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Trust and Risk in eGovernment Adoption

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ABSTRACT

Citizen confidence in the competence of the government and the reliability of the technology used to implement e-government initiatives is imperative to the wide-spread adoption of e-government. This study analyzes how citizens' trust in technology and government affect their willingness to engage in e-government transactions. We proposes a model of e-government trust composed of disposition to trust, institution-based trust (IBT), characteristic-based trust (CBT) and perceived risk. Data were collected via a survey of 214 citizens ranging in age from 14 to 83 old. The model was tested using Structural Equation Modeling techniques. Results indicate that disposition to trust positively affects IBT and CBT trusts, which in turn affect intentions to use an e-government service. CBT trust also affects negatively perceived risk, which affects use intentions as well. Implications for practice and research are discussed.

Keywords

E-government, adoption, trust, risk

INTRODUCTION

E-government growth is prevalent at all levels of government in the United States. Federal spending is predicted to reach $2.33 billion in 2005 (Gartner, 2000), while state and local spending is predicted to more than double by 2008 (Bailor, 2004). As technological advancements diffuse through society, concerns of identity theft and privacy loss rise (Myron, 2004). Recently, phishing, hacking, and spamming have received a considerable amount of attention from the media. In 2003, the Federal Trade Commission (FTC) received 516,740 consumer fraud and identity theft complaints. Of the fraud complaints, 55 percent were Internet-related, up from 45 percent in 2002 (Myron, 2004). Citizens seek a sense of assurance that their interaction with e-government services is safe; they want credible information and secure transactions. Therefore, while e-government has the potential to improve government transparency, responsiveness, and accountability to citizens, e-services will only be adopted if citizens deem them trustworthy.

Unlike traditional means of interacting with the government, e-services are unique due to the distant and impersonal nature of the Internet and the inherent uncertainty of using an open technological infrastructure (Pavlou 2003). The literature identifies trust as an essential element of a relationship when risk is present (Mayer et al., 1995; Pavlou 2003; Siau and Shen, 2003; Warkentin et al. 2002). Numerous studies have explored the role of trust in e-commerce (Bélanger et al., 2002; Chadwick, 2001; Gefen and Straub, 2002; Gefen et al., 2003; Hoffman et al. 1999; Jarvenpaa et al., 2000; Pavlou 2003; Pavlou and Gefen, 2004; Tan and Theon, 2001; Van Slyke et al., 2004). However, researchers are just beginning to empirically explore the role of trust in e-government adoption (Carter and Bélanger, 2005; Welch et al., 2004; Warkentin et al. 2002). Some studies have included trust in broader adoption models, such as the technology acceptance model and the diffusion of innovation theory (Gefen et al., 2002; Pavlou, 2003; Warkentin et al., 2002), but few, if any, have focused solely on the implications of trust regarding e-government adoption. This study proposes a parsimonious yet explanatory model of trust and risk in e-government adoption. The model identifies four fundamental constructs that impact intention to use e-government services: disposition to trust, institution-based trust, characteristic-based trust and perceived risk.

BACKGROUND LITERATURE

Trust is defined as an expectancy that the promise of an individual or group can be relied upon (Rotter 1967). This definition is rooted in social learning theory which suggests that experiences of promised negative or positive reinforcements vary for different individuals and, as a result, people develop different expectancies that such reinforcements would occur when promised by other people (Rotter 1967). Rotter's research is referenced in numerous studies of trust (Johnson-George and

Swap, 1982; Rotter 1980; Castelfranchi and Pedone, 2000; Mayer et al. 1995; McKnight and Cummings, 1998; Zucker, 1986).

This study focuses on users' initial trust in an e-government service. Initial trust refers to trust in an unfamiliar trustee. Initial trust is required in a relationship in which the citizen does not yet have credible or meaningful information about the e-service provider (McKnight et. al. 2002). In initial relationships people use whatever information they have, such as perceptions of the website or the government agency, to assess the trustworthiness of the trustee (McKnight et. al. 2002). During initial encounters, trust is largely based on characteristics of the trustor (their disposition to trust), assumptions made about the traits of the trustee (characteristics-based trust), and institutional factors (institution-based trust) (Grazioli and Jarvenpaa, 2000).

