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# **E-GOVERNMENT DIFFUSION: A COMPARISON OF ADOPTION CONSTRUCTS**

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## **Abstract**

*E-government adoption is the focus of many research studies. However, few studies have compared the adoption factors to identify the most salient predictors of e-government use. This study compares popular adoption constructs to identify the most influential. A survey was administered to elicit citizen perceptions of e-government services. The results of stepwise regression indicate perceived usefulness, trust of the internet, previous use of an e-government service and perceived ease of use all have a significant impact on one's intention to use an e-government service. The implications for research and practice are discussed below.*

## **Keywords**

E-government, Technology Adoption, TAM, Computer Self-efficacy

## Introduction

Internet diffusion among adults in the United States is steadily increasing. The Pew Internet and American Life Project revealed Internet adoption was at an all-time high in 2006 with 73 percent of the respondents (approximately 147 million Americans) being Internet users (Madden 2006). In addition to an increase in use, satisfaction with Internet initiatives is also increasing. According to Chabrow (2005) those who interact with government agencies online are more satisfied with their electronic services every year. In light of an increase in diffusion and satisfaction, it is important to understand the factors that drive citizen acceptance of e-government services. This study compares constructs from the technology acceptance model (TAM) and the online trust literature to gain a better understanding of the most prominent predictors of e-government adoption. Several studies integrate trust and TAM (Gefen et al. 2003; Pavlou 2003; Warkentin et al. 2002); however, few studies have tried to identify which of these factors exerts the strongest influence on intention to use. This study also explores the role of computer self efficacy in technology adoption since the literature recognizes it as an important element of e-service adoption (Agarwal et al. 2000; Jeyaraj et al. 2006).

The paper is organized as follows: the next section reviews the adoption literature, including TAM, online trust and computer self-efficacy. The following section presents the research model. The methodology section discusses the instrument, sample, and data analysis. The concluding sections present the results, implications and suggestions for future research.

## Background Literature

### *Technology Acceptance Model (TAM)*

Davis' (1989) Technology Acceptance Model (TAM) is widely used to study user acceptance of technology. It includes two primary constructs: perceived ease of use (PEOU) and perceived usefulness (PU). Davis defines PU as "the degree to which a person believes that using a particular system would enhance his or her job performance", and PEOU as "the degree to which a person believes that using a particular system would be free of effort." These measures have been tested and validated for a diverse set of users and applications. TAM has been used to evaluate user adoption of e-commerce (Gefen & Straub, 2000; Gefen *et al.*, 2003; Pavlou, 2003) and e-government (Carter and Belanger 2005; Warkentin et al. 2002).

According to TAM, perceived usefulness (PU) and perceived ease of use (PEOU) influence one's behavioral intention to use a system. Venkatesh et al. (2003) include these constructs in their unified theory of acceptance and use of technology (UTAUT), but rename them *performance expectancy* and *effort expectancy*, respectively. UTAUT integrates constructs from eight prominent models – the theory of reasoned action, the technology acceptance model, the motivational model, the theory of planned behavior, a model combining the technology acceptance model and the theory of planned

behavior, the model of PC utilization, the innovation diffusion theory, and the social cognitive theory - to form a comprehensive or unified view of technology adoption. In the interest of parsimony, I only include the TAM constructs perceived usefulness and perceived ease of use in the model. Several recent studies of adoption still explore the role of TAM constructs in system acceptance (Holsapple and Sasidharan 2005; Walczuch et al. 2007; Wang et al. 2006). Research has shown these variables alone explain a significant percentage of the variance in intention to use a system (Plouffe et al. 2001). I refer to them by their original name because I am only referring to TAM and not the unified model.

