

Gender, Age, and Frequency of Internet Use as Moderators of Citizens' Adoption of Electronic Government

Full paper

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Abstract

This paper proposes a model of citizen acceptance of e-government systems by extending the UTAUT with two additional constructs (Anxiety and Attitude). The revised model includes three commonly employed moderators; gender, age, and frequency of Internet use, and was tested with primary data gathered within the context of use of an e-government system in India. Data analysis using a variance-based structural equation modelling approach revealed that the model received good empirical support, explaining 53.7% of variance in citizen intention to make use of e-government systems. The paper contributes to e-government services research by highlighting key influencing factors (particularly the importance of Attitude), identified a number of significant differences based on the use of the moderators (primarily in terms of gender and age), and acknowledged a number of aspects appropriate for government attention and future work.

Keywords

E-Government, UTAUT, PLS, Attitude, Anxiety, Moderators

Introduction

Large amounts of investment and developmental activity over the past two decades have seen governments worldwide adopt and expand the use of innovative approaches to delivering government information and services to citizens (G2C), businesses (G2B), and other governments (G2G) – a phenomenon commonly referred to as *electronic government* (Norris and Reddick, 2013). Electronic government (e-government) has grown in popularity to the extent that it is nowadays a global phenomenon (Rufin et al. 2014), with all national governments, the majority of sub-national governments, and the bulk of local government authorities of any reasonable size providing official websites through which they are able to deliver information and services electronically at all times (Norris and Reddick, 2013). However, despite the numerous apparent benefits associated with the use of e-government, including more transparent and easily accessible services, reduced administrative burdens, and cost-effective service delivery (Hackney et al. 2007), governments continue to face numerous challenges in successfully introducing e-government services to their citizens (Gauld et al. 2010; United Nations, 2014) with corresponding relatively low utilization rates around the world (Venkatesh et al. 2012).

Notwithstanding the various benefits associated with e-government use, investment levels world-wide in developing infrastructures capable of facilitating the provision of online services and the apparent

differences between anticipated and actual e-government adoption levels, there is an evident need for greater insights into what motivates citizens to adopt and continue making use of these services. Given that most citizens are potential user of e-government (Venkatesh et al. 2012), and that citizens both within and across different societies are unlikely to behave in a homogenous manner, there is also a need to fine-tune our understanding by exploring how differences in moderating aspects such as age, gender, and experience of the Internet influence citizens perceptions of e-government services. Against this background, the aim of this paper is to present details of an empirical investigation into citizen adoption of e-government, thus contributing to the body of knowledge in this area. The remainder of the paper is organized as follows. The next section provides a brief review of previous work. We then present an overview of the theoretical context, along with the development of the research model and hypotheses tested. This is followed by an account of the methods employed, and by sections presenting and discussing the results. Finally, concluding remarks including implications, limitations, and suggestions for further research are presented.

Literature Review and Context

As governments continue to develop e-government systems to deliver services to citizens, there is a corresponding need for evaluation efforts that can determine their effectiveness (Wang and Liao 2008) and extent of adoption. However, despite an emerging body of literature reporting on the adoption of e-government services, few studies to date have examined the role of moderating variables on the relationships between determinants and dependent variables such as behavioral intention and use behavior. For instance, Lee and Rao (2009) proposed a research model that supports the impact of task complexity on citizen's decisions to use e-government services in the United States. Similarly, Wang and Shih (2009) examined the determinants of use behavior regarding information kiosks and the moderating effects of age and gender differences on the relationships between the determinants and behavioral intentions/use behavior in context of Taiwan. However, to our knowledge, there have not been any studies conducted on the adoption of an e-government system based on age, gender, and frequency of Internet use as moderating variables. Moreover, many studies employing the UTAUT do not make use of the recommended moderating variables at all (Williams et al. 2015), hence the application of UTAUT along with its recommended moderating variables is an area requiring further activity.

