THE INNOVATIVENESS AND SELF-EFFICACY PREDICT THE ACCEPTANCE OF USING iPAD2 AS A GREEN BEHAVIOR BY THE GOVERNMENT'S TOP ADMINISTRATORS

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ABSTRACT
Apple released the first iPad in 2010, and since then various operating systems have emerged. Many corporations have adopted the use of tablets in efforts toward organizational innovation. Innovation is the motivation for organizations to move forward and it is a key in the maintenance of their competitive advantage. The Environmental Protection Administration (EPA) of Taiwan started to use the iPad 2 in 2010. In subsequent years, they wrote a new operating system for an innovative plan to input all meeting materials into the system. The present study used a technology acceptance model (TAM), and its innovativeness, to elucidate the rationale for the use of the iPad 2 by top administrators (most of who were more than 50 years of age and were conditioned to having secretaries handle the work of document processing). We also investigated the factors that predict the use of the iPad 2 in a business-meeting setting, and the acceptance of the iPad 2 by EPA participants. The results of this study revealed the following points. 1.) Innovativeness and iPad self-efficacy had a significant positive influence on each participant's perceived usefulness (PU) and perceived ease of use (PEU) of the iPad 2, as well as on its usefulness in creating a paperless meeting environment. 2.) The PEU had a significant positive influence on participants' PU of the iPad 2 in creating a paperless meeting environment. 3.) PEU and PU had a positive influence on user satisfaction. 4.) User satisfaction had a positive influence on user's will to continue using the iPad 2.
Keywords: iPad 2; iPad self-efficacy; innovativeness; TAM

INTRODUCTION

Green behavior change has become one of the most stringent and severe international environmental topics of the 21st century. Taiwan as a newly industrialized country (NIC) and an effective party in the United Nations Framework Convention on Climate Change (UNFCC) is at a turning point in terms of development. In order to uphold Taiwan's competitive strength, the Environmental Protection Administration (EPA), Administration's Executive Yuan, should draft a more constructive policy to reduce carbon dioxide emissions and to save energy. Programs for impact adjustment should also be planned. On January 25, 2010, Executive Yuan issued an official plan to promote the use of electronic official documents to reduce paper consumption and save energy in all government institutions. The most evident benefit from this plan would be a reduction in the quantity of paper used. Judging by the quantity of paper used by Executive Yuan's Research, Development and Evaluation Commission in the past years, the adoption of electronic official documents would significantly reduce the more than 80,000 sheets of paper used per year. There are approximately 8,000 government institutions from local to central with an estimated 30,000 official documents being processed each year. If these government institutions could adopt the electronic official document verification and start using networks for the issuing and approval of official documents, 9,000 trees could be saved. Executive Yuan of Taiwan later announced a regulation requesting government officers to use the iPad 2 as a tool for reducing the use of paper in administrative document processing.

In order to meet the requirements of the new regulation, the EPA started to promote the new policy and requested that top administrators use the iPad 2 at meetings and for all other forms of organizational communication from 2011 on. Eventually, those top administrators had to use the iPad 2 in order to receive, organize and deliver information. The nature of the use of this new technology by the middle-aged officers showed a preference towards relatively low-risk activities, and relatively simple lock-in opportunities (Lichtenstein & Williamson, 2006) to ensure efficient communication with others. The initial reason for use of the new technology might have been because it was a tenant of employment, but as the officers adopted the use of the iPad in their administrative jobs, the ability to perform fast information transactions anywhere, at any time,

quickly became apparent. However, in using a new technological device, older adults often tend to report less comfort, lower efficacy, and less of a perception of control (Czaja et at., 2006; Morris & Venkatesh, 2000; Heart & Kalderon, 2011), and this reaction is likely to decrease innovation acceptance (Selwyn, Gorard, & Furlong, 2005; Selwyn, Gorard, Furlong, & Madden, 2003). Thus, the motivation for this research lay in the differences in attitude that those top administrators had towards the innovation adoption constraint imposed by government policy. The present study was undertaken to understand the intent of top administrators toward the use of an iPad 2 and also the relative factors that affected the use of an iPad 2 at meetings based on the technology acceptance model (TAM); In other words, the acceptance of the iPad 2 was investigated in order to prove the TAM. Also, we investigated the differing behaviors in the use of the iPad 2, in order to explain user intent. We hope the research results provide insights on the experiences of top administrators as they attempted to apply a new technological innovation to Research, Development and Evaluation Commissions, and that these insights will provide concrete evidence and suggestions for the development of an official policy for electronic documentation.