### ***Online Trust***

Trust has been defined by researchers in numerous fields. Rotter (1967) draws from social learning theory and defines trust as an expectancy that the promise of another can be relied upon. Rotter's research is referenced in numerous studies of trust (Mayer et al. 1995; Zucker, 1986). Trust of electronic services has been explored extensively in both e-commerce (Gefen and Straub, 2002; Gefen et al., 2003; Jarvenpaa et al., 2000; McKnight et al. 2002; Pavlou 2003; Tan and Theon, 2001; Van Slyke et al., 2004) and e-government (Carter and Bélanger, 2005; Gefen et al. 2005; Welch et al., 2004; Warkentin et al. 2002). Tan and Theon (2001) suggest there are two targets of trust: the entity providing the service and the mechanism through which it is provided. Adoption of e-government services is contingent upon citizens' confidence in both the enabling technologies and the agency offering the service (Carter and Belanger 2005; Lee & Turban, 2001).

For e-government transactions, the enabling technology is the Internet. McKnight *et al.* (2002) refer to this trust of the Internet as institution-based trust. Institution-based trust, is associated with an individual's perceptions of the institutional environment, such as the structures, regulations and legislation that make an environment feel safe and trustworthy. This construct contains two dimensions: structural assurance and situational normality. Structural assurance means 'one believes that structures like guarantees, regulations, promises, legal recourse or other procedures are in place to promote success' (McKnight *et al.* , 2002). Situational normality presumes that the environment is normal, favorable, and in proper order (McKnight *et al.* , 2002).

In addition to trust in the Internet as a reliable medium, citizens must also possess trust in the government agency providing the service. E-government acceptance hinges upon the belief that government agencies are capable of providing electronic services effectively and that these agencies will protect the privacy of sensitive information. In e-commerce research, this concept is frequently referred to as the firm's reputation. Reputation effects 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 believed to be unwilling to endanger their reputational assets by behaving unethically (Chiles and McMackin 1996; Ruyter et al., 2000; Smith and Barclay, 1997). Regarding e-government, citizens will be more likely to use Internet services provided by agencies with a good reputation.

### ***Computer Self-Efficacy***

Bandura (1994, p.1) defines perceived self-efficacy as “people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives.” These beliefs determine how people feel, think and behave (Bandura 1977, 1986). Self-efficacy has been studied in various contexts: career development (Lent and Hackett 1987), academic achievement (Pajares 2002), and political participation (Lawless and Fox 2001).

Computer self-efficacy refers to one’s assessment of his ability to use computers in diverse situations (Compeau and Higgins 1995). Those with high levels of CSE are more likely to have positive views of technology and use technology more frequently (Compeau et al. 1999; Venkatesh and Davis 1996). Computer self-efficacy (CSE) has been explored in various technology adoption studies (Agarwal et al. 2000; Compeau and Higgins 1995; Hasan 2006; Jeyaraj et al. 2006; Thatcher and Perrewe 2002; Torkzadeh et al. 2006). Jeyaraj et al. (2006) exam 48 empirical studies of technology adoption by individuals; although computer self-efficacy is not included in adoption models as frequently as TAM, the authors state it is a very promising predictor of system usage. Several studies advocate the inclusion of computer self-efficacy, in addition to TAM constructs, in technology adoption research (Agarwal et al. 2000; Holsapple and Sasidharan 2005; Wang et al. 2006).

### **Research Model & Hypotheses**

The purpose of this study is to identify which of the adoption factors exerts the strongest influence on intention to use an e-government service. In addition to adoption constructs, Schaupp and Carter (2005) posit that previous use of an e-government service significantly impacts adoption. Hence, this demographic is included in the model. Based on the aforementioned literature, the following model of e-government adoption is proposed.