The majority of studies investigating individuals' acceptance of technologies have focused on industrialized countries (Alsajjan and Dennis 2010). Hence, while additional research in general is needed on consumer adoption of e-government, research is particularly required in diverse cultural settings as responses to technology may differ across cultures. Consequently, data for this study were collected in India – a developing country that has embraced the digital revolution in pursuit of socio-economic improvement. While the emphasis of the digital agenda in India has been primarily on automation and computerization, Indian State Governments have also endeavored to use ICT tools for connectivity, networking, processing information and delivering services to citizens (Mujtava and Pandey 2012). A number of the State Governments have initiated measures to incorporate ICT and associated tools into their governance processes. Indeed, the majority of Indian states have implemented some form of ICT-enabled applications to improve service delivery to citizens (Monga 2008). One example of such an application is the *e-District* system, which has been developed in order to provide citizens with an integrated, seamless, efficient, transparent, and reliable service. *E-District* benefits include faster processing of citizens' cases, appeals and grievances, an effective electronic workflow system, better and faster decision-making services for district administrations, improvements in the efficiency of the workforce, post-delivery evaluation for further improvement, and faster service delivery to citizens (Rana et al. 2015).

A review of the literature on e-government adoption suggests that only a handful of studies (Bhatnagar and Singh 2010; Mitra and Gupta, 2008; Rana et al. 2015; 2016) have been published in the context of India. Therefore, in order to contribute toward filling this research gap, this study analyzes the adoption of the Indian e-District system by employing the UTAUT as a core model, and examining the moderating effects of age, gender, and frequency of Internet use on the relationships between determinants (i.e., Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, and Anxiety) and dependent variables (Attitude and Behavioral Intentions).

Theoretical Framework and Hypotheses

Consumer acceptance of technological innovations has long been a subject of interest for both researchers and practitioners, and remains a management challenge (Alsajjan and Dennis 2010; Williams et al. 2009). Among the numerous behavioral models employed in studies investigating consumer adoption of technology, the UTAUT developed by Venkatesh et al. (2003) has emerged to become one of the best known, being widely employed in technology adoption and diffusion research (Williams et al. 2015). The UTAUT was therefore viewed as suitable for use as the core of the model used in this study.

Based on an analysis of eight prominent models/theories in the information systems/information technology (IS/IT) adoption field (the Technology Acceptance Model (Davis 1989), the Theory of Reasoned Action (Fishbein and Ajzen 1975), the Theory of Planned Behavior (Ajzen 1991), the Combined TAM and TPB Model (Taylor and Todd 1995), Innovation Diffusion Theory (Moore and Benbasat 1991; Rogers 2003), Social Cognitive Theory (Bandura 1986; Compeau and Higgins 1995), the Motivational Model (Davis et al. 1992), and the Model of PC Utilization (Thompson et al. 1991; Triandis 1977), the resulting UTAUT employs constructs from across the eight competing principles. The UTAUT contains four core determinants of technology-use behavior (Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions), along with four moderators of key relationships (gender, age, experience, and voluntariness of use).

In addition to the core UTAUT, we propose the inclusion of *Attitude* as a mediating construct in the model. The role of Attitude in explaining technology acceptance is widely acknowledged - see for instance the work of Bobbitt and Dabholkar (2001), Kim et al. (2009), and Taylor and Todd (1995) among numerous others. The inclusion of Attitude in models of IS/IT acceptance is also consistent with the Theory of Reasoned Action (Ajzen and Fishbein 1980; Fishbein and Ajzen 1975), the Theory of Planned Behavior (Ajzen 1991), and the Decomposed Theory of Planned Behavior (Taylor and Todd 1995). We therefore propose that based on a combination of conceptual development and empirical research - see for instance, Chen and Lu (2011) and Zhang and Gutierrez (2007) - Attitude will positively influence Behavioral Intention. We also introduce the relationship between Facilitating Conditions and Behavioral Intention into the core model. This is based on both theoretical foundation (see Ajzen, 1991; Taylor and Todd, 1995) and empirical findings (see Eckhardt et al. 2009; Foon and Fah 2011; Rana et al. 2015; 2016).

We also suggest that Anxiety be introduced as an determinant of Attitude within the core model. Our approach is aligned with the views of Venkatesh et al. (2003), who argue that Anxiety should not be considered a direct determinant of Behavioral Intention. In this research, Anxiety may be viewed as a determinant of Attitude, as potential adopters of an e-government system may be unfamiliar with the technology and the implications of using this channel to engage with government. Moreover, in recognizing the significance of relationships between Social Influence and Performance Expectancy and Facilitating Conditions and Performance Expectancy evident from an analysis of prior research (Rana et al. 2015), we incorporate them into our proposed model. Hence, the hypotheses tested in our study are as follows:

- H1: Performance expectancy will have a positive and significant influence on attitude.
- H2: Effort expectancy will have a positive and significant impact on attitude.
- H3: Social influence will have a positive and significant impact on attitude.
- H4: Social influence will have a positive and significant relationship on performance expectancy.
- H5: Facilitating conditions will have a positive and significant impact on performance expectancy.
- H6: Facilitating conditions will have a positive and significant impact on behavioral intention.
- H7: Anxiety will have a negative and significant impact on attitude.
- H8: Attitude will have a positive and significant impact on behavioral intention.

