

Senior Citizens' Adoption of E-Government: In Quest of the Antecedents of Perceived Usefulness

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Abstract

E-Government, as a vehicle to deliver enhanced services to citizens, is now extending its reach to the elderly population through provision of targeted services. In doing so, the ideals of ubiquitous e-Government may be better achieved. However, there is a lack of studies on e-Government adoption among senior citizens, especially considering that this age group is growing in size and may be averse to new IT applications. This study aims to address this gap by investigating an innovative e-Government service specifically tailored for senior citizens, called CPF e-Withdrawal. Technology adoption model (TAM) is employed as the theoretical foundation, in which perceived usefulness is recognized as the most significant predictor of adoption intention. This study attempts to identify the antecedents of perceived usefulness by drawing from the innovation diffusion literature as well as age-related studies. Our findings agree with TAM and indicate that internet safety perception and perceived ease of use are significant predictors of perceived usefulness.

Keywords

E-Government, senior citizens, technology adoption model, perceived usefulness.

1. Introduction

The notion of E-Government has received significant attention in recent years. E-Government refers to the strategic application of information and communication

technology to “provide citizens and organizations with more convenient access to government information and services; and to provide delivery of public services to citizens, business partners and suppliers, and those working in the public sector” [1, 2]. The provision of enhanced services to citizens has been a major part of the agenda of e-Government as a means for government to better fulfill its political mandate of serving the general public. As a platform to serve the public, it is important that e-Government services are able to reach all sections of the population, including senior citizens. The need for governments to extend their e-Government services to senior citizens is amplified by the steady and sustained growth of the elderly population. According to an International Population Report jointly published by the U.S. Department of Health and Human Services and the Department of Commerce [3], the global population is aging at an unprecedented rate. Further, the elderly population may be less receptive to new technologies and applications [20]. These observations indicate a need to study e-government adoption factors for senior citizens, a topic which has received little research attention. With such motivation in mind, this study investigates an innovative e-Government service that is specifically tailored to the needs of senior citizens, called Central Provident Fund (CPF) e-Withdrawal.

Previous studies on information technology (IT) adoption have consistently identified perceived usefulness as the most significant factor that explains people's intention to adopt an IT innovation (e.g. [4, 5, 6, 7]). However, many of these studies did not clearly reveal the antecedents of perceived usefulness, knowledge of which are valuable to practitioners in guiding them to design a system that warrants high adoption [7]. Even if they do,

these studies are mostly conducting in organizational contexts (e.g. [8]). Our study aims to explicate factors that will affect senior citizens' perceived usefulness of an e-Government service. The factors identified should help e-Government implementers in designing services for senior citizens.

2. Theoretical Development

The Technology Acceptance Model (TAM) was used as the theoretical backbone for this study. TAM represents an important theoretical contribution towards understanding IT usage and acceptance behavior [4]. The goal of TAM is "to provide an explanation of the determinants of computer acceptance that is general, capable of explaining user behavior across a broad range of end user computing technologies and user populations, while at the same time being both parsimonious and theoretically justified" [4]. The model attempts to predict and explain system use by positing that two beliefs, perceived usefulness and perceived ease of use, are key determinants of computer acceptance behavior [4]. In its original form, the model defined the constructs of perceived usefulness as the degree to which a person believes that using a particular system would enhance his or her job performance, and perceived ease of use as the degree to which a person believes that using a particular system would be free of effort [4]. Most of the previous studies that employed TAM have shown that perceived usefulness is the most important determinant of intention to use a technology, while perceived ease of use becomes less important over periods of sustained usage [7, 9]. Although perceived usefulness is well accepted as the major antecedent affecting usage, it is practically useful to further elucidate the determinants of this factor [8].