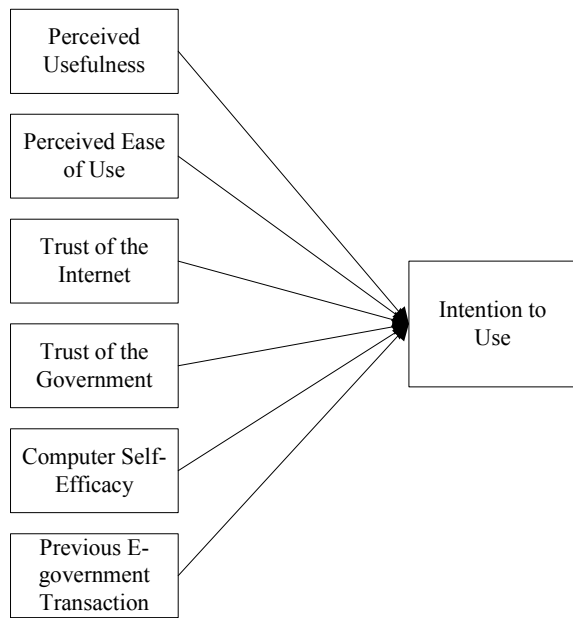


Figure 1. Predictors of E-government Adoption

The hypotheses that will be tested in this research are:

*H1: Higher levels of perceived usefulness (PU) will be positively related to intention to use a state e-government service.*

*H2: Higher levels of perceived ease of use (PEOU) will be positively related to intention to use a state e-government service.*

*H3: Higher levels of trust in the Internet (TRUS\_I) will be positively related to intention to use a state e-government service.*

*H4: Higher levels of trust in the government (TRUS\_S) will be positively related to intention to use a state e-government service.*

*H5: Higher levels of computer self-efficacy (CSE) will be positively related to intention to use a state e-government service.*

*H6: Previous completion of an e-government transaction (EGOV TRANS) will be positively related to intention to use a state e-government service.*

## **Methodology**

The study was conducted by surveying citizens at a community event. Participants were asked to complete a 10-15 minute questionnaire regarding their perceptions of state e-government services. The following sections discuss the instrument development, the sample and data analysis.

### ***Instrument Development***

The items for perceived ease of use, perceived usefulness, trust of the Internet, trust of the government, and computer self-efficacy were adapted from previous studies (Davis, 1989; Gefen & Straub, 2000; McKnight et al., 2002;

Pavlou, 2003; Van Slyke et al. 2004) The items were rated on a seven point likert scale ranging from strongly disagree to strongly agree. Final survey items are available from the author by request.

To test state e-government adoption, two versions of the survey were developed: one referenced the Department of Motor Vehicle (DMV) the other the Department of Taxation (TAX). Questions and instructions were worded according to which instrument version the respondent received. For instance, depending on which version the participant received, the statement would read “I think the VA TAX web site would provide a valuable service for me.” or “I think the DMV web site would provide a valuable service for me.” The selection of two agencies was deemed important to obtain increased generalizability of results. Hence, two widely known state online systems in Virginia were used.

The instrument was pre-tested for unclear wording and revised. It was then pilot tested with 136 undergraduate students. The initial reliability measures using Cronbach’s alpha were above the 0.70 cut-off (Cronbach, 1970). Construct validity was evaluated by using factor analysis, and most items loaded properly on their expected factors. Minor changes in wording were done to marginal items.

### ***Sample***

In the actual study, the instrument was administered to 106 citizens at a community concert. Of the 106 administered questionnaires, 105 were completed and used in the analyses. Subjects were between 14 to 83 years of age. Fifty-six percent of the subjects were Caucasian; 26% were minorities; and 18% did not report ethnicity. Since this was a voluntary survey, participants were allowed to skip demographic questions that made them uncomfortable. Males accounted for 36% of the sample. Ninety-six percent reported having convenient access to the web, and 80% used it every day. Eighty-three per cent of the subjects use the web to gather information from the government, and 66% have used the web to complete a government transaction.

### ***Data Analysis***

The two versions of the instrument (DMV and TAX) were distributed randomly, and roughly half of the respondents answered one of the versions. To control for bias towards a particular state government agency with respect to respondent demographics (age, access to the Internet, etc.), a chi-square test was conducted. All chi squares were non-significant, indicating that there were no statistical differences between respondents for the two versions of the survey. Tests for differences in use across the two agencies were also performed; the results revealed no statistical significance. The reliability analysis, using Cronbach’s alpha, is presented in the following table.