Finally, as specified by the UTAUT, we examine the role of moderating variables (in our study, age, gender, and frequency of Internet use) between determinants and dependent variables to examine if these moderators influence relationships. The key objective of investigating moderating effects is to develop greater understanding of whether the different forms of the moderating variables influence the proposed relationships.

Methodology

Subjects and Data Collection

This study uses data captured from the citizens of the Aurangabad, Madhubani, Gaya and Nalanda districts in Bihar State in India, where the e-District system was in the pilot testing phase. The New Delhi-based National Informatics Centre (NIC), as the organisation implementing the system, coordinated the contributions of various public and private sector organisations in four districts in order to pilot test the system in a phased manner. Students, employees and other non-adopters from these districts were invited to test the system and provide feedback. We made the users aware about the functioning of the system on the very first day of testing, and asked them to complete the data collection questionnaires. We distributed 250 survey questionnaires to the respondents in each district, making a total of 1000 questionnaires. Some respondents filled in the questionnaire and returned it immediately, whereas others returned it within a week during the pilot test camps in these districts. Respondents in the Aurangabad, Madhubani, Gaya and Nalanda districts respectively returned 92, 104, 81 and 112 questionnaires, resulting in 389 responses in total. Examination of the returns revealed that 85 questionnaires were either incomplete or incorrectly completed, and were hence discarded, leaving a sample of 304 usable responses.

Measurement

Items used to measure the original UTAUT constructs, and the additional constructs of Anxiety and Attitude were drawn from previously validated scales in the extant literature, reworded where appropriate to fit the e-District context. Hence, items used to measure Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions (FI) were adapted from those of Venkatesh et al. (2003). The measure of Anxiety was captured using items based on Venkatesh et al. (2003), while items to capture Attitude were based on those of Fishbein and Ajzen (1975).

Analysis and Results

Data analysis was performed using Partial Least Squares (PLS), a variance-based structural equation modelling (SEM) approach allowing simultaneous analysis of both measurement model and structural model. PLS has become prominent in fields including marketing (Hair et al. 2012) and information systems (Ringle et al. 2013), and was chosen in this study over covariance-based SEM given its suitability for predictive applications and theory exploration (as is the case here).

Measurement Model Evaluation

All first-order constructs in the research model are reflective, measurement quality being verified by examining convergent validity, discriminant validity, and internal consistency. The influence of common methods bias was also scrutinized.

Convergent validity was assessed in two ways. Firstly, item reliability was examined for each item. Convergent validity requires indicator loadings to be 0.6 or more (Bagozzi and Yi, 1988). All indicators had loadings well above 0.6, apart from two - both measuring anxiety. Neither exceeded 0.5 and hence were removed from the model. Remaining item loadings exhibited adequate convergent validity and were retained for subsequent analysis. Secondly, average variance extracted (AVE) was examined for all constructs. All AVE values were substantially greater than the 0.5 threshold, thus indicating satisfactory reliability and convergent validity.

Discriminant validity was also assessed in two ways. Firstly, all items loaded well onto their corresponding constructs, and more heavily than onto other constructs. Secondly, the square root of AVE for each factor was higher than the correlations with all other factors, again satisfying conditions for discriminant validity.

Internal consistency was assessed by means of composite reliability measures (CR), all of which were well in excess of the 0.7 threshold. Internal consistency was further assessed via Cronbach's α values, all of which were above 0.7, indicating either excellent (0.90 and above) or high (0.70-0.89) reliability.

Common methods bias (CMB) can be a major source of measurement error for survey-based research (Bagozzi and Yi 1988). Given that high CMB may lead to incorrect conclusions being reached about relationships between constructs, Harman's single-factor test (Podsakoff et al. 2003) was used to check if a single common factor accounted for the majority of variance across all factors. Harman's test yielded five factors with Eigenvalues above one, the first factor accounting for 37.8% of variance and all five factors accounting in total for 61.4% of total variance, suggesting that CMB was not present in the data. Finally, the more rigorous marker variable approach (Lindell and Whitney 2001) was performed in which marker variables were employed within the model, with paths to each of their own indicators as well as paths to the other constructs in the model. Comparison of model relationships with and without the marker variables revealed no notable differences of variance explained, with all theorized paths maintaining statistical significance, again suggesting that CMB was not of major concern.