RESEARCH CONTENTS AND HYPOTHESES

Apple released the first iPad in 2010, and it brought a new look to the tablet PC market. Users were to interact with the iPad via multi-touch display control — a new means of interaction with computers. Whether this new interaction method would add value to administrative work was something worth trying. Many of the alternative models which have been developed have included variables taken from the TAM in their structures, and the TAM seems to be particularly well-suited for use as the theoretical base for studying the influence of additional variables (Venkatesh & Bala, 2008).

Technology Acceptance Model (TAM): In order to achieve the purposes of promoting a new technological device, and taking into consideration the factors that affect acceptance of a new technological device, this study adapted Davis' (1989) TAM to examine the participants' intent to use the new technological device. Davis' TAM was based on the theory of reasoned action (TRA) (Ajzen, 1988; Fishbein & Ajzen, 1975) and was developed to provide a theoretical basis for determination of the external variables that affect users' internal beliefs, attitudes, and intent, thereby affecting users' information technology usage behavior.

Two motivational factors, perceived usefulness (PU) and perceived ease of use (PEU), were the main factors that elicited an "attitude." Moreover, the PEU should indirectly impact both PU and user attitude. According to Davis (1989), PU means that users perceive the system as an enhancement for work efficiency. The PEU, however, means that the user perceives that the device being used enhances learning. TAM explains the user acceptance of a technology based on user perceptions (Davis, Bagozzi, & Warshaw, 1989). The mediating roles of PU and PEU are examined in the relationship between external variables and the intention of system usage. Both PU and PEU influence an individual's attitude toward use (ATU) of an information system. Attitude and PU, in turn, predict the individual's behavioral intention (BI) to use (Venkatesh & Bala, 2008). Davis (1989) also believed in different research applications, or when predicting or interpreting the acceptance of technology through different theories and studies, external variables should be elaborated on to expands discussion of the degree of acceptance. Therefore, when scholars adapted the TAM, they would normally omit the attitude variable in order to simplify it (Davis et al., 1992; Igbaria et al., 1996；Teo et al., 1999；Venkantesh and Davis, 2000; Teo 2001; Gefen et al., 2003).

Although TAM is considered as a well-recognized model in the field of information systems, little systematic research has been conducted in the environmental concern, this context indicating a significant gap in knowledge. Therefore, there is a strong current need to develop and gain empirical support for the TAM within environmental organizations. Several researchers have adapted the above frameworks to describe adoption of ICT by elder employees, indicating PU and PEU are the primary determinants affecting attitude toward use (ATU), which affects intention to use (IU) (Adams, Stubbs, & Woods, 2005; Phang et al., 2006; Hill, Beynon-Davies, & Williams, 2008). Based on the above statements, we examined users' PU and PEU for the iPad 2, and we proposed a hypothesis for the relationship between innovativeness and iPad self-efficacy. We also probed the behavioral intent of top administrators at the EPA to use the iPad 2 in meetings.

Innovativeness: Innovativeness has to do with how early in the process of adoption of new ideas, practices, etc., that an individual or an organization is likely to accept a change. Rogers (1976, p.292) defined *innovation* as "an idea, practice or object perceived as new by an *individual* or other *relevant unit* of adoption." Adoption has been studied as a technology-related concept and is defined by Rogers (2002) as a behavior exhibited by individuals when they first put a new technology to use. With this perspective, the prerequisites of adoption — acceptance that is related to overwhelming complexity, innovation overloads, and difficult-to-learn interfaces of such products — may cause a change in the apprehensions of the user, thus, the resistance to a new product, system

or process. Personal innovativeness, or the tendency to accept innovations, is influenced by demographics, product experience and personal values, the perceived relative advantage of the innovation, perceived compatibility, complexity, observation and trial-ability, and additionally the social context and social norms of an organization (Woodside & Biemans, 2005). Then, how the constructs of innovativeness affect the constructs of TAM would be a matter of realizing the acceptance of using iPad 2 as a tool to reduce the use of paper in document processing.