**Table 1. Reliability Analysis**

Construct	# of Items	Alpha
PEOU	5	.864
PU	5	.883
TRUS_I	3	.903
TRUS_S	4	.871
CSE	6	.890
USE	4	.954

Construct validity was evaluated using factor analysis. As can be seen from the following table, most items loaded properly on their expected factors. Cross loading items PEOU4 and USE4 were dropped from further analysis. The items from trust of the internet (Trus\_I) and trust of state government (Trus\_S) loaded together. This occurrence is consistent with other adoption studies. Carter and Belanger (2005) identify trust of the government and trust of the Internet as two distinct concepts during theory development, yet combine them during analysis due to cross loadings. Moore and Benbasat (1991) state that some constructs that are conceptually distinct may be viewed identically by respondents and hence the items for the two constructs load together. The authors, however, still analyze them separately. Since the purpose of this study is to identify the importance of each individual construct I include them in the regression model individually<sup>1</sup>. As shown in table 2, the factor loadings exceed the .40 cut-off employed in social science research (Costello and Osburne 2005).

**Table 2. Factor Loadings**

Item	PU	PEOU	TRUS_I & TRUS_S	CSE	USE
PU1	.519				
PU2	.634				
PU3	.850				
PU4	.539				
PU5	.575				
PEOU1		.670			
PEOU2		.653			
PEOU3		.633			
PEOU4		.620			
PEOU5		.417			
TRUS_I1			.760		
TRUS_I2			.813		
TRUS_I3			.801		
TRUS_S1			.690		
TRUS_S2			.806		
TRUS_S3			.741		
TRUS_S4			.689		
CSE1				.714	
CSE2				.753	
CSE3				.783	
CSE4				.756	
CSE5				.729	
CSE6				.737	
USE1					.937
USE2					.913
USE3					.890
USE4					.898

<sup>1</sup> Further support for this distinction is illustrated in the results section. TRUS\_I and TRUS\_I behave differently in the regression equation.



In summary, model and hypotheses tests were conducted with five independent variables: PU, PEOU, TRUST\_I, TRUST\_S, CSE; one demographic, EGOV TRANS; and one dependent variable, use intentions (USE). The basic characteristics of the independent and dependent variables are presented in the following table.

**Table 3. Summary of Variables**

<b>Construct</b>	<b>Mean</b>	<b>Standard deviation</b>
PU	5.29	1.19
PEOU	5.38	1.26
TRUS_I	4.51	1.54
TRUS_S	4.53	1.20
CSE	5.71	1.20
USE	6.26	1.41

## **Model Testing**

There were two activities used to test the model. First, a regression analysis was performed to assess the significance of demographics on use intentions. Secondly, stepwise regression analysis was used for hypothesis testing. With this type of analysis variables enter the regression analysis one at a time. The first x variable (where x is an independent variable) to enter is the one that explains the largest amount of variance in y (where y is the dependent variable). The second x variable to enter will be the one that explains the greatest amount of the remaining variance in y. This process is repeated until there are no more variables left that explain a significant percentage of the variance in y. Stepwise regression is especially useful when there are numerous independent variables that are highly correlated because stepwise regression balances the contradictory goals of 1) explaining the most possible variance in y and 2) using the fewest possible x variables. Statistical experts recommend the use of stepwise regression to test a model that has already been hypothesized (Weiers 2005). Hence, this technique is ideal to identify which of the previously tested adoption constructs are most influential on intention to use e-government.

