The Effect of Information Quality on Trust in E-Government Systems

Ally Lee
Graduate School of Computer and Information Sciences, Nova Southeastern University, Ft. Lauderdale, FL, United States., ally_pheng@yahoo.com

Yair Levy
Graduate School of Computer and Information Sciences, Nova Southeastern University, Ft. Lauderdale, FL, United States., levyy@nova.edu

William Hafner
Graduate School of Computer and Information Sciences, Nova Southeastern University, Ft. Lauderdale, FL, United States., hafnerw@nova.edu

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Yair Levy
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Graduate School of Computer and Information Sciences
levyy@nova.edu

William L. Hafner
Nova Southeastern University
Graduate School of Computer and Information Sciences
hafnerw@nova.edu

ABSTRACT

Over the past decades, the citizen–government relationship has changed. Citizens transitioned from traditional communications to interactions through e-government systems. While e-government systems expenditures increased, citizens' trust in e-government systems was a challenge. Moreover, although the role of information quality (IQ) as a contributor to trust in information systems (IS) received some attention, such role in e-government systems received limited attention. This two-phased study was designed to uncover citizens' perceived IQ factors, and determine their influence on trust in e-government systems. A list of e-government's IQ characteristics was developed and validated. Citizens were surveyed on their perceived importance level of IQ characteristics and trust in e-government systems. Exploratory factor analysis (EFA) based on 363 records obtained was used. Ordinal logistic regression (OLR) was used to formulate and test the predictive model. Results demonstrated two factors out of the three had a significant influence on trust. Results determined no significant gender differences.

Keywords

e-Government Systems, Information Quality, Trust in e-Government Systems

INTRODUCTION

The Internet is one communication tool that has the potential to change the face of government in the 21st century (Reddick, 2005). E-government systems have the potential to improve and advance the interactions between citizen and government, on all levels of the government (Jaeger, 2003). There has been a rapid growth of Web-based systems in government, which promises cost savings through delivery of government information and services to the citizens (Reddick, 2003). However, there are many citizens who do not trust e-government systems (Evans and Yen, 2006).

With e-government systems, citizens interact with a Website rather than having face-to-face interaction with government staff (Warkentin, Gefen, Pavlou and Rose, 2002). That lack of personal interaction creates resistance, uncertainty, and a feeling of lack of control (Warkentin et al., 2002). Citizens are also unsure about turning over information to the government through these systems due to a concern that the information could be used to harm them (Evans and Yen, 2006).

Trust is an important construct, serving as a determinant on whether citizens will use e-government systems (Moon and Welch, 2003; Prasuraman and Miller, 2004). Information Quality (IQ) is crucial to the development of trust (Salaun and Flores, 2001). Moreover, it appears that there is a gap in literature about how IQ characteristics relate to citizens' trust in e-government systems (Tan, Benbasat and Cenfetelli, 2008). This study was set to address that gap.

THEORETICAL BACKGROUND

Using a consumer perspective, this study drew upon an IQ framework to determine IQ characteristics effecting citizens' trust in e-government systems. An IQ framework is the process of measuring and evaluating how well e-government systems preserve IQ to become an asset to citizens, to provide better services to citizens, and to become an efficient consumer resource (Chutimaskul, Funikul and Chongsuphajaisiddhi, 2008). IQ is a major research construct used to evaluate the success of IS (Strong et al., 1997). Scholl et al. (2009) indicated that IQ is an important building block, and remains crucial to the success of e-government systems. Poor IQ has led to poor decision making by the government. For example, 50% to 80% of U.S. criminal databases have inaccurate, incomplete, or ambiguous information (Strong, Lee and Wang, 1997). The social impact of poor IQ in criminal databases is that poor IQ endangers the rights and safety of citizens. Poor IQ was also found to hinder e-government growth. Scholl, Barzilai-Nahon, Ahn, Popova and Re (2009) determined that in e-government, poor IQ is still an important building block, and remains crucial to the failure of e-government systems.

According to relationship marketing behavior theory, consumers want simplified information processing and a reduction in perceived risks that maintain both cognitive consistency and a state of psychological comfort (Jagdish and Parvatiyar, 2005). Jagdish and Parvatiyar (2005) noted that IS can influence citizens to become information consumers of e-government systems. The Internal Revenue Service department influenced citizens to consume information by effectively using electronic systems for filing tax returns, and for import-export of information. Chutimaskul et al. (2008) proclaimed that it is crucial for e-government systems to become a strong information resource for citizens. E-government systems can transform governments to become more citizen-centered, meaning that government entities provide services and resources tailored to the actual needs of citizens (Bertot, Jaeger and McClure, 2008). While citizens became information consumers, governmental agencies sponsoring e-government system initiatives are morphed into the role of information marketers. As this transformation occurred, IQ appears to be significantly important for citizens using e-government systems. IQ literature indicates the need to ask the information consumers what IQ characteristics they feel are important (Wang and Strong, 1996).