iPad self-efficacy (ISE): The concept of self-efficacy, which comes from the Social Cognitive Theory, refers to the belief that one has the capability to perform a task (Bandura, 1997). Bandura (1986) defined it as "people's judgment of their capabilities to organize and execute courses of action required attaining designated types of performances." The nature of self-efficacy as a task-specific psychometric property is that it is measured directly (Cassidy & Eachus, 2002). Over the past decade, a number of studies have been focused on computer and Internet self-efficacy (Eastin & LaRose, 2000) and have been revised as technology has progressed. In order to be consistent with the "specificity" notion of self-efficacy theory, self-efficacy perceptions have involved beliefs about specific skills and abilities needed for a given behavioral performance (Bandura, 1986). In the present study to examine iPad usage by older individuals, the effect of self-efficacy beliefs which determine propensity and intensity of iPad use was examined, and positive beliefs were associated with early adoption, and increased use, of the iPad. For the new iPad, the present study used the term "iPad self-efficacy" as an extension of the TAM.

Research hypotheses: The research sample of the present study was selected from persons in high ranking positions who may not have used computers as often as youngsters or as lower-ranking persons; some of them may even have subordinates who operate computers for them. These high ranking officers seemed to have a high digital divide (Lenhart et al., 2003; Rice & Katz, 2003). Some studies have focused on the intention-to-use digital divide from a cognitive prospective, e.g., examining how new technology self-efficacy influences new technology use intent (Lam & Lee, 2005), others have examined the effects of innovation (Rogers, 2003) on bridging the digital gap (Zhao et al., 2010). Bhattacherjee (2001) proposed the Information Systems Continuance Model (ISCM). This model is based on the individual behavior theory of Expectation–Confirmation and the TAM. The ISCM has been modified and used by a number of researchers and has been used to predict a user's intention to continue to use a new information system (Ifinedo, 2006). DeLone and McLean's (2003) ISCM suggested that there are three success dimensions that have causal relationships with user satisfaction and intention-to-use, which can ultimately allow net benefits to accrue. In this sense, the present study replaced "ATU" with "satisfaction with usage (SU)" as the construct of success, and used innovation and iPad self-efficacy (iPad SE) as the external variables to form the research hypotheses as follows.

H1: PEU is significantly correlated to PU of an iPad used for document processing.
H2: PEU is significantly correlated to SU of an iPad used for document processing.
H3: PU is significantly correlated to SU of an iPad used for document processing.
H4: PU is significantly correlated to intention to use an iPad.
H5: SU usage is significantly correlated to intention to use an iPad for document processing.
H6: Innovativeness is significantly correlated to PU of an iPad used for document processing.
H7: Innovativeness is significantly correlated to PEU of an iPad used for document processing.
H8: iPad SE is significantly correlated to PU of an iPad used for document processing.
H9: iPad SE innovation is significantly correlated to PEU of an iPad used for document processing

RESEARCH DESIGN

Research participants: The present study targeted the top administrators attending meetings at the EPA. A total of 58 questionnaires were distributed and 42 were returned. After scanning, 2 incomplete questionnaires were discarded resulting in a total of 40 effective questionnaires, for a return rate of 68.96%. Descriptive statistics were performed on the valid questionnaires to analyze each variable. Among those valid returns, 83.3% were male and 16.7% were female. With respect to age distribution, 23.8 % were 50 years-of-age, and 76.2% were 55 years-of-age. With respect to the experience in using iPad 2 before replying to the questionnaire, 78.6% had no experience where 11.9% had more than a half year of experience in using iPad 2.

Research instruments: The present study used a questionnaire to survey "Innovativeness, and how the iPad 2 self-efficacy affects the intention and satisfaction of iPad use as a tool to process administrative documents," and a 5-point Likert-type scale was used to measure the perceptions of the participants. The innovativeness scale referred to Hurt, Joseph, and Cook's (1977) individual innovativeness scale which was designed to measure individuals' orientations toward change. Research has indicated that this orientation is associated with several

communication variables**.** This study employed Compeau and Higgings' (1995) computer self-efficacy and Lam and Lee's (2005) Internet self-efficacy to define iPad self-efficacy. The TAM constructs used in the present study referred to David's (1989) TAM for items such as perceived usefulness, ease of use and behavioral intent. In addition, the present study employed satisfaction to replace the behavioral attitude that was used in DeLone and McLean's (2003) study.