It has been suggested there are two targets of trust: the entity providing the service (party trust) and the mechanism through which it is provided (control trust) (Tan and Theon, 2001). Thus, users should consider both the characteristics of the Web vendor and characteristics of the supporting technological infrastructure before using an electronic-service (Pavlou, 2003). Trust in an e-service is therefore composed of the traditional view of trust in a specific entity (characteristic-based) as well as trust in the reliability of the enabling technology (institution-based) (Carter and Bélanger, 2005; Pavlou, 2003). Consequently, in the context of e-government, adoption is affected by citizens' trust of both the government and the Internet (Carter and Bélanger, 2005).

Zucker (1986) describes three different modes of trust: characteristic-based, institution-based, and process-based. Characteristic-based trust refers to one's belief in the integrity and veracity of the trustee. Institution-based trust refers to one's belief that established guidelines and potential penalties exist to discourage opportunistic behavior. Finally, the process mode refers to the trustor's familiarity and experience with the trustee. In new relationships, there is no interaction with which to support the process mode (McKnight et al., 1998), so process-based trust does not apply to this study's context.

Institution-Based Trust

Institution-based trust is associated with an individual's perceptions of the institutional environment, such as the structures, regulations, and legislations that make an environment feel safe and trustworthy. This construct contains two dimensions: structural assurance and situational normality. Structural assurance is grounded in the belief that regulations, promises, legal recourse and other procedures are in place to encourage honesty (McKnight et. al. 2002). Situational normality presumes the environment is normal, favorable, and in proper order (McKnight et. al. 2002). In the context of e-government, the Internet constitutes the institutional environment.   E-government adoption is contingent upon citizens' belief that the Internet is a dependable medium, capable of providing accurate information and secure transactions.

> *H1: Institution-based trust (IBT) will positively influence citizen intention to use (USE) an e-government service.*

Characteristic-based Trust

Wide-spread e-government adoption is also impacted by citizens' confidence in the benevolence, integrity, and competence of the agencies providing theses services. These factors - benevolence, integrity, and competence - have been significant in numerous studies (Beccerra & Gupta, 1999; Ganesan & Hess, 1997; Jarvenpaa et al., 1998; Lee & Turban, 2001; Mayer et al., 1995; McKnigth et al., 2000; McKnight & Cummings, 1998; McKnight et al., 2002).

Benevolence refers to the trustee's motivation to act in the trustor's best interest (Mayer et al., 1995). Citizens must believe that government agencies provide e-government services for the purpose of benefiting, not monitoring, society. Integrity refers to trustee honesty and promise keeping (Mayer et al., 1995). Candid, non-fraudulent interaction with e-government service providers will enhance citizen trust and acceptance of e-government services. On the contrary, unfulfilled promises and dishonesty from government officials and employees will decrease trust and increase opposition to these initiatives. In e-commerce research, the concepts captured by benevolence and integrity are addressed by consumer perceptions of a firm's reputation. Reputation refers to the extent to which buyers believe an organization is honest and concerned about its customers (Doney and Cannon, 1997; Jarvenpaa et al. 2000). Firms with a good reputation are perceived to be reluctant to jeopardize their reputational assets by acting opportunistically (Chiles and McMackin 1996; Ruyter et al., 2000; Smith and Barclay, 1997). Finally, competence is defined as the ability of the trustee to do what the trustor needs (McKnight et al. 2002). Before endorsing e-government initiatives, citizens must believe government agencies possess the astuteness and technical resources necessary to implement and secure these systems.

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H2: Characteristic-based trust (CBT) will positively influence citizen intention to use (USE) an e-government service.

Disposition to Trust

Disposition to trust is defined as one's general propensity to trust others. It is composed of two concepts: faith in humanity and trusting stance. Faith in humanity assumes others are good-natured and dependable. Trusting stance assumes better outcomes result from dealing with people as if they are well meaning and reliable (McKnight et. al. 2002). Therefore, trust is the result of psychological dispositions that are beyond the immediate control of any government agency. These perennial propensities deal with the life-long socialized tendency to believe in social entities and to believe that better results will occur if one trusts others (McKnight et al., 1998; Rotter, 1971; Warkentin et al., 2002). Characteristic-based trust and institution-based trust are influenced by one's disposition to trust.