IQ has been defined in numerous ways in prior literature and has shown to have varying effects on the information consumer. Operationally, IQ is information that is good, useful, current, and accurate (Rieh, 2002). Lee, Strong, and Wang (1997) defined IQ as information that is useful for the information consumer. Klischewski and Scholl (2006) had a more elaborate view as they indicated that there are numerous e-government information consumers, and that the definition of IQ depends on which key player is being asked. Citizens believe that IQ is customer-centered information (Klischewski and Scholl, 2006). Government administrations define IQ as being information that is integrated and follows government standards (Klischewski and Scholl, 2006). IT developers define IQ as information that follows prescribed IT data formats (Klischewski and Scholl, 2006). This study applied the IQ definition as described by the citizen since this study centered on the information consumers of such e-government systems.

According to Delone and McLean (2003), IQ is important for IS success. IQ in e-government systems is essential for persuading citizens to trust the system, which leads to the need for an IQ framework for e-government systems (Chutimaskul et al., 2008). In this study, the IQ framework by Lee et al. (1997) was applied. While trust appears to be a significant construct in predicting IS success, a fundamental antecedent of trust is IQ. It is known that trust is a fundamental element in the development process associated with computerization (Dunne, Haim, Forker and Powell, 2008). Trust has a strong social element, because it involves an expectation that others are obligated to fulfill their commitments (Gefen, 1997). Trust is also a central defining aspect of many economic interactions as it implies a belief that certain results will occur (Warkentin et al., 2002). Furthermore, trust is an efficient mechanism for governing transactions (Gefen, 1997), since high trust reduces the risk of falling victim to opportunistic behavior (Warkentin et al., 2002).

E-government is a powerful tool used for improving the internal efficiency of government, and improving the quality of service delivery, as well as enhancing public participation (Parent, Vandebeek and Gemino, 2004). The decision to engage in e-government transactions, however, requires citizens' trust in e-government systems (Carter and Belanger, 2004). Many citizens may be reluctant to adopt e-government services due to a lack of trust in the security of online transactions and concerns regarding the use of information submitted to their government (Belanger and Carter, 2008). E-government systems may have the potential to improve government transparency, responsiveness, and accountability, but such services will be adopted only if citizens trust e-government services (Belanger and Carter, 2008). According to Carter and Belanger (2004), more studies are needed to empirically explore the factors that influence citizens' trust in e-government systems. Moreover, while trust is found to be an important construct in determining citizens' use of e-government systems (Moon and Welch, 2003; Prasuraman and Miller, 2004), much less is known about the effect of IQ on trust in e-government systems.

According to Reid and Levy (2008), gender plays an important role in an individual's trust in IS. Although researchers have studied IS outcomes since the inception of IS, there is still a need for additional investigations about gender and IS (Gefen and Straub, 1997). Gender appears to be fundamental when it comes to trust, while gender differences appear to be one of the most important aspects of the overall cultural differences that exist between human beings (Gefen and Straub, 1997). It appears that additional research is needed to investigate if there are differences in trust, especially in the context of e-government systems.

METHODOLOGY

Overview and Research Questions

This study included a two-phase approach combining qualitative and quantitative methods. The qualitative phase was aimed at collecting IQ characteristics citizens find important when using e-government systems. The quantitative phase was aimed at collecting survey responses for the importance level of the IQ characteristics and trust. To develop and test a framework in the context of e-government systems, this study used Lee et al. (1997)'s four IQ factors as a starting point for this exploratory investigation. Figure 1 shows the conceptual map for this study. This study also evaluated the effect of the IQ factors that were resulted from the exploratory analysis on trust in e-government systems. Moreover, an assessment of differences on trust based on gender was performed.

