compatibility - were found to be significant in predicting citizen intention to use state e-Government services. Table 5 presents the results of the individual hypotheses being tested.

Table 5: Hypothesis Testing

	Variable	Coeff.	t-value	Sig.	Supported
H1	RA	.255	2.671	.009	YES
H2	IM	.206	3.421	.001	YES
H3	CT	.439	4.811	.000	YES
H4	EOU	.066	.817	.416	NO

7. Discussion

The purpose of this research was to use PCI constructs to test a model of e-Government adoption. Perceived relative advantage, image, and compatibility were found to be significant in predicting citizen intention to use state e-Government services. These factors are summarized in Figure 2. We discuss the results in this section, and present suggestions for practitioners with respect to what can be done to improve citizens' perceptions in section 9.2 (Implications for Practice).
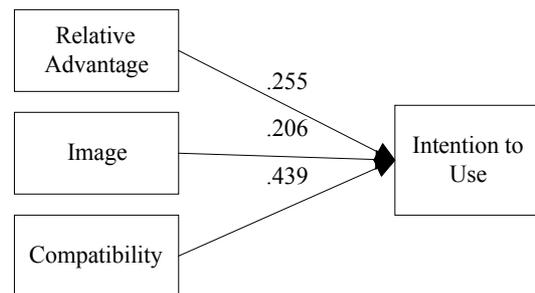
Figure 2: DOI and e-Government adoption

7.1 Relative advantage

Higher levels of perceived relative advantage increase citizens' intentions to use state e-Government services. State government agencies should identify and communicate to citizens the advantages of using online services as opposed to other means of retrieving information from and completing transactions with state government agencies. As a result of e-Government services, citizens receive faster, more convenient services from a more responsive and informed government (Trinkle 2001). For example, state agencies could encourage the adoption of online license renewal by emphasizing its convenience and speed compared to the traditional method of visiting the brick-and-motor Department of Motor Vehicles (DMV) office. Online license renewal can be completed from the home or office 24 hours a day, seven days a week. The availability of the service isn't limited to standard business hours. The citizen can complete this transaction whenever and from wherever it is most convenient. The online service is also quicker than the traditional method since citizens don't have to travel to a physical branch of the DMV and then wait in line. The online service is immediately available to each citizen individually. The

comparative benefits of other online services such as license renewal or tax filing should be shared with citizens by appropriate agencies to increase adoption of these services.

7.2 Image

Higher levels of perceived image enhancing value of e-Government increase citizens' intention to use state government services online. In other words, those who regard the use of state e-Government services as prestigious will have higher intention to use state e-Government services than those who do not. For example, citizens who view the adoption of e-Government services as a way to appear technically savvy and/or politically progressive will demonstrate a higher intention to use e-Government services.

7.3 Compatibility

Higher levels of perceived compatibility are associated with increased intentions to adopt state e-Government initiatives. Many cultures now embrace Internet technology in business (e-Commerce and e-business) and leisure (instant messaging and virtual communities). Citizens who've adopted these Internet-supported initiatives are likely to adopt state e-Government services as well. Citizens who have adopted e-Commerce initiatives can be expected to view e-Government initiatives as compatible with their lifestyle. E-Commerce adopters are comfortable searching for information and services, providing personal information and conducting transactions electronically. These citizens will have higher intentions to use e-Government services than those who view these services as incompatible with their lifestyle.

7.4 Ease of use

Contrary to hypothesis 4, higher levels of perceived ease of use are not significantly associated with increased use intentions of e-Government services. This unpredicted outcome could be the result of the use of college students as subjects. Our sample consisted of experienced computer users whose perceptions of ease of use probably differ from the overall population of citizens. The subjects have an average of nine years of experience using a computer and 98 % of the sample

uses the Web everyday. Since these college students are confident in their ability to use online services, apprehension provoked by potential complexity is not a significant deterrent of e-Government adoption.