H3: Disposition to trust (DT) will positively influence characteristic-based trust (CBT).
H4: Disposition to trust (DT) will positively influence institution-based trust (IBT).

Perceived Risk

Trust is necessary when risk is present (Pavlou, 2003). Since risk is difficult to measure objectively, the literature focuses on users' risk perceptions. Perceived risk is defined as the citizen's subjective expectation of suffering a loss in pursuit of a desired outcome (Warkentin et al. 2002). Perceived risk is composed of behavioral and environmental uncertainty. Behavioral uncertainty exists because online service providers may behave in an opportunistic manner by taking advantage of the impersonal nature of the electronic environment, while environmental uncertainty arises due to the unpredictable nature of Internet-based technology that is beyond the control of the consumer (Pavlou 2003). In e-commerce perceived risk reduces users' intentions to exchange information and complete transactions (Pavlou 2003). Warkentin et al. (2002) suggest that perceived risk will have a synonymous effect on e-government.

H5: Perceived risk (PR) will negatively influence intentions to use (USE) an e-government service.

Mayer et al. (1995) define risk perception in terms of the trustor's belief about the likelihood of gains and losses. The literature states perceived risk decreases when trust is present (Featherman and Pavlou, 2003; Ganesan 1994; Grazioli and Jarvenpaa, 2000; Jarvenpaa et al., 2000).

H6: Higher institution-based trust (IBT) will reduce the perceived risk (PR) of using an e-government service.
H7: Higher characteristic-based trust (CBT) will reduce the perceived risk (PR) of using an e-government service.

Model of Trust and Risk in E-government Adoption

Based on the literature, the theory of reasoned action (TRA), and the previous discussion, we propose a model of trust in e-government adoption, presented in Figure 1. The theory of reasoned action (TRA) states beliefs influence intentions and intentions influence one's actions (Ajzen and Fishbein 1972). In this study, we measure one's intention-to-use an e-government service. Intention-to-use has been found a strong predictor of actual system usage in the IS literature (Sheppard et al. 1988; Taylor and Todd 1995b; Venkatesh et al. 2003).
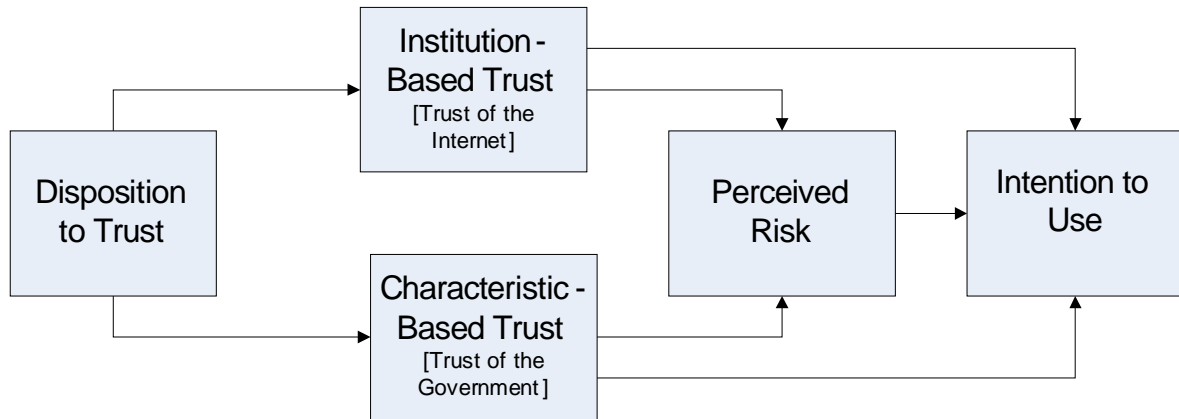
Figure 1.Trust and Risk in E-government Adoption

METHODOLOGY

This study surveyed a diverse group of citizens to obtain their perceptions of e-government. The results were analyzed using structural equation modeling in Amos 4.