Results from evaluation of the measurement model therefore demonstrated the adequate convergent and discriminant validity, internal consistency, and absence of CMB necessary to justify testing of the hypotheses.

Structural Model Evaluation

Results of hypothesis testing are summarized in Figure 2 and in Table 2. In Figure 2, R^2 values are presented for each endogenous variable, illustrating that the model explains 47.0% of the variance in PE, 40.3% of the variance in ATT, and 53.7% of the variance in intention to use e-government systems. Calculation of the Stone-Geisser criterion returned Q^2 values of 0.29 (PE), 0.28 (ATT), and 0.38 (behavioral intention), hence underlining the model's predictive relevance. Bootstrapping was performed to obtain significance levels for each of the hypothesized relationships – parameter settings for bootstrapping include 304 cases per sample, no sign changes, and 5,000 samples.

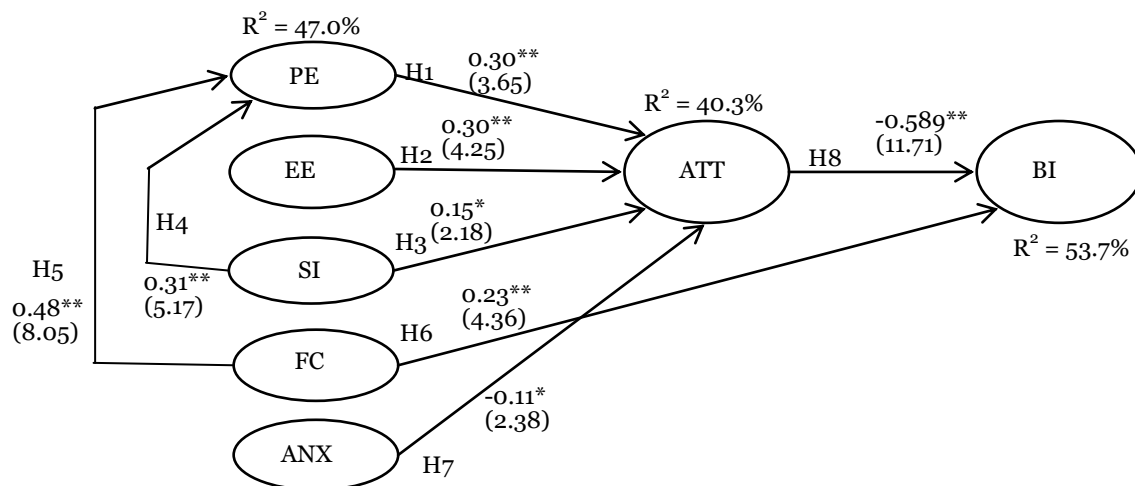


Figure 2. All Data Results

(*t*-values in parentheses, **significant at 1% level, *significant at 5% level)

Calculation of total effects produced a ranking among factors in terms of performance as drivers of e-government adoption. Additional insights were provided by an impact-performance analysis conducted at construct level, the combination of these techniques highlighting areas suitable for managerial attention by providing greater understanding of how the various constructs impact on the dependent variable. Results of this activity suggest that perceived attitude has the largest impact on intention to use e-District system. The impact of attitude has been seen on behavioral intentions across various theories of IS/IT adoption including the theory of reasoned action (TRA) (Fishbein and Ajzen 1975), the technology acceptance model (TAM) (Davis et al. 1989), the theory of planned behavior (Ajzen 1991), and the

decomposed theory of planned behavior (Taylor and Todd 1995). A number of studies (e.g. Hung et al. 2013; Lu et al. 2010; Rana et al. 2015; 2016) in the field of e-government and public administration have also supported the significant relationship between these two variables. For example, analysing the users' acceptance of mobile government services in Taiwan, Hung et al. (2013) found attitude as a critical factor that impact behavioral intention. Developing a unified model for e-government adoption in India, Rana et al. (2016) showed a positive and significant relationship between attitude and behavioral intention.