Attempting to identify the antecedents of perceived usefulness, this study applies a well-established theory to a new research context, i.e., a specific e-Government service called CPF e-Withdrawal which targets senior citizens. CPF e-Withdrawal is an e-Government service that allows senior citizens over 55 years of age to withdraw their CPF and transfer funds to their designated bank accounts electronically. CPF is set up primarily to ensure that members have financial security in their old age. Both employers and employees make monthly contributions to employees' CPF account. Upon reaching age 55, citizens will be able to withdraw their CPF as a means to support their daily expenses. In this study we also included citizens in the 50-55 age group as they are potential users who may be using the service in the near future.

In our quest for the antecedents of senior citizens' perceived usefulness of the CPF e-Withdrawal service, we

first reviewed literature related to aging from the psychology field. According to activity theory [10, 11], as people grow old, they tend to maintain practices and habits of their middle age. Hence we can expect that compatibility, which refers to the degree to which an innovation meshes with the adopter's current habits and practices [12], will be a salient determinant of perceived usefulness in the context of senior citizens. Further, a meta-analytic review of age effects [13] concluded that affiliation needs increase with age, thereby implying that older people are more likely to be influenced by the people surrounding them. The image construct, defined as the degree to which an individual believes that the adoption of an innovation will bestow him with added prestige in his relevant community [12], is used to capture this factor.

In addition, we also conducted unstructured interviews with five senior citizens in order to explore other possible determinants of perceived usefulness. From the interviews, Internet safety perception emerged as an additional potential antecedent. Accordingly, we modeled these three factors i.e., compatibility, image, and Internet safety perception, as antecedents of perceived usefulness in our study.

Compatibility

Previous innovation diffusion studies have identified the link between perceived usefulness (relative advantage in innovation diffusion theory) and compatibility [14, 15]. The argument is that if the individual perceives an innovation to be inconsistent with his current practice, he will tend to be more uncertain about the expected benefits of the innovation. In this study, we define the compatibility construct to more specifically mean "the degree to which the CPF e-Withdrawal service is perceived as consistent with the senior citizens' existing practices and habits". The CPF e-Withdrawal service requires senior citizens to make use of computers to access the Internet and the particular application. To the extent that this behavior is compatible with citizen's existing practices and habits, they are likely to consider the service as useful. Hence, we hypothesize:

H1a: Perceived compatibility of the CPF e-Withdrawal service is positively related to senior citizen's perceived usefulness of the CPF e-Withdrawal service

Image

For certain innovations, the social prestige that the innovation confers to its adopter may be the sole benefit that the adopter receives [15]. In the context of CPF e-

Withdrawal service adoption by senior citizens, those who have adopted the service may impress others that even though they are old in age, they are still able to learn and use new technologies, hence keeping up to date with changes in society. This may enhance their social status and also enable them to serve as role models for other senior citizens who have not adopted this e-Government service. Accordingly, senior citizens having a higher need for social recognition will perceive the CPF e-Withdrawal service to be beneficial to them. Thus, we posit:

H1b: Perceived image from using the CPF e-Withdrawal service is positively related to senior citizen's perceived usefulness of the CPF e-Withdrawal service

Internet Safety Perception

The construct of Internet safety perception is adapted from the concept of structural assurance [16, 17, 18] to more specifically refer to “one’s believes that structures like guarantees, regulations, promises, legal resources, or other procedures are in place to promote the use of Internet for transactions as being safe and free from danger”. This definition is deemed adequate to capture the concerns of some senior citizens whom we interviewed about the security of performing transactions using the Internet. Despite its enormous potential, ubiquitous adoption of e-Government service has not taken place [19]. One possible reason for this is that e-Government “exposes citizens to unique threats to data privacy and security of information” [19]. Accordingly, when senior citizens’ perceive the Internet as being unsafe, their perceived usefulness of the CPF e-Withdrawal service is likely to deteriorate. Hence, we hypothesize:

H1c: Internet safety perception is positively related to senior citizen's perceived usefulness of the CPF e-Withdrawal service