Sample

The instrument was administered to 243 citizens. Of the 243 surveys administered, 214 were complete and used in the analysis. The subjects had an average of 10 years experience using a computer; the age range was 14-83 years; and, 49% were female. 92% of the sample has purchased an item or service online. 85% use the Internet to gather information about the government. 59% have completed a transaction with the government online.

Instrument Development and Validity

Items used in this survey were adapted from previous studies for use intentions (USE) (Carter and Bélanger, 2005; Gefen and Straub, 2000, Pavlou, 2003), characteristic-based trust (CBT) (McKnight et al., 2002; Pavlou, 2003; Van Slyke et al., 2004), institutional-based trust (IBT) and disposition to trust (DT) (McKnight et al., 2002), and perceived risk (PR) (Pavlou, 2003). Each item is rated on a scale of 1 to 7 (Strongly Disagree to Neutral to Strongly Agree). A copy of the items is available from the authors.

To increase generalizability, two versions of the survey were created. One referred to the Department of Motor Vehicles (DMV) and the other to the Department of Taxation (VA Tax), both services being offered online. Reference to a specific agency provided the participants with a reference point.

Item reliabilities, summarized in Table 1, were evaluated using Cronbach's alpha. All reliabilities were above the suggested .70 cut off point (Cronbach, 1970).

Construct	No. of Items	Reliability
USE	4	.86
IBT	3	.83
CBT	4	.88
DT	5	.80
PR*	2	.83
* Due to reliability issues, two items were dropped.		

Table 1. Reliability Analysis

Confirmatory factor analysis was used to test construct validity. With the exception of USE4, all items loaded on the proper factor. Due to cross-loadings, USE4 was dropped from further analysis. See Table 2 below.

	USE	IBT	CBT	DT	PR
USE1	.834				
USE2	.807				
USE3	.805				
USE4	.377		.409		
USE5	.805				
IBT1		.773			
IBT 2		.813			
IBT 3		.691			
CBT1			.791		
CBT2			.654		
CBT 3			.799		
CBT 4			.754		
DT1				.790	
DT2				.626	
DT3				.663	
DT4				.766	
DT5				.741	
PR1					.914
PR2					.920

Table 2. Factor Analysis

Data Analysis

In previous studies, frequency of Internet usage and frequency of Internet shopping had significant impacts on use intentions (Carter and Bélanger, 2004; Jarvenpaa et al. 2000). Therefore, we first ran a multiple regression with these variables on use intentions as the dependent variable. None of the variables was significant, so we did not include them in the structural model. Chi-squares tests also revealed no statistical differences between respondents for the DMV and VA Tax versions of the survey. The data was then analyzed using structural equation modeling.

RESULTS

The overall model fit is adequate, as can be seen from Table 3. The test of overall model fit resulted in a chi-square value of 425.36 with 159 degrees of freedom and a probability value of less than .001. The p-value being significant indicates the absolute fit of the model is less than desirable. However, because the chi-square test of absolute model fit is sensitive to sample size and non-normality, a better measure of fit is chi-square over degrees of freedom. This ratio for our model is within the suggested 3 to 1 bracket (Chin and Todd, 1995; Gefen et al., 2000; Hair et al., 1998).

Typically, researchers also report a number of fit statistics to assess the relative fit of the data to the model. Descriptive fit statistics compare a specified model to a baseline model, typically the independence model, in an attempt to demonstrate the superiority of the proposed model. Jaccard and Wan (1996) recommend the use of at least three fit tests. We report the Tucker-Lewis Index (*TLI*), the Comparative Fit Index (*CFI*) and the Normed Fix Index (NFI). The *TLI* and the *CFI* compare the absolute fit of a specified model to the absolute fit of the independence model. The greater the discrepancy between the overall fit of the two models, the larger the values of these descriptive statistics. Research by Gerbing and Anderson (1992) identifies the CFI as one of the most stable and robust fit indices. We also report the NFI, which measures the normed difference in chi-square between a single factor null model and a proposed multi-factor model (Gefen et al., 2000). A rule of thumb for most of the indices is that a good model should exhibit a value greater than 0.90 (Mulaik, et al., 1989; Bentler, 1990; McDonald and Marsh, 1990), as they are in our model (TLI: .97, CFI: .98, NFI: .97). We also report RMSEA (Root Mean Square Error of Approximation), which measures the discrepancy per degree of freedom (Steiger and Lind, 1980).