Data analysis: Based on the research evidence, we used Visual PLS 1.04 software to perform reliability analysis, factor analysis, structural equation modeling (SEM), and other research tests on the data from valid questionnaires. SEM was used to explore the causal relationship between variables and to examine the relationships among different hypothetical models to verify our theoretical framework.

RESEARCH RESULTS

Item analysis with composite reliability and convergent validity: The study used Visual PLS 1.04 as an analytical tool to carry out descriptive statistics, factor loading, and t-value calculations in order to understand the items of the study. Internal consistency can be determined by examination of the composite reliability (CR) of the constructs (Fornell & Larcker, 1981), and all CR values in the present study ranged from .895 to .963, surpassing the suggested threshold value of 0.7 (Nunnally, 1978; Hair et al., 1998). Model validation was discussed extensively in the literature, but most authors merely offer terminology instead of a methodology (Refsgaard & Henriksen, 2004). Convergent validity referred to the degree to which multiple items measure one construct. Convergent validity in the present study was evaluated by checking whether (1) the average variance extracted (AVE) values were larger than 0.5 (Fornell & Larcker, 1981) and (2) the factor loadings of all items were significant and higher than .5 (Nunnally, 1978). All these conditions were met, indicating acceptable convergent validity. Additionally, all t-values were significant, showing that all items were discriminative, and all items were able to identify the degree of response for different samples (see Table 1). The results showed that the alpha values for innovativeness, iPad SE, PEU, PU, ATU, and BI were .848, .890, .950, .867, .856 and .929 respectively.

Table 1. Factor Loadings, CR, and AVE

Items	Mean	SD	Loading	t-value
Innovativeness: CR=.895; AVE=.634, α=.848				
1. I would like to try all kinds of new inventions or new ideas.	4.24	.91	.851	22.060
2. I would try to use new methods to sort things out.	4.38	.58	.854	18.019
3. I could often think of different ways to solve difficult problems.	4.52	.59	.630	4.136
4. My thinking and behavior are original.	4.19	.77	.745	7.139
5. I believe new technology devices can trigger my creativity	4.38	.66	.875	16.739
IPad 2 self-efficacy: CR=.924; AVE=.710, α=.890				
1. I can use iPad 2 without any obstruction even when no one has taught me how to use it.	3.21	1.42	.730	5.712
2. I'm able to use iPad 2 if I have the user manual as a reference.	3.74	1.15	.763	8.886
3. I have confidence in utilizing all the functions on the iPad 2.	3.67	1.00	.878	24.059
4. I have the confidence to use iPad 2 if someone could demonstrate the operating methods briefly for me once.	3.86	1.03	.912	27.014
5. I am very confident to in using new technology devices.	3.95	.96	.914	35.743
Perceived ease of use: CR=.964; AVE=.842, α=.950				
1. The function of iPad 2 is easy to learn	4.02	.75	.958	60.350
2. The function of iPad 2 is easy to master	4.02	.75	.958	60.350
3. It is convenient for me to use iPad 2 for any occasion.	4.19	.67	.944	45.008
4. The implicit knowledge of iPad 2 is easy to figure out by myself.	4.10	.85	.928	46.326
5. In meeting occasion, I can use iPad 2 for document process easily.	4.21	.72	.791	11.896
Perceived usefulness: CR=.899; AVE=.607, α=.867				
1.Using iPad 2 can enhance the efficiency of the document process	4.02	.75	.805	12.500
2.Using iPad 2 can promote job performance	3.88	.92	.912	43.268
3. Using iPad 2 can enhance the effectiveness of meetings	4.05	.88	.912	48.222
4. Using iPad 2 can promote the convenience in organizational communication.	3.83	1.01	.840	17.821
5. Using iPad 2 can really reduce the paper usage	4.81	.51	.626	5.308
Satisfaction with usage: CR=.924; AVE=.802, α=.856				
1. I am satisfied with using iPad 2 as an organization	4.36	.66	.928	33.257