The second most influential factor in this study was facilitating conditions. E-government service providers could therefore potentially increase adoption levels by emphasizing this aspect of the service. For example, individuals may associate importance to the facilitating conditions such as help desks, common service centres (CSCs), and training programs. Hence, government organisations should consider providing adequate infrastructural facilities and proper training to users through the CSCs established across the country so that they can be positively influenced to use a relatively new e-government system (Rana et al. 2016). Venkatesh et al. (2012) emphasized the need for training and support programmes to be conducted on behalf of the government for strengthening the cause of facilitating conditions toward enhancing the acceptance of e-government systems. Designers of systems can provide additional packages of online training along the given e-government systems to ensure that the users can see a demonstration or obtain the relevant help required to access the system.

Relationship	Path Coefficients						
	Overall	Gender		Age		Frequency of Use	
		Female	Male	Gen X	Gen Y	Freq	Non-Freq
H1: Performance Expectancy (PE) on Attitude (Att)	0.297**	0.149 ^{ns}	0.365**	0.182	0.570**	0.296**	0.323**
H2: Effort Expectancy (EE) on Attitude (Att)	0.301**	0.383**	0.292**	0.374**	0.160 ^{ns}	0.294**	0.246*
H3: Social Influence (SI) on Attitude (Att)	0.145*	0.201 ^{ns}	0.095 ^{ns}	0.144 ^{ns}	0.117 ^{ns}	0.066 ^{ns}	0.329**
H4: Social Influence (SI) on Performance Expectancy (PE)	0.307**	0.343**	0.232**	0.290**	0.385**	0.312**	0.302**
H5: Facilitating Conditions (FC) on Performance Expectancy (PE)	0.482**	0.379**	0.567**	0.519**	0.408**	0.486**	0.477**
H6: Facilitating Conditions (FC) on Behavioral Intention (BI)	0.231**	0.074 ^{ns}	0.313**	0.220**	0.268**	0.209**	0.237**
H7: Anxiety (Anx) on Attitude (Att)	-0.109*	-0.241**	-0.059 ^{ns}	-0.149**	-0.004 ^{ns}	-0.121*	-0.083 ^{ns}
H8: Attitude (Att) on Behavioral Intention (BI)	0.589**	0.669**	0.549**	0.605**	0.581**	0.69**	0.591**

Table 2. Summary of Results
(**significant at 1% level, *significant at 5% level)

Moderator Analysis

A multi-group analysis based on gender as a moderator revealed a significant difference between R² values explained by social influence and facilitating conditions for PE, the model explaining 56.6% of variance for males, and 35.5% of variance for females. Path coefficients varied significantly according to gender in two aspects; the impact of Anxiety on Attitude (Male = -0.059, Female = -0.241), and the impact of FC on BI (Male = 0.313, Female = 0.074).

Age within the sample was divided broadly into two categories; Generation X (aged between 37-56) and Generation Y (aged between 16-36). Multi-group analysis based on age as a moderator revealed a significant difference between R^2 values for Attitude, the model explaining 35.5% of variance for Generation X, and 58.6% of variance for Generation Y. Path coefficients varied significantly according to age in terms of the impact of PE on Attitude (Generation X = 0.182, Generation Y = 0.570). There was also some evidence of a difference between path coefficients in terms of the impact of Anxiety on Attitude, but with significance only being observed at the 10% level, further work in this respect would be appropriate.

The final multi-group analysis focused on the concept of frequency of Internet use as a moderator. Frequency of Internet use within the sample was divided broadly into two categories; those who described their level of use as being frequently, or always using the Internet (categorized as Frequent Users), and those who described their Internet use as being occasional, rare, or very rare (categorized in this study as Non-Frequent Users). Multi-group analysis on this basis did not reveal any significant differences between the R^2 values obtained. However, path coefficients varied significantly according to level of Internet use in terms of the impact of SI on Attitude (Frequent = 0.066, Non-Frequent = 0.329).

Discussion

This research contributes to the body of knowledge of citizen's use of e-government services. Using the UTAUT as a basis, and employing extensions in the form of two additional constructs, the extended model was proposed and tested using primary data captured in an Indian context. With all eight specified hypotheses being supported by the empirical data (seven being significant at the 1% level, and one being significant at the 5% level), the model explains 53.7% of the variance in intention to use the e-District e-government system, and with a Q^2 value of 0.38 for behavioral intention, the predictive relevance of the model is apparent. Further investigation via a multi-group analysis approach to examine the influence of the moderating variables (gender, age, and frequency of Internet use) provided a number of additional insights.