Other Hypotheses from TAM

Based on TAM, perceived ease of use is expected to positively influence perceived usefulness of a technology. Together with perceived usefulness, perceived ease of use is also hypothesized to directly influence the intention of using a technology. Although some studies [7, 9] found that perceived ease of use has less significant effect on intention over a period of sustained usage, we decided to retain the construct as prior research found that perceived ease of use has a stronger effect on intention for individuals who are of older age [20]. Increased age has been shown to be associated with difficulty in processing complex stimuli and allocating attention to information on

the job [21], both of which may be necessary when using a software system [7]. Consistent with the conceptualization of TAM that excludes attitude in order to explain intention parsimoniously, we decided to exclude the attitude construct from our research model [7]. Our dependent variable is the intention to use the service instead of actual usage due to the fact that the CPF e-Withdrawal service is relatively new and less than 0.3% of senior citizens currently use the service. The remaining hypotheses are as follows:

H1d: Perceived ease of use is positively related to perceived usefulness of the CPF e-Withdrawal service

H2a: Perceived usefulness is positively related to senior citizen's intention to use the CPF e-Withdrawal service

H2b: Perceived ease of use is positively related to senior citizen's intention to use the CPF e-Withdrawal service

Our research model is depicted in Figure 1.

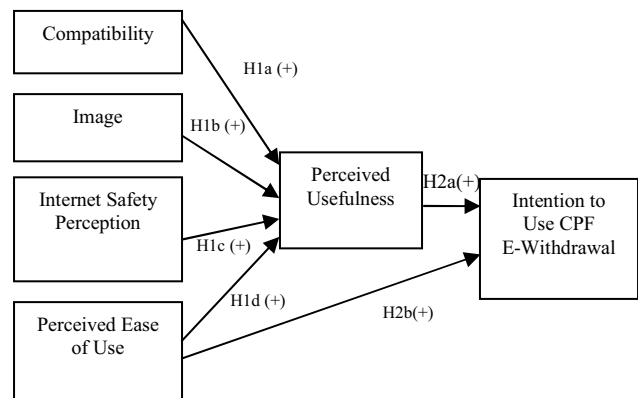


Figure 1. Research model

3. Research Methodology

The survey research method was used for our data collection. Survey methodology provides a basis for establishing generalizability, allows replicability, and has statistical power. An instrument anchored on 7-point Likert scale was constructed based on established measures of constructs as shown in Table 1. With the consideration that senior citizens may have more difficulty in allocating attention to complex stimuli and information presented [21], we decided to keep the questionnaire short by removing repetitive items and retaining the necessary items to tap the constructs.

Table 1. Construct operationalization

* – denotes items deleted

Construct Items	Source
Intention to Use E-Withdrawal 1. I would like to use the CPF E-Withdrawal service today, if possible (INT1) 2. I would try to use the CPF E-Withdrawal service as soon as I can (INT2) 3. I am likely to be one of the first senior citizens to use the CPF E-Withdrawal service (INT3) *	[6]
Perceived Usefulness 1. I think the CPF E-Withdrawal service is useful (USE1) 2. I think the CPF E-Withdrawal service will be beneficial to me (USE2) 3. I think the CPF E-Withdrawal service is valuable (USE3) 4. Overall, using the CPF E-Withdrawal service will be advantageous (USE4)	[6]
Image 1. Using the CPF E-Withdrawal service can give me more prestige (IMAGE1) 2. Using the CPF E-Withdrawal service can improve my profile (IMAGE2) 3. Using the CPF E-Withdrawal service is a status symbol among the senior citizens I know (IMAGE3) *	[12]
Perceived Ease of Use 1. It will be easy to learn how to use the CPF E-Withdrawal service (EASE1) 2. It will be easy to use the CPF E-Withdrawal service (EASE2)	[6]
Compatibility 1. Using the CPF E-Withdrawal service is compatible with the way I spend my time in dealing with the government (COMP1) 2. Using the CPF E-Withdrawal service is compatible with the ways (online or offline) I usually deal with the government (COMP2) 3. Using the CPF E-Withdrawal service is compatible with the ways (online or offline) I obtain government services (COMP3)	[14, 6]
Internet Safety Perception 1. The Internet has enough safeguards to make me feel comfortable using it to perform transactions (INTER1) 2. I feel assured that legal structures adequately protect me from problems on the Internet e.g., ability to bring up disputes with legal courts or third party institutions (INTER2) 3. I feel assured that technological structures e.g., security technologies like data encryption and secure firewalls, make it safe for me to perform transactions there (INTER3) 4. In general, the Internet is now a safe environment in which to perform transactions (INTER4)	[16, 17, 18]