communication tool.				
2. I am satisfied with using iPad 2 as a document processing tool.	4.45	.59	.848	17.677
3. I am satisfied with the reduced rate of paper use by using iPad 2.	4.10	.93	.910	40.830
Behavior intention to use: CR=.954; AVE=.838, α=.929				
1. I will continue using iPad 2 as a document processing tool	4.50	.67	.909	23.848
2. I will continue using iPad 2 as a tool of searching relative information.	4..40	.63	.920	28.316
3. I will continue using iPad 2 as an organization communication tool.	4.38	.66	.922	32.046
4. I will recommend the use of iPad 2 as a document processing tool for all occasions.	4.26	.86	.911	44.877

Factor analysis with internal reliability and construct validity: The construct validity of the research instruments was established using confirmatory factor analysis (Byrne, 2001). All factor loadings were statistically significant and ranged from .899 to .964. To evaluate the consistency of the variables, reliability analysis of the questionnaire was identified using Cronbach's *α*. According to Nunnally (1978), a Cronbach's α value above .5 indicated an acceptable level of reliability. Table 1 showed Cronbach's α values and indicated that all values were above 0.5 and that the reliability coefficient for the entire questionnaire was .952, which suggests that the variables were reliable. According to Kaiser (1970; 1974), if the value of the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy wass above .5, then the construct validity was acceptable. Table 2 presented the KMO values and indicates that all values were above .5 and that the composite validity of the entire questionnaire was .678, which further indicates that the variables are reliable. Table 1 showed that the mean values of each dimension were between 3.69 and 4.39 and that the standard deviations were small, indicating a low degree of dispersion.

Table 2 Factor and reliability analysis

Dimension	Mean	SD	Cronbach's *α*	KMO
Overall	4.18	.55	.952	.678
Innovativeness	4.34	.56	.848	.751
iPad SE	3.69	.94	.890	.751
PU	4.12	.81	.950	.553
PEU	4.11	.68	.867	.670
SU	4.30	.65	.856	.714
BI	4.39	.64	.929	.737

Correlation analysis: Table 3 showed that there was a significant positive correlation between most of the various dimensions. Only innovativeness was not significantly correlated to iPad SE, and iPad SE was not significantly correlated to perceived usefulness.

Table 3 The correlation matrix

	Innovativeness	iPad SE	PEU	PU	SU	BI
Innovativeness	1					
iPad SE	.178	1				
PEU	.599***	.273	1			
PU	.541***	.693***	.736***	1		
SU	.596***	.532***	.817***	.728***	1	
BI	.590***	.353*	.818***	.629***	.788***	1

* $p < .05$ ** $p < .01$ *** $p < .001$.

Path Analysis: Figure 1 shows the results of the path relationship among the hypotheses. It is evident that all the hypotheses were supported. Figure 2 indicates and supports that the test of innovativeness influenced participant PU and PEU with standardized regression coefficients (SRC) of .26 and .38. The test of iPad SE influenced and supported PU and PEU with an SRC of .37 and .63. The test of PEU influenced and supported PU with an SRC of .85. The test of PU and PEU influenced and supported SU with an SRC of .60 and .30. Finally, the test of PU and SU influenced and supported BI with a SRC of .55 and .33.

DISCUSSION

A majority of the research participants were older than 55 years old, they were assumed to have used iPad 2 as a tool to reduce paper usage in governmental organization. A revised TAM was used as the basic framework to examine how much innovativeness of top administrators and the self-efficacy in using iPad 2 would predict their SU and behavioral intention mediated by PU and PEU. Consequently, the statistical results indicated all

hypotheses were supported, that is, the higher level of self-efficacy the research participants in using iPad 2, the higher level of PEU and PU they would have, and further reflect to higher level of SU and IU towards iPad 2. This evidence somewhat contradicted the common assertion that limited willingness in of technology use by older adults stems from low self-efficacy, computer anxiety, or technophobia — a negative attitude toward modern technology in general (Selwyn, 2004, 2006). In addition, the results of the present study were consistent with Selwyn's studies which showed a higher level of iPad self-efficacy led to a higher PU and PEU, as well as the study results from previous researches (Agarwal and Prasad (1998), Gilly and Zeithaml (1985), and Zeithaml and Gilly (1987)).