The use of gender as a moderator revealed a significant difference in the impact of Anxiety on Attitude – a result that has previously found support in the information systems and psychology literature (see for instance, Broos, 2005; Gefen and Straub, 1997; Venkatesh and Morris, 2000). Broos (2005) established that females had more negative attitudes towards computers and the Internet than did males. Broos' study also revealed that males tended to have less computer anxiety than females. This view is further supported by the general information systems literature, which indicates that females typically display higher levels of computer anxiety when compared to males (Venkatesh and Morris, 2000). Furthermore, evidence from real world settings suggests that females tend to be more anxious than males about computer use in general (Bozionelos, 1996). These results clearly suggest that the differences between genders occurring in computer-related situations are also reflected in e-government scenarios. Hence, this study suggests that the Indian government could create bespoke e-government awareness and training programs aimed at decreasing anxiety levels of female users of the system, potentially resulting in the formation of more positive attitudes toward relatively new e-government systems such as the e-District scheme.

Findings, with regard to gender differences also indicated that male and female perceptions are significantly different as far as the impact of facilitating conditions on behavioral intentions is concerned. This result suggests that the nature of infrastructural facilities and training programs impact differently upon male and female intentions to use e-government systems, and supports the view that government agencies should be mindful of this particular issue when planning for, and providing infrastructural support and training. Previously documented (Elena, 2012) differences in India between male and females in terms of literacy rates and the digital divide (access to and use of e-government services) add further support the proposal that bespoke training and support frameworks would be beneficial in increasing use of e-government services.

Age has received relatively little attention in the technology acceptance literature (Venkatesh et al. 2003; Wang and Shih 2009), yet the results of this investigation clearly indicate that in terms of e-government use, there are differences in perceptions between more mature users (categorized as Generation X) and more youthful users (categorized as Generation Y). The significant difference between R^2 values formed for Attitude (explaining 35.5% of the variance for Generation X and 58.6% for Generation Y) suggests that

further exploration would be useful in this respect, as age is clearly a noteworthy factor. Our results also indicate a significant difference between generations in terms of the impact of PE on attitude, with PE having a far lower impact on the formation of attitude for older users. According to Venkatesh et al. (2003), governments should attempt to identify the potential “magic number” with regard to age where effects begin to appear or disappear for performance expectancy, and to treat the overall population accordingly. While the limited impact of age as a moderator in this study may not provide further compelling evidence to support this argument, results nevertheless do indicate some significant differences between age categories – particularly in respect to the formation of a positive attitude toward a system.

Analysis of the level of Internet use (categorized as Frequent or Non-Frequent) as a moderator revealed a significant difference in terms of the impact of social influence on attitude. This is perhaps not surprising as individuals making frequent use of Internet can more easily refine their attitudes based on information or stories shared by their significant others who have already adopted similar e-government or other systems than those who do not make frequent use of the Internet (Pynoo et al. 2007).

The government could therefore exploit this difference and identify and select frequent Internet users to act as champions who in turn could train and convince people in their immediate society. Highlighting the importance and benefits of using e-government systems by seasoned users would positively impact upon the attitudes of relatively new users, and can potentially help the government to reach out to the greater population through such champions. The government place greater emphasis on promoting Common Service Centers (a strategic component of the Digital India initiative) in rural areas, and encouraging local people to become more involved in their day-to-day management and operations in order that they may play a greater part in the promotion of, and facilitating access to e-government services nationwide.

Conclusion

This paper proposed a model of citizen acceptance of e-government systems by extending UTAUT with two additional constructs (Anxiety and Attitude), and including three moderators; gender, age, and frequency of Internet use. The model was tested with primary data gathered within the context of use of an e-government system in India. The model received good empirical support, explaining 53.7% of variance in citizen intention to make use of e-government systems. The paper contributes to e-government services research by highlighting key influencing factors (particularly the importance of attitude), identified a number of significant differences based on the use of the moderators, and identified a number of aspects appropriate for government attention. To our knowledge, this is the first study which has performed such a multi-group analysis making use of three significant moderating variables in an attempt to understand how overall variance and path coefficients within the extended model alter according to moderator categories. However, we acknowledge a number of limitations. While the sample size of 304 is sufficient for PLS analysis, sample sizes subsequently available for the multi-group analysis (which required the sample to be divided into two categories in each case) were naturally smaller. Further study would therefore attempt to collect a larger amount of data. This work focused only on non-adopters of the e-District system – hence further work would also engage adopters, and incorporate ‘actual use’ into the model. While the study acknowledges these limitations and identifies areas requiring further investigation, it can serve as a foundation for additional research into citizen acceptance of e-government within the context of moderating factors.

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