Apart from the constructs above, we also collected data on several important demographic variables that may confound our findings i.e., gender, ethnic group (as the target country is a multiracial nation), education, and income.

The study is staged in an Asian country where Chinese are the largest ethnic group (76.8%) and Chinese language is one of the major spoken languages (75.8%). A large portion of the senior citizens in this country do not receive education that includes formal training in the English language (79.7%), and only speak or write Chinese language. Hence, to cater to this Chinese-speaking community, an instrument in Chinese was also prepared by performing double translation with the help of 4 PhD students. Discussions with domain experts were also conducted to assess the face validity of the scales followed by a process of conceptual validation. After a pilot study was conducted to assess the reliability and validity of the scales, the field survey was conducted.

The pilot study involved a convenience sample of 20 senior citizens who were asked to participate in the survey voluntarily. A cover letter was included with the survey instrument that explained the purpose of the study along with a description about the CPF e-Withdrawal service. After they agreed to participate, the senior citizens were given a brief demonstration of the CPF e-Withdrawal service (e.g., the website interface, the features offered, and the steps in performing a transaction). According to Chin and Gopal [22], the initial interest can be gauged by providing a brief simplified demonstration, or through a promotional or informational videotape. Initial beliefs and adoption intentions in such situations have been shown to be indicative of future intentions and use [4]. Moreover, beliefs have also been shown to remain relatively consistent for individuals when only conceptual training is provided without procedural training [23]. Based on these reasons, this approach is deemed appropriate as it is impractical to expect all subjects to have used the service before since the service is still new (introduced 3 months before the survey). Based on the feedback we gathered from the pilot study, two items were deleted. For instance, some respondents commented that INT3 measuring Intention “I am likely to be one of the first senior citizens to use the CPF e-Withdrawal service” is ambiguous because according to them, it is unrealistic to expect them to know whether they are “one of the first”. This item was then deleted. Another item (IMAGE3) measuring Image “Using the CPF E-Withdrawal service is a status symbol among the senior citizens I know” was reported as ambiguous. Some of the senior citizens did not understand the meaning of “status symbol”. The final instrument contained 17 items.

4. Data Collection and Analysis

In the field study we administered the survey instrument to 99 randomly selected senior citizens from coffee shops, community centers, and public housing estates. These

locations were selected since they are the places where senior citizens with lower education levels usually gather. The reasons for targeting lower education level senior citizens were two-fold. First, low educated senior citizens account for a large percentage of senior citizens in the country that we conducted the study. Second, studies have shown that individuals with low education levels tend to have more difficulty to adopt an innovation (e.g. [24, 15]). Hence by focusing on such group of people, it is hoped that we can obtain better insights into the factors that will lead to the adoption of an innovation. The survey procedure was the same as that of the pilot study. Due to the nature of the study that focuses specifically on a particular population and the need to demonstrate the service to the subjects, we conducted face-to-face surveys instead of the more typical mail or telephone survey. As a precaution step, we tried to keep intervention minimal by letting the subjects complete the survey privately, offering explanation in a neutral tone only when needed. This was done in order to minimize potential errors due to social desirability and interviewer bias.