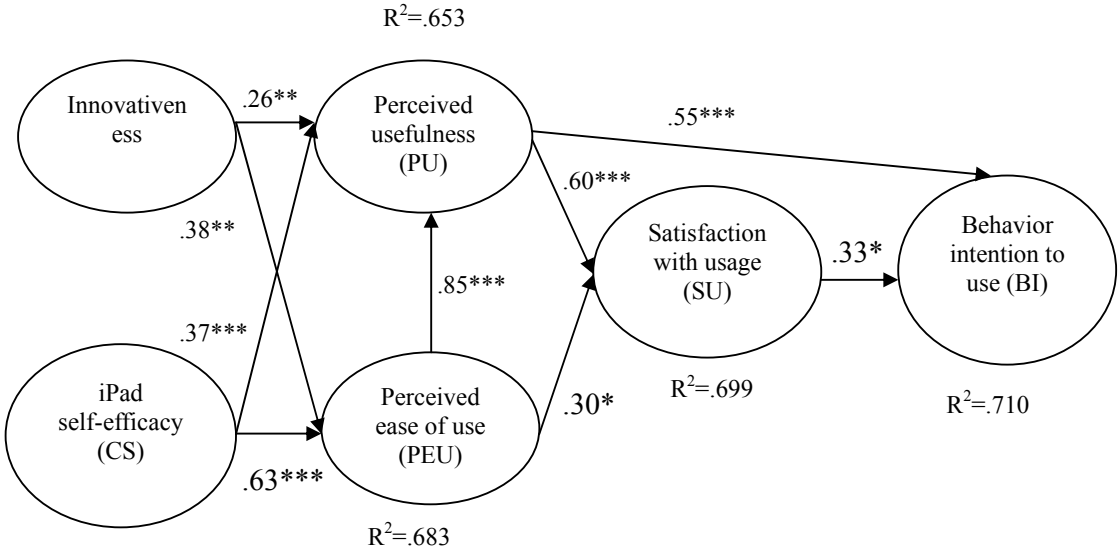

Figure 1: Verification of research model

Another finding of this study indicated the innovativeness also revealed the positive correlation to PEU and PU, which in turn reflected to a high level of SU with using iPad 2 and IU for administrative jobs. The mean of personal innovativeness of those top administrators was found to be 4.34 in the present study, which revealed tendency in participants' to adopt new information technologies. The result was supported by Woodside and Biemans' (2005) argument, personal innovativeness, or the tendency to accept innovations, is influenced by perceived compatibility and complexity. In this view, the prerequisites of innovativeness acceptance can be said to relate to interface design of a certain product, as well as its PEU. However, the finding was in contrary to Rogers' (2002) highlights, that resistance to use new technological device exhibits in people, even to individuals with high innovativeness when they first encounter a new technology. Conclusively, the present findings may be explained by participants who had no difficulties in using the interface of iPad and were satisfying the new policy, in short, the results indicated the role of innovativeness was essential for top administrators, as elder adults were to accept new technological devices.

CONCLUSION AND FUTURE STUDY

There are numerous factors that affect the use of a new technological device. In the present study, TAM was adopted to examine the innovativeness and iPad self-efficacy. The results of present study disagreed with the proverb "old dog cannot learn new skills", that is, when elderly had the innovativeness and iPad self-efficacy, they were found to willingly adopt new technological device, such as iPad 2.

The issue of new technologies acceptance has been widely discussed by researchers and others within the different industries, each shown to have different influential factors towards technology acceptance, however, in order to enhance future technology use by other government sections, such as the ministry of education (promotes environment education), the results of the present study may be applied to encourage more top administrators in applying iPad 2 to replace their paper document processing. In the end, the samples of this study were limited to EAP employees, as they exhibit stronger Green sense over other employees from government units. Thus, the future studies may focus on studying the innovativeness and self-efficacy toward technological device in other government units for further understanding into innovativeness and iPad acceptance in promoting a greener workplace.

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