8. Limitations

Our sample consisted of undergraduate students and the use of student subjects may limit the generalizability of the results. Although several studies in technology acceptance have used student subjects (Davis 1989; Gefen & Straub 2000; Moon & Kim 2001; Trinkle 2001) college student demographics, such as experience using the Internet, differ from the demographics of the overall population of citizens. A majority of college students frequently use and have easy access to Internet services. However, there are many citizens who are members of the digital divide, in the United States and other countries, who do not have easy access to or much experience with Internet technology. This study is the pilot of a larger scale study of citizen adoption of e-Government initiatives. The next phase of data collection will elicit participation from a broad diversity of citizens in age, gender, ethnicity, and social groups.

9. Implications

9.1 Implications for research

This study presents an introductory model that explains 50 percent of the variance in citizen adoption of state e-Government initiatives. This model can serve as a starting point for other e-Government adoption research, while encouraging further exploration and integration of additional adoption constructs. In the future, we plan to integrate constructs from the technology acceptance model (Davis 1989) and the Web trust literature (Belanger et al. 2002; Gefen et al. 2003; McKnight et al. 2002) to develop a more comprehensive, yet parsimonious model of e-Government adoption.

9.2 Implications for practice

The study reveals three significant indicators of citizens' intention to use state government services online. State agencies should promote citizen acceptance and use of e-Government services by manipulating these factors:

perceived relative advantage, perceived image, and perceived compatibility. Specifically, state government agencies should capitalize on the unique benefits of online services, promoting their use as a status symbol, and indicating the services' congruence with a citizen's lifestyle. They could send citizens a letter explaining the speed, convenience and accessibility of online government services. In this letter, government agencies could also increase citizens' perceptions of compatibility by noting the similarities between traditional government services and online government services. For instance, online license renewal may utilize the same form used in the manual process to allow citizens to easily incorporate e-Government services usage into their life. Another way to enhance perceived compatibility could be to provide tangible verification of transaction completion. Many citizens are accustomed to receiving a paper receipt that can be utilized to verify a transaction. The lack of this tangible record may make many citizens reluctant to engage in electronic transactions. Agencies could still make paper receipts available to citizens upon request via mail or fax. To enhance the perceived image of e-Government adopters, agencies could pursue endorsements from local celebrities or well-respected citizens in the community advocating the use of state e-Government services.

10. Conclusion

This study uses constructs from Moore and Benbasat's (1991) perceived characteristics of innovating to develop a parsimonious model of citizen adoption of state e-Government services. Perceived relative advantage, perceived image, and perceived compatibility are significant elements of e-Government adoption. The model explains 50 percent of the variance in citizen intention to use e-Government services. As e-Government grows in importance and priority for governments worldwide, an understanding of the factors that influence citizen adoption of these online services is invaluable.

11. Acknowledgements

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12. Appendix

State e-Government adoption items

Use Intentions (USE)

I would use the Web for gathering state government information.
I would use state government services provided over the Web.
Interacting with the state government over the Web is something that I would do.
I would use the Web to inquire about state government services.

Relative Advantage (RA)

Using the Web would enhance my efficiency in gathering information from state government agencies.
Using the Web would enhance my efficiency in interacting with state government agencies.
Using the Web would make it easier to interact with state government agencies.
Using the Web would give me greater control over my interaction with state government agencies.

Image (IM)

People who use the Web to gather information from state government agencies have a high profile.
People who use state government services on the Web have a high profile.
People who use the Web to gather information from state government agencies have more prestige than those who do not.
Interacting with state government agencies over the Web enhances a person's social status.

Compatibility (CT)

I think using the Web would fit well with the way that I like to gather information from state government agencies.
I think using the Web would fit well with the way that I like to interact with state government agencies.
Using the Web to interact with state government agencies would fit into my lifestyle.
Using the Web to interact with state government agencies would be incompatible with how I like to do things.

Ease of Use (EOU)

Learning to interact with a state government Website would be easy for me.
I believe interacting with a state government Website would be a clear and understandable process.
I would find most state government Websites to be flexible to interact with.
It would be easy for me to become skillful at using a state government Website.