Demographic and Measurement Statistics

The descriptive statistics of the respondents are shown in Table 2.

Table 2. Subjects' descriptive statistics

Gender	Male	57.6%
	Female	42.4%
Ethnic	Chinese	84.8%
	Malay	9.1%
	Indian	6.0%
	Others	0.1%
Highest education level	Primary school	27.3%
	Secondary school	40.4%
	Junior college	9.1%
	Polytechnic	10.1%
	University	8.1%
	Others	5.0%
Age	50-54	50.5%
	55-59	21.2%
	60-64	15.2%
	65-69	5.1%
	70-74	5.1%
	75-79	2.9%
Current or highest monthly income before retirement	Below S\$2,000	37.4%
	S\$2,000 – 4,999	52.5%
	S\$5,000 – 7,999	6.1%
	S\$8,000 – 10,000	4.0%
	Above S\$10,000	0.0%

The descriptive statistics of model variables is shown in Table 3.

Table 3. Descriptive statistics of model variables

Variable	No. of Items	Mean	S.D.
INT	2	4.51	1.41
COMP	3	3.78	1.17
IMAGE	2	3.44	1.10
INTER	4	3.77	1.30
EASE	2	4.19	1.60
USE	4	4.77	1.28

We performed exploratory factor analysis using principal component analysis with varimax rotation. Table 4 shows the rotated component matrix obtained.

Table 4. Rotated component matrix

	Component					
	1	2	3	4	5	6
INT1	0.22	0.19	0.37	0.18	0.78	0.19
INT2	0.22	0.21	0.34	0.15	0.78	0.27
USE2	0.17	0.25	0.72	0.16	0.40	0.24
USE3	0.23	0.25	0.78	0.13	0.28	0.20
USE4	0.33	0.20	0.80	0.16	0.19	0.21
IMAGE1	0.31	0.20	0.15	0.86	0.14	0.10
IMAGE2	0.26	0.13	0.15	0.91	0.12	0.10
EASE1	0.26	0.28	0.25	0.15	0.20	0.83
EASE2	0.26	0.28	0.32	0.09	0.30	0.78
COMP1	0.16	0.90	0.17	0.07	0.18	0.09
COMP2	0.19	0.89	0.16	0.16	0.13	0.22
COMP3	0.27	0.79	0.26	0.21	0.10	0.25
INTER1	0.83	0.18	0.30	0.18	0.01	0.22
INTER2	0.82	0.16	0.21	0.20	0.15	0.27
INTER3	0.85	0.18	0.25	0.21	0.23	0.14
INTER4	0.87	0.21	0.06	0.22	0.19	0.05

LISREL 8.51 was used to perform confirmatory factor analysis (CFA) to verify the measurement properties of all constructs i.e., assess convergent validity and discriminant validity. Table 5 shows the results of convergent validity tests i.e., Cronbach's alpha, average variance extracted, and composite reliability of the scales. Table 6 shows the results of discriminant validity test i.e., χ^2 differences between constrained and unconstrained models between each pair of constructs. As shown in the two tables (5 & 6), all the constructs demonstrate adequate convergent and discriminant validity.

Table 5. Convergent validity

Variable	Cronbach's Alpha	Average Variance Extracted	Composite Reliability
Intention	0.90	0.83	0.91
Compatibility	0.94	0.85	0.94
Image	0.94	0.89	0.94
Internet Safety Perception	0.95	0.85	0.95
Perceived Ease of Use	0.96	0.92	0.96
Perceived Usefulness	0.91	0.78	0.91