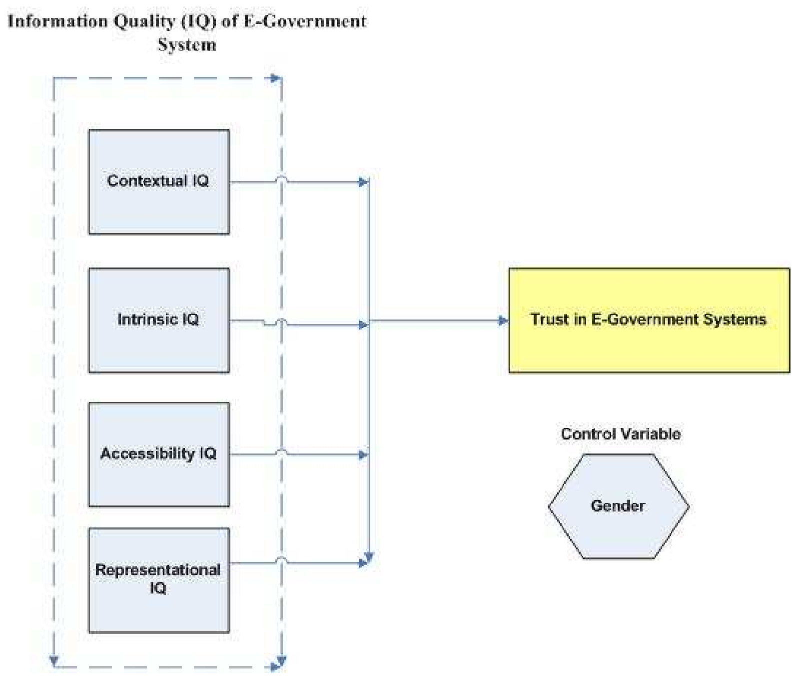

Figure 1. The Conceptual Research Map

The specific research questions this study addressed are:

RQ1: What IQ characteristics do citizens find important when using e-government systems?

RQ2: What are the key factors for citizens' important IQ characteristics when using e-government systems?

RQ3: What is the relative weight of each of the IQ factors when predicting users' trust in e-government systems?

RQ4: Are there significant differences in trust based on gender, for citizens using e-government systems?

To respond to the first research question, an open-ended qualitative questionnaire was sent to a group of 20 citizens who use an e-government system following Keeney (1999)'s approach. Results from the qualitative questionnaire augmented the IQ characteristics found in literature. Together, the characteristics found from literature and from the qualitative questionnaire were analyzed using Keeney (1999)'s approach. Similar responses were converted to common terms, and these IQ characteristics were assigned to the IQ category that matched most closely. There were 33 IQ items identified which were grouped under the appropriate original IQ categories. Adjustments were made to the IQ characteristics listed in the quantitative survey instrument administered via Web in Phase-II. Table 1 shows the IQ characteristics that were the outcome of Phase I.

No	IQ Characteristics, Phase One
	Accessibility IQ
1	Accessibility of information
2	Amount of uptime of information
3	Continuous and repeated exchange of information
4	Credible source of information
5	Information provided is clear for the task
6	Information provides ease of operation
7	Precision of domains of information
8	Robustness of information
9	Security of information
	Contextual IQ
10	Amount of information
11	Clarity of information content
12	Completeness of information
13	Information coverage
14	Information is available in printable form
15	Information is current
16	Information relevancy
17	Perceived value of information
18	Usefulness of information
	Intrinsic IQ
19	Believability of information
20	Dynamic information
21	Information accuracy
22	Precision and recall of information
23	Reliability of information
24	Validity of information
	Representation IQ
25	Information is comprehensive
26	Easy-to-understand information
27	Flexibility of information
28	Information has added value
29	Presentation of information
30	Type of language used
31	Information provided is interpretable
32	Essentialness of information
33	Efficiency of information

Table 1. IQ Characteristics from Exploratory Phase

In Phase-II, a quantitative Web survey instrument was developed. IQ characteristics determined from the first phase were listed on the quantitative survey instrument, and participants were asked to rate each one. Trust was measured on a 10-item construct based on trust literature (Gefen, 1997; Komiak and Benbasat, 2006; Chen and Dhillon, 2003; Dunne, Haim, Forker and Powell, 2008; Warkentin, et al. 2002; Tan, et al., 2008). This quantitative survey instrument used a six-point Likert-type scale and adverbial qualifiers, which ranged from 'Not important at all' to 'Extremely important.' The Likert scale is a popular scale since it is detailed, easy to administer, and easy to respond to (Albaum, 1997). This study targeted about 1,000 participants for the anticipated 300 responses. According to Schleyer and Forrest (2000), as well as Shannon and Bradshaw (2002) there is a 30% response rate for Web surveys.