## **Results**

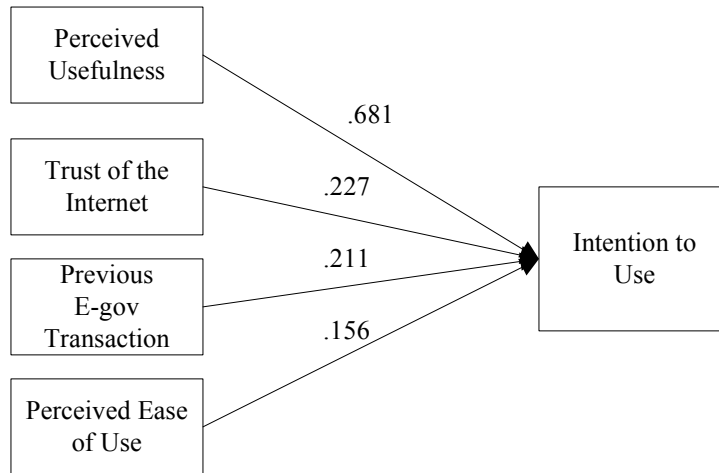
The results indicate that four of the independent variables are significant predictors of intention to use a state e-government service: perceived usefulness, trust of the internet, previous completion of an e-government transaction and perceived ease of use. Perceived usefulness is the most important factor in predicting intention to use e-government. This factor alone explains 74.8% of the variance in intention to use, demonstrated in the following table.

**Table 4. Stepwise Regression Results**

Model	Variables entered	Adjusted R Square	Std. Error of the Estimate
1	PU	.748	.664
2	PU, TRUS_I	.827	.550
3	PU, TRUS_I, EGOV_TRANS	.836	.536
4	PU, TRUS_I, EGOV_TRANS, PEOU	.841	.527

PU = Perceived Usefulness  
 TRUS\_I = Trust of the Internet  
 EGOV\_TRANS = Previous completion of an e-government transaction  
 PEOU = Perceived Ease of Use

The overall resulting model depicts perceived usefulness, trust of the internet, previous use of an e-government service and perceived ease of use as significant predictors ( $F = 127.983, P = 0.000$ ). This model explains 84% of the variance in intention to use e-government. Interestingly, frequency of Internet use, computer self-efficacy, and trust of the government were not significant predictors of use intentions. The following figure presents the significant constructs, along with their coefficients, in order of significance.



**Figure 2. Most Salient Predictors of E-government Adoption**

**Discussion**

The purpose of this research was to identify the most salient predictors of e-government adoption. The results indicate that the most important factor in predicting intention to use e-government is perceived usefulness (H1). Further, two

other adoption factors, perceived ease of use (H2) and trust of the Internet (H3) and one demographic variable, previous completion of an e-government transaction (H6) also contribute to explaining the variance in intention to use. However, trust of the government (H4) and computer self-efficacy (H5) were not significant predictors of use intentions.

### ***Perceived Usefulness***

Perceived usefulness is the most significant predictor of intention to use e-government services. Citizens who value the benefits of completing transactions online are more likely to adopt e-government services. Hence, not only should government agencies provide a convenient and efficient means of completing e-transaction; but also, agencies need to communicate these benefits to citizens in order to attract non-adopters. Government agencies could communicate these advantages to citizens via its brick-and-mortar locations, local news outlets such as, the newspaper, radio or television, and any other venue that reaches both users and non-users of Internet services.

In light of these findings, researchers should still explore the role of TAM in technology adoption. Through time this model has proven to be a robust, yet parsimonious way to explore the factors that influence technology acceptance in diverse situations. TAM may be especially useful to theory development when using a research model that incorporates constructs from multiple disciplines. The use of TAM constructs enables a researcher to develop an inter-disciplinary model that is both comprehensive and prudent.