Table 6. Discriminant validity

Dimensions	Unconstrained model	Constrained model	
	χ^2 (df)	χ^2 (df)	$\Delta \chi^2$
INT & USE	17.91 (8)	50.24 (9)	32.33
INT & IMAGE	5.86 (4)	69.85 (5)	63.99
INT & EASE	0.45 (1)	49.9 (2)	49.45
INT & COMP	12.37 (4)	67.16 (5)	54.79
INT & NTER	23.09 (8)	71.35 (9)	48.26
USE & IMAGE	27.9 (3)	138.64 (4)	110.74
USE & EASE	15.76 (8)	87.35 (9)	71.59
USE & COMP	20.05 (13)	204.53 (14)	184.48
USE & INTER	39.52 (19)	296.00 (20)	256.48
IMAGE & EASE	7.55 (4)	91.07 (5)	83.52
IMAGE & COMP	21.96 (8)	231.03 (9)	209.07
IMAGE & INTER	27.19 (13)	129.03 (14)	101.84
EASE & COMP	11.40 (4)	190.26 (5)	178.86
EASE & INTER	17.77 (8)	99.65 (9)	81.88
COMP & INTER	27.25 (13)	458.29 (14)	431.04

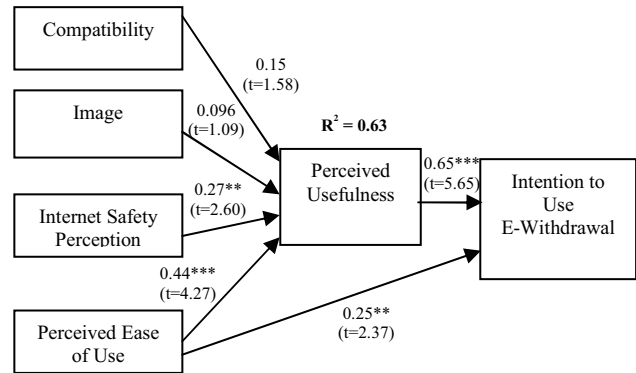
Table 7. LISREL indices of the structural model

LISREL Fit Indices	
χ^2 (Chi-square)	154.51
χ^2/df (Chi-square/degree-of-freedom)	1.68
Goodness-of-Fit Indices (GFI)	0.84
Adjusted Goodness-of-Fit Indices (AGFI)	0.76
Standardized Root-Mean-Square Residual (RMR)	0.043
Root-Mean-Square Error of Approximation (RMSEA)	0.083
Normed Fit Index (NFI)	0.91
Comparative Fit Index (CFI)	0.95

The LISREL indices for the structural model are shown in Table 7. The goodness-of-fit index (GFI) of the structural model is 0.84, a marginally acceptable level [25]. However, caution needs to be taken since GFI is sensitive to sample size. After adjusting for sample size, the fit is acceptable, as indicated by the CFI (> 0.90). Both the standardized RMR and RMSEA are within the acceptable range. The standardized factor loadings for all the items are greater than the recommended threshold of 0.50. The t-statistics of all factor loadings are also

substantial and significant ($p < 0.001$). Overall, the model is adequate.

Hypotheses Testing



- * - significant at $p < 0.05$,
- ** - significant at $p < 0.01$,
- *** - significant at $p < 0.001$

Figure 2. Structural model

The results of structural model testing are shown in Figure 2. The hypotheses testing shows that perceived usefulness and perceived ease of use are significant determinants of intention to use the CPF e-Withdrawal service (H2a and H2b supported). Also Internet safety perception and perceived ease of use are significant determinants of perceived usefulness (H1c and H1d are supported). Compatibility and image were not significant in determining perceived usefulness (H1a and H1b were not supported). The effects of the possible confounding variables were also evaluated. None of these effects were found to be significant. This suggested that these variables did not play a role in influencing the dependent variable in this study.

5. Discussion

In general, the findings are consistent with TAM in that perceived usefulness and perceived ease of use are the two significant predictors of use intention, while perceived ease of use is a significant predictor of perceived usefulness. In addition, the findings are also in line with the past studies that find perceived usefulness as the most significant determinant of use intention, suggesting that senior citizens' intention to use the e-Withdrawal is closely tied to the instrumentality of the service. The finding, however, contradicts Morris and Venkatesh [20], who found that perceived ease of use was more significant than perceived usefulness in explaining use intention for older people in the workplace. This shows that perceived

usefulness remains the most significant predictor of use intention even in the context of senior citizens' adoption intention in non-workplace settings.