Fit Index	Model	Recommendation	Source
Chi-square	425.36	n/a	n/a
Degrees of freedom	159	n/a	n/a
P	<0.001	non significant	Gefen et al.(2000)
Chi-square / df	2.675	< 3.000	Hair et al. (1998)
Normed fit index (NFI)	.97	>.90	Chin and Todd (1995)
Comparative fit index (CFI)	.98	>.90	Chau (1997)
Tucker-Lewis Index (TLI)	.97	>.95	Hu and Bentler (1999)
Root mean square error of approx. (RMSEA)	.10	<.10	Clark et al. (2003)

Table 3. Fit Indices

Having established the relative adequacy of the model's fit, it is appropriate to examine individual path coefficients corresponding to our hypotheses. This analysis is presented in Table 4. Five of the seven hypotheses are supported. Institution-based trust and characteristic-based trust positively influence intention to use (H1 and H2). Disposition to trust positively influences institution-based trust and characteristic-based trust (H3 and H4). Characteristic-based trust reduces the perceived risk of using e-government services (H7). Hypotheses 5 and 6 are not supported. Higher levels of perceived risk did not decrease intention to use, and institution-based trust did not affect risk perceptions.

Name	Relationship	Coeff.	p-value	Supported
H1	IBT -> USE	.30	< .001	YES
H2	CBT -> USE	.43	< .001	YES
H3	DT -> IBT	.66	< .001	YES
H4	DT -> CBT	.61	< .001	YES
H5	PR->USE	.20	<.001	NO*
H6	IBT->PR	.125	.192	NO
H7	CBT->PR	-.28	<.01	YES
*The path is significant. However, the hypothesis is not supported since the sign of the coefficient is in the opposite direction of the prediction.				

Table 4. Hypothesis Testing

Figure 2 shows the path coefficients for each significant relationship. With the exception of the relationship between perceived risk and intention to use, the signs of the coefficients are in the predicted direction.

DISCUSSION

The model presents several factors that significantly impact citizen intention to use an e-government service. Disposition to trust is a personal propensity which government agencies cannot manipulate. However, e-government service providers should be aware of its existence and its impact on other, more pliable modes of trust, such as institution-based trust and characteristic-based trust.
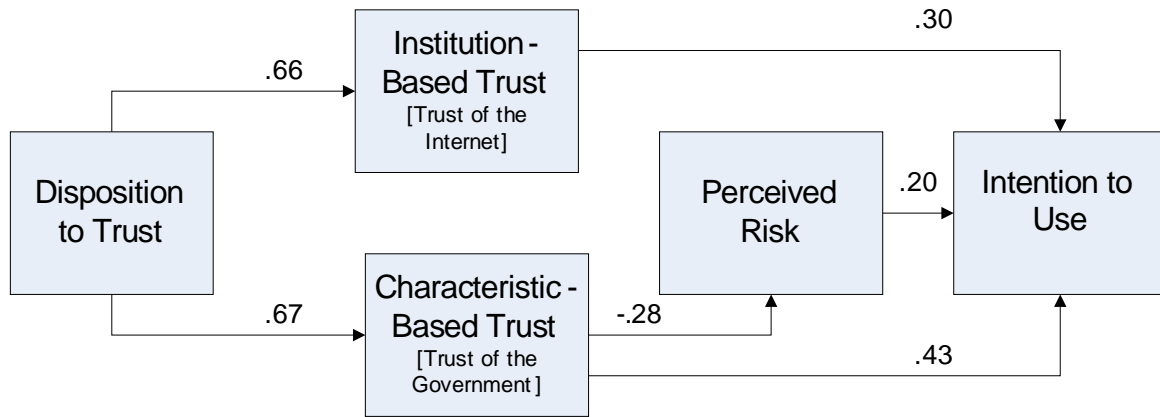
Figure 2. Significant Relationships

Institution-based trust, or trust in the Internet, is an essential element of e-government adoption. Citizens must believe that mechanisms are in place to ensure secure and private data transmission over such an impersonal medium. Government agencies should take advantage of trust-building mechanisms used by e-commerce vendors, such as posting security and privacy seals, to encourage adoption of e-government services. Agencies should also use pamphlets and posters at their brick-and-mortar locations to emphasize the security and privacy mechanisms employed to ensure reliable services.