### ***Trust of the Internet***

Trust of the Internet explained the second largest amount of the variance in use intentions. The Internet is a distant and impersonal medium. It does not offer the reassurance of seeing or talking to a customer service representative during the transaction. It is this distance and uncertainty that makes trust such an important element of e-government adoption. There are several tools government agencies can use to improve citizen confidence in the Internet as a reliable means of interacting with government agencies. First, they could follow the lead of cutting edge e-commerce companies and allow users to chat in real-time with a government employee during a transaction. This option may help ease the perceptions of risk that accompany providing sensitive information and completing government forms online. It would also give citizens a chance to enquire about the risk of providing personal information while affording the agency a chance to highlight the security measures in place to reduce those risks. Government agencies could also provide statistical information that illustrates the reliability of their e-services. For instance, an agency could post the number of successful transactions that are completed online every day. These positive figures may help re-assure skeptics. Regardless of the technique employed, government agencies must have a strategy for demonstrating their ability to provide online services securely.

### ***Previous Completion of an E-government Transaction***

Previous completion of an e-government transaction was the third most significant predictor of e-government adoption. Hence, those who have used an e-government service in the past are more likely to use one in the future. Perhaps,

those who have used e-government have heightened levels of perceived usefulness due to positive experiences. In other words, after renewing a driver's license quickly from the convenience of home instead of traveling to and waiting in line at a physical branch, the citizen begins to value the service. After realizing the benefits, he is more likely to use electronic options in the future. Since completion of an e-government service increases adoption, government agencies should target potential first-time adopters. For instance, drivers typically receive their license at age 16 and have to renew in 4 years. Hence, college students represent a body of potential first-time adopters of online license renewal. Agencies could develop "Try Me!" campaigns that heighten awareness of this option and provide statistics on its convenience.

### ***Perceived Ease of Use***

Finally, perceived ease of use was also a significant predictor of use intentions. Based on the literature, it is not surprising that it exerts the weakest influence on intention to use. Davis (1989) suggests from the beginning that its primary role may be that of an antecedent of perceived usefulness. However, various studies have also found that it has a direct effect on intention (Carter and Belanger 2005; Venkatesh et al. 2003). In light of its influence, government agencies should constantly elicit user feedback to improve the ease with which users navigate and interact with their Websites. An intuitive, user-friendly design should always be a priority for developers of e-government systems.

### ***Non-significant Findings: Trust of the Government and Computer Self-Efficacy***

Trust of the government was not a significant predictor of intention to use. Recent surveys of citizen satisfaction with e-government services indicate that although citizens are dissatisfied with government, they are pleased with government Web sites (Chabrow 2005). Chabrow (2005) indicates, "government Web sites scored higher in citizen satisfaction than the government itself." Hence, citizen perceptions of e-government may be different from their perceptions of traditional government services. Perhaps, in the online environment citizens use Website-specific criteria, such as, ease of navigation, relevance of information, etc. instead of the agency's offline reputation to evaluate e-government services.

Also, computer self-efficacy is not significant. Jeyaraj et al. (2006) identify computer self-efficacy as a promising predictor of technology adoption; however, CSE was not a salient predictor of use intentions in this study. Perhaps CSE has an impact on use intentions, but it is not one of the dominant predictors. In light of the strong influence of the other adoption variables its influence is inconsequential. Future studies should continue to explore the role of CSE in adoption. Perhaps its influence is most profound as an antecedent of the TAM constructs (Hasan 2006). The non-significance of CSE may also be a function of the demographics of the sample. The participants had, on average, twelve years of computer experience. Also, eighty percent of the subjects use the Internet every day. Understandably, these participants may be highly confident in their ability to use a computer in most situations, including e-government.

## **Conclusion**

This exploratory study seeks to identify the most prominent predictors of e-government usage. A better understanding of the leading drivers of this phenomenon will help agencies reach more citizens and retain current adopters. The results indicate that despite its simplicity, TAM still proves to be a useful predictor of technology adoption. In fact it is the integration of TAM, trust and previous e-government experience that work together to explain a large percentage of variance in intention to use e-government. Future research should obtain an even more diverse sample to validate these findings. This study surveyed citizens in a rural town in Virginia. These citizens may not be representative of the entire population. Future studies should also explore the role of Internet-self-efficacy in e-government adoption. Perhaps a more context-specific version of self-efficacy would be significant in the presence of other adoption variables.

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