Survey Instrument

Figure 2 illustrates the instrument development process. In Phase-1, an initial list of IQ characteristics collected from prior literature was formed, and then an open-ended qualitative questionnaire was created based on the list of IQ characteristics from literature. Phase-II included the list of key IQ factors uncovered from data reduction and analysis via factor analysis, and then the web-based quantitative survey instrument was developed which included results from Phase-I.

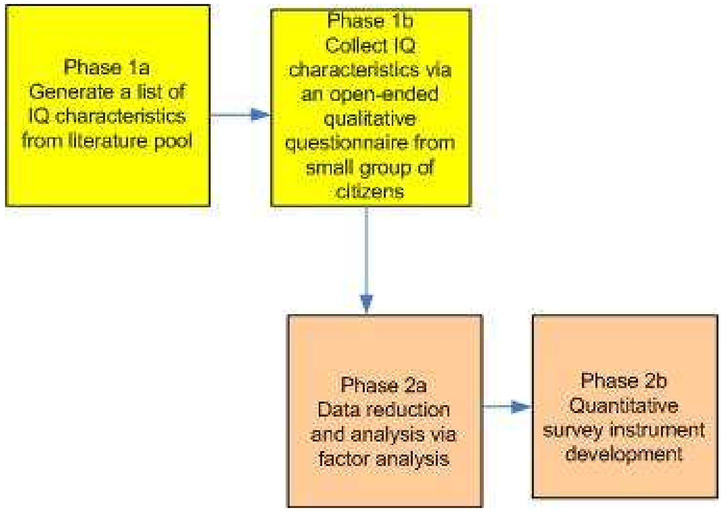

Figure 2. Instrument Development Process

Analysis and Result

Data Collection

Between May to September 2011, email invitations were sent to over 1,300 citizens via local government organizations in Southeast Michigan. Survey responses (or cases) from government staff were removed to eliminate bias. There were 360 usable survey responses (28%) collected, indicating the likelihood of reliability. According to Mertler and Vannata's (2002) general rule of thumb, a data set should include at least 300 cases for factor analysis to return reliable factors.

Data collected from the quantitative survey instrument was analyzed using Exploratory Factor Analysis (EFA) via Principal Component Analysis (PCA). EFA is used to discover the factor structure of a measure and to examine its internal reliability (Hair, Black, Babib and Anderson, 2010). Four IQ factors were identified in the literature. However, after conducting PCA it was determined that based on this study's data there are three IQ factors (accuracy/dependability, accessibility/completeness, and representational), as shown in Table 2. According to Kaiser's rule, those components whose eigenvalues are greater than one, should be retained (Mertler and Vannatta, 2001, p. 250); also, a general rule of thumb is to retain factors that account for at least 70% of the cumulative percentage (Mertler and Vanatta, 2001). Our results indicated that these three factors had eigenvalues greater than 1, with a cumulative variance was 76.7%. Therefore, the three factors were retained.

Item No	Factor	1	2	3
ADIQ1	Accuracy/Dependability	0.858		
ADIQ2		0.843		
ADIQ3		0.784		
ADIQ4		0.772		
ADIQ5		0.760		
ADIQ6		0.753		
ADIQ7		0.682		
ADIQ8		0.653		
ACIQ9	Accessibility/Completeness		0.689	
ACIQ10			0.671	
ACIQ11			0.668	
ACIQ12			0.654	
ACIQ13			0.637	
ACIQ14			0.594	
ACIQ15			0.592	
ACIQ16			0.589	
ACIQ17			0.581	
ACIQ18			0.571	
ACIQ19			0.560	
ACIQ20			0.545	
ACIQ21			0.539	
RepIQ22	Representat -ional			0.854
RepIQ23				0.829
RepIQ24				0.761
RepIQ25				0.584
Cronbach's Alpha		0.963	0.948	0.938

Table 2. Three Key IQ Factors

The perceived IQ items that were grouped to form factors are in Table 3. In this study, some items that originally grouped under an IQ factor in Phase-I, were regrouped under a different IQ factor in Phase-II. For example, the item AccIQ5 (information provided was clear for the task) was grouped under accessibility IQ in the literature. However, the results of this study determined that this item should be grouped with intrinsic IQ items. Therefore, a new IQ factor was named 'accessibility/dependability.' The three factors uncovered after PCA answered the second research question in this study.