In terms of the proposed antecedents to perceived usefulness, Internet safety perception and perceived ease of use were found to be significant in predicting perceived usefulness. Compatibility and image were found to be insignificant. These results were robust even after controlling for potential confounding variables (income, ethnic group, education, and gender). The reasons for these results may possibly be explained from a cultural perspective. Specifically, image is insignificant probably because of the collectivistic culture of the country where this study is conducted (as indicated by the low individualism index) [26]. Collectivism stands for a society in which people from birth onwards are integrated into strong, cohesive in-groups, which throughout people's lifetime, continues to protect them in exchange for unquestioning loyalty. In a collectivistic society, people might consider too much differentiation and rewards for any reason as inimical to the fundamental goal of maintaining harmony in groups [27]. There may be little incentive in trying to gain high prestige, which would make one distinctive from the rest. Thus regardless of whether the use of the service can bestow higher image, the senior citizens' perception of the service will not be significantly affected.

Compatibility is also insignificant maybe because the country of study has a low uncertainty avoidance index (UAI) [26]. Uncertainty avoidance refers to the extent to which a culture feels threatened by ambiguous, uncertain situations and tries to avoid them by establishing more structures. Cultures with low UAI scores feel more comfortable with unknowns, and believe in accepting dissenting views among cultural members and in trying out new things. Since incompatibility is associated with uncertainties being introduced [15], due to low uncertainty avoidance, the incompatibility experienced by the senior citizens in using the e-Withdrawal may not significantly affect their perceived usefulness of the service. Interviews with respondents indicated that our explanations of these rival hypotheses may be plausible.

6. Conclusion

The study has a few limitations. The small sample size may affect the statistical power of the findings. However, the high R^2 yielded (0.72) seems to suggest good explanatory power. Nevertheless, future studies may consider using a larger sample size to obtain a higher statistical power of the findings. In addition, the research findings were obtained from a single study. Thus caution needs to be taken in generalizing our results.

Despite these limitations, this research is one of the initial studies that focus on a specific age group (senior citizens) in the context of e-Government's adoption. The study offers theoretical implications in the following ways. First, it shows that TAM is robust even when applied to a new context, i.e., senior citizens' adoption of e-Government service. This contributes to the cumulative tradition of IS adoption research. Second, it uncovers the salient factors that influence the senior citizens' usefulness perception of an e-Government service i.e., Internet safety perception and perceived ease of use. Last, it suggests that culture may supersede certain factors (image and compatibility) in influencing the perceived usefulness of users towards a technology. Nonetheless, as this study is conducted in a single national culture, more studies involving different national cultures are called for in order to find further support for this finding.

In terms of practical contributions, this study provides prescriptive guidance to the designers of e-Government services in enhancing the acceptance of these services. Furthermore, the guidance provided is not limited to knowing about the importance of perceived usefulness. Additionally, in order to make the service useful to the target users, practitioners can strive to ensure that the service is easy to use and assure the users that using the service through the Internet will be safe. The latter may be achieved by providing certain guarantees against possible financial losses to senior citizens who use the service, especially since the e-Withdrawal service being studied here can involve large amounts of electronic funds transfer. Overall the study helps sensitize the government in extending its services to the growing population of senior citizens.

As one of the first studies that focus on the senior citizens' adoption of e-Government, this research paves the way for other more fruitful studies which can contribute towards attaining successful e-Government implementations and subsequently help realize ubiquitous e-Government. Future research may investigate the factors influencing adoption among different age groups to see if there are differences in terms of the salient factors among them. This will help e-Government implementers to better design specifically-targeted services to citizens from different age groups.

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