Characteristic-based trust is also important to e-government adoption. Agencies need to communicate their ability and desire to provide citizens with convenient, dependable service via a plethora of channels, including the Internet. Government agencies should publicize stories of e-services that are successful and statistics of citizens who are pleased with these services. Such publicity would positively impact citizens' perceptions of the competence of government agencies. The American Customer Satisfaction Index (ACSI) is one means of measuring and highlighting citizen satisfaction with e-government services. This index reflects overall satisfaction and the likelihood of desirable future behaviors, such as repeat visits. Each year more federal websites including the Department of Treasury, Central Intelligence Agency, and the Department of Transportation, measure their performance using the ACSI index (ForSee, 2003). Research has shown that users of government websites have an unusually high likelihood to recommend the site to others (ForSee, 2003). Such positive publicity will help to increase non-adopters' perceptions of characteristic-based trust. This has two effects, increasing their intention to use e-government services, and decreasing their perceptions of risk affiliated with adopting these services.

Interestingly, higher levels of institution-based trust did not decrease citizens' risk perceptions, nor did risk perceptions decrease citizens' intention to use an e-government service. This finding is incongruent with the e-commerce literature. However, there are differences between commercial businesses and government agencies. E-commerce and e-government differ in their reasons for existence (profit vs. service) and constituents served (target market vs. population at-large). Citizens perceive businesses differently than government. Perhaps the perception of risk in e-commerce is more prevalent than in e-government. Or, perhaps different trust constructs impact risk in e-government. Future research should address these potential differences.

This study has various practical implications for government service providers. It highlights the importance of citizens' trust in both the agency and the technology used to provide electronic services. Hence, government agencies should first emphasize their general competence in their particular areas of expertise, and then highlight their ability to provide their services via the Internet. In the private sector, businesses have acknowledged the importance of trust and risk perceptions. E-commerce firms post trust seals, promote privacy policies, and emphasize security features. It is imperative government agencies acquire and advertise features that increase citizens' perceptions of the site's trustworthiness as well. They could also provide trust and privacy seals on their websites and promote their reputation via online testimonials. Collaborating with well-respected businesses in the private sector is also an avenue to increase citizens' perceptions.

Future research is needed to determine if there are additional trust constructs unique to e-government adoption. For example, given that over half of the respondents had experience using e-government services, it would be interesting to compare their perceptions of process-based trust to their actual use of e-services. The differences between government-to-citizen interaction and business-to-consumer interaction may result in additional factors that aren't present in e-commerce. Future studies should also explore the antecedents of each construct to expand the explanatory power of the model. This model can also be used to study trust in specific e-government systems, such as e-voting systems. Trust and risk are integral concepts of e-voting adoption. This model provides a means of eliciting citizen perceptions of the risk involved and trust required to encourage acceptance of Internet-based technology.

LIMITATIONS

Because we estimated the means and intercepts of the latent constructs in the model, we could not report GFI, AGFI, and RMR due to missing data. These are widely used fit indices in SEM analyses. However, the reported fit indices -CFI, NFI, TFI and RMSEA- have often been used in research (Gefen et al., 2000; Gerbing and Anderson, 1992; Hu and Bentler, 1999). Second, the adoption model only explores issues of trust and risk. Other factors may affect intention-to-use e-government services.

CONCLUSION

This study integrates disposition to trust, institution-based trust, characteristic-based trust and perceived risk in a model of e-government adoption. This model represents a step toward identifying the unique elements of trust in e-government. Research reports repeatedly show that a lack of trust hinders citizen adoption of e-government services. As government agencies increase spending to implement and maintain these initiatives, it is imperative that they also acknowledge and address e-government trust issues. In addition to technical staff and software, government agencies should also budget trust-building strategies into their fiscal plan.

As technology continues to become ingrained in society, citizens' perceptions of the accuracy and reliability of e-services will increase in importance. If government agencies expect citizens to provide sensitive information and complete personal transactions online, they must acknowledge and enhance citizens' views concerning the credibility of e-government services.

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