Item	Factor	Perceived IQ Items
IntIQ1	Accuracy/Dependability	Availability of links
IntIQ2		Believability of information
IntIQ6		Reliability of information
IntIQ4		Information accuracy
IntIQ7		Validity of information
IntIQ3		Dynamic information
IntIQ5		Precision and recall of information
AccIQ5		Information provided is clear for the task
AccIQ8	Accessibility/Completeness	Robustness of information
AccIQ3		Continuous and repeated exchanges of information
AccIQ2		Amount of uptime of information
AccIQ1		Accessibility of information
AccIQ4		Credible source of information
AccIQ6		Information provides ease of operation
ConIQ5		Information is available in printable form
ConIQ7		Information relevancy
RepIQ1		Information is comprehensive
AccIQ9		Security of information
RepIQ7	Representat-ional	Essentialness of information
RepIQ8		Efficiency of information
RepIQ3		Flexibility of information
RepIQ4		Information has added value

Table 3. Perceived IQ Items Grouped into Factors

Reliability Analysis

Results from the reliability analysis determined by calculating the Cronbach's Alpha for the three IQ factors determined from this study indicate high (above 0.7) reliability for all three IQ factors. See Table 4.

Factor	**Cronbach's Alpha**
Accuracy/Dependability	0.963
Accessibility/Completeness	0.948
Representation	0.938

Table 4. Results of the Reliability Analysis

Ordinal Logistic Regression (OLR)

To address the third research question, OLR was performed to determine the weight of the IQ factors that effect the probability on the score of citizens' trust in e-government systems. OLR was performed because this study did not assume linearity between the constructs measured and their relationship. OLR is a valid non-linear approach for ordinal data (O'Connell, 2000).

Prior to OLR, an aggregation process was used to give each factor and trust measure an aggregate value. OLR was calculated using SPSS. The values determined the weight or contribution of each of the three perceived IQ factors on trust. The OLR results for determining citizens' trust in e-government systems based on the three IQ factors demonstrated an overall significant model with a -2 Log Likelihood of 852.9, chi-square ($\chi 2$) to the third degrees of freedom, $\chi 2$ (3) = 377.8, and a significance level of $p = .001$. The regression results obtained from OLR indicate an overall model fit to be good. Table 5 shows the results of the overall model fit.

Model	-2 Log Likelihood	Chi-Square	df.	Significance
Intercept	852.9			
Final	475.1	377.8	3	***0.000****

p<0.001

Table 5. OLR Model Significance

The results of OLR showed that the three weights, one for each of the IQ factors are positive (Table 6), so an increase of these IQ factors is indicative of an increased probability of trust being classified in a higher category (1<2<3<4<5). The OLR estimates also determined that two factors—accessibility/completeness (Factor 2), and representational (Factor 3)—both had positive weights, and both factors had a statistically significant contribution to trust ($p < 0.001$). Although accuracy/dependability (Factor 1) showed a positive weight on the dependent variable, it is not a statistically significant ($p = .09$) contributor to trust. This answers research question 3 of this study.

Location	Estimate	Sd Error	Wald	Sig	95% Confidence	Interval
F1	0.38	0.23	2.87	0.90	-0.60	0.83
F2	2.07	0.38	29.67	***.000****	1.33	2.82
F3	1.33	0.22	38.12	***.000****	0.91	1.75

***p < 0.000**

Table 6. OLR Parametric Estimates (n=360)

Mann-Whitney U Test Analysis

Mann-Whitney U Test analysis was performed using SPSS to answer the fourth research question. Table 7 shows the results of the Mann-Whitney U test. This test generated z values and two-tailed p values. The trust measures produced p values greater than .05, signifying that there is deficient evidence to show conclusive differences between males and females. Therefore, the results of this study's Mann-Whitney U indicated that there were no significant differences in trust based on gender for citizens using e-government systems, for each of the trust measures in this study. This provides a response to research question four of this study.

Factor or Variable	Mean	SD	Sig
TM1	3.61	0.92	0.44
TM2	3.46	0.98	0.70
TM3	3.35	0.97	0.17
TM4	3.85	0.81	0.20
TM5	3.71	0.81	0.34
TM6	3.09	0.92	0.40
TM7	3.66	0.89	0.48
TM8	3.27	1.01	0.36
TM9	3.14	0.97	0.39
TM10	3.41	0.89	0.51

Table 7. Results of the Mann-Whitney U Test

DISCUSSION

The goal of this study was to contribute to the IS knowledge domain by identifying IQ characteristics that are important to citizens, and understanding their impact on citizens' trust in e-government systems. This study deployed a two-phased mixed qualitative and quantitative methodology to citizens who use e-government systems, which resulted in response rate of 28%.

To answer the first research question, a literature review was conducted to develop an initial list of IQ characteristics. Then, an open-ended questionnaire was administered to ask citizens what IQ characteristics were important in trusting e-government systems. A combined list of perceived IQ characteristics was developed in Phase-I, which consisted of IQ items from literature and from the open-ended questionnaire. This list was used to create the Web quantitative survey in Phase-II. To address the next question, SPSS was used to run EFA with PCA. Results identified three factors with a cumulative variance of 76.7%. Factors identified were: accuracy/dependability, accessibility/completeness, as well as representational, and indicated high reliability. For the third research question, all three factors showed a positive parameter estimate. Results from OLR demonstrated that two of the three factors, accessibility/completeness as well as representational, had a significant contribution to trust. These findings on IQ were consistent with IS literature (Berry, Jeffery and Aurum, 2004; Horan, Abhichandani and Rayalu, et al., 2006; Katteranakul and Siau,1999; Klischewski and Scholl, 2006; Lee et al., 1997; Salaun and Flores, 2001). Furthermore, the results on perceived IQ were consistent with prior literature indicating that IQ has an effect on citizens' trust in e-government systems (Moon and Welch, 2003; Prasuraman and Miller, 2004). However, prior studies failed to identify which IQ factors would effect citizens' trust in e-government systems. Results of this study addressed that gap by determining such factors. Reid and Levy (2008) noted that gender differences play an important role in determining an individual's trust in IS. However, results of the Mann-Whitney U test in this study show no significant differences in trust based on gender, for citizens using e-government systems. Results of this study indicate that importance of IQ is equal among males and females. The IQ characteristics that impact trust in e-government systems are equivalent.

CONCLUSION

Summary of the Results

This study has several implications for the existing body of knowledge in IS and practice. A predictive model was developed and constructed with the factors of perceived IQ. This model was developed as a unified model, not specific to a particular level of e-government systems.

Implications for Research

An important contribution of this study was the discovery of the IQ factors that effect citizens, as information consumers of e-government systems. Prior literature discussed IQ factors that effect information consumers with non-e-government systems, such as corporate employees and entrepreneurs. However, literature lacked empirical studies that investigated IQ factors effecting citizens as the information consumers when e-government systems is the information resource. Tan et al. (2008) indicated that IQ is important for citizens using e-government systems, and that it is crucial to understand IQ characteristics that would culminate in citizens' trust in e-government systems.

This study used the IQ framework established by Lee et al. (1997) as the foundation for identifying IQ factors effecting citizens' trust in e-government systems. From the results of this empirical study, the three IQ factors uncovered are accuracy/dependability, accessibility/completeness, and representational. Additionally, a validated survey instrument has been proposed that can be used in future studies to determine citizens' trust in e-government systems.

Implications for Application

According to Gilbert, Balestrini and Littleboy (2004), public-service managers need to consider the IQ characteristics that effect trust in order to break the barriers to e-government system use. By understanding the IQ factors that effect trust in e-government systems, guidance would be available to system developers for design of such systems. Furthermore, understanding IQ characteristics that improve trust would enhance the relationship between citizens and e-government systems. The results of this study highlighted the IQ factors that would have a significant impact on citizens' trust in e-government systems-Factor 2 and Factor 3 (accessibility/completeness; and representational).

Limitations

Several limitations were identified for this study. While citizens' e-government experience was diverse, culture was not considered in this study. The extent and type of e-government system interaction varied and the type of e-government service as well as the type of e-government information was not standard among the citizens who participated. Secondly, over half of the citizens who responded had about 11 years of computer experience, while only four percent had less than five years of experience. Since the survey was delivered via email, more experienced computer users may have participated, while citizens who did not have as much access to computers or the Internet were less likely to participate. Additionally, some items loaded high on more than one factor, and had to be taken out of the analysis. The high loadings may be because the wording of such items in the survey may have caused confusion to citizens who participated. Furthermore, exclusive consideration on IQ is a limitation of this study, as the focus and measures was confined to IQ and citizens' trust.

Future Research

This study has provided the groundwork for further investigation on IQ and e-government systems. Uncovering of the three factors of perceived IQ provides the foundation for future studies. Additional work is needed in investigating perceived IQ factors uncovered at the same level of e-government systems (local, state, or federal), or in exploring how IQ and its perceived importance could be dependent on the type of e-government information and service provided to the citizen. In addition, further research is required to investigate how the factors uncovered would effect trust in e-government systems when the amount and type of interaction is similar. Further studies may investigate if demographics, culture, or amount of e-government experience would contribute to the significance of the factors of perceived IQ.

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