

Full Length Research Paper

Consumer adoption of e-service: Integrating technology readiness with the theory of planned behavior

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Increases in labor costs and innovations in technology have contributed to the growth of Internet-based e-service. Customers use the new technologies to produce and consume services without direct personal contact with companies. The trends of e-service technologies will continue as e-service are increasingly implemented in customer-firm interactions. This study devoted effort for developing an integrated model designed to predict and explain an individual's continuous use of e-service based on the concepts of Technology Readiness (TR) and Theory of Planned Behavior (TPB). The participants were from undergraduate student, selected 405 responses as the sample finally. We applied Structural Equation Model (SEM) to demonstrate the stability of the proposed model and the results of hypotheses testing. Overall, the research findings showed that the effect of attitude and perceived behavioral control are very important but that subjective norm does not influence an individual's continued usage intention of e-service. Besides, technology readiness has significantly influence on attitude, subjective norm and perceived behavioral control. This research represented the initial study to empirically examine and discuss the relationships among TR and TPB. The integrated model can fully reflect the spirit of TPB and take advantage of technology readiness. Implications of the empirical findings and future research are also discussed.

Key words: E-service, theory of planned behavior (TPB), technology readiness (TR), structural equation modeling (SEM).

INTRODUCTION

New electronic service, like online taxing, e-government, and various web-services have become popularized in the customer service role while traditional telephone and fax, are being deployed at a swift pace (Burke, 2002). The service space is a virtual environment where transactions take place through virtual channels, no longer requiring the physical presence between customers and service providers. The trend away from face-to-face contact toward online and technology-mediated methods has implications both for selecting technologies and for managers who provide service in these high-tech

environments (Parasuraman and Colby, 2001; Ray, Muhanna, and Barney, 2005; Chen et al., 2009). On account of technologies' broadening characters in service delivery, it is necessary to comprehend customers' readiness to use technology-based systems such as e-service (Parasuraman, 2000; Burke, 2002; Lin et al., 2007). The personalities of consumers play a principal role while they adopt a new technology or service either in the context of work or home. Such a research is the technology readiness (Parasuraman, 2000), which developed multidimensional psychographic constructs and offered a way to segment online customers based upon underlying positive and negative technology beliefs. TR measures an individual's readiness to use new technology in general by four personality traits: optimism, innovativeness, discomfort, and insecurity. The TR

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personalities and insecurity. The TR personalities of customers should be discussed in order to precisely predict the perception and behavior of customers (Chen and Chen, 2009).

The development of Theory of Planned Behavior (TPB) is originally based on the theory of Reasoned Action (TRA) (Ajzen and Fishbein, 1980; Fishbein and Ajzen, 1975) which is designed to explain almost any human behavior and has been proven successful in predicting and explaining human behavior across various application contexts (e.g. Carswell and Venkatesh, 2002; George, 2004; Wu and Chen, 2005). This study attempted to synthesize the essence of technology readiness and TPB to propose an integrated model for explaining customers' continued use of e-services. We adopted Structural Equation Modeling (SEM) to demonstrate the stability of the proposed model and the results of hypotheses testing. Finally, we discuss the influence of technology readiness, attitude, subjective norm and perceived behavioral control on satisfaction and continuance intention towards e-service.

LITERATURE REVIEW

Technology readiness

Technology readiness (TR) refers to people's propensity to embrace and use new technologies for accomplishing goals in home life and at work (Liljander et al., 2006; Parasuraman and Colby, 2001). The technology readiness index (TRI) is supported by Parasuraman's multiple cross-sectional research design. The study sample consisted of a cross-section of 1000 adults (18 years or older) chosen through random-digit dialing from all over the United States. According to Parasuraman (Parasuraman, 2000), technology readiness can be categorized into four distinct components (optimism, innovativeness, discomfort, and insecurity). Parasuraman (2000) defined TR as four dimensions of users separated by their prevailing personality trait with two dimensions being motivators of new technology use and another two being inhibitors (Figure 1).

Although, many literatures have studied customer reactions with new technologies or e-related service (e.g. Haque et al., 2009; Jahangir and Begum, 2009), scholarly research on people's readiness to use technology-based systems is sparse. TR refers to people's propensity to embrace and use new technologies for accomplishing goals in home life and at work (Parasuraman, 2000). Technology readiness index defines four groups of users separated by their prevailing personality trait with two factors being motivators of new technology use and another two being inhibitors as following (Parasuraman, 2000; Parasuraman and Colby, 2001):

(i) Optimism: a positive view of technology (belief in

increased control, flexibility, and efficiency in life due to technology).

(ii) Innovativeness: a tendency to be the first using a new technologies (a tendency to be a technology pioneer and thought leader).

(iii) Insecurity: distrusting of technology and skepticism about its ability to work properly.

(iv) Discomfort: a perception of lack of control over technology and a feeling of being overwhelmed by it.

Optimism and innovativeness are the positive drivers of technology readiness index (TRI); they encourage customers to use technological products/services, and to hold a positive attitude towards technology. The relative strength of positive drivers in TR indicates a person's openness towards technology. On the contrary, discomfort and insecurity are the negative attitudes, i.e. inhibitors; they make customers reluctant or have less intention to adopt new technology (Yen, 2005).

Theory of planned behavior

The development of theory of planned behavior (TPB) is originated from the theory of reasoned action (TRA) (Ajzen, 1991; Ajzen and Fishbein, 1980; Fishbein and Ajzen, 1975) which is designed to explain human behavior and has been proven successful in predicting and explaining human behavior across various application contexts (e.g. Carswell and Venkatesh, 2002; George, 2004; Wu and Chen, 2005). According to TPB (Figure 2), belief (an individual's subjective probability of the consequence of a particular behavior) influences attitude (an individual's positive and negative feelings about a particular behavior), which in turn shapes behavioral intention. A person's actual behavior in performing certain action is directly influenced by his or her behavioral intention and in turn, jointly determined by attitude, subjective norm and perceived behavioral control toward performing the behavior. Behavioral intention is a measure of the strength of one's willingness to try and exert while performing certain behavior. In essence, TPB differs from TRA in its addition of the component of perceived behavior control (Taylor and Todd, 1995).

Attitude refers to "the degree of a person's favorable or unfavorable evaluation or appraisal of the behavior in question". Ajzen (1991) further described that a favorable or unfavorable attitude has a direct proportion to the strength of the behavioral beliefs about likely consequences and can be formulated with an expectancy-value model. Subjective norm refers to "the perceived social pressure to perform or not to perform the behavior". In other words, subjective norm is related to the normative beliefs about the expectation from other people (Wu and Chen, 2005). Perceived behavioral control refers to "the individual's perception of ease or difficulty in performing the behavior of interest" (Ajzen, 1991). It is associated with the beliefs about the presence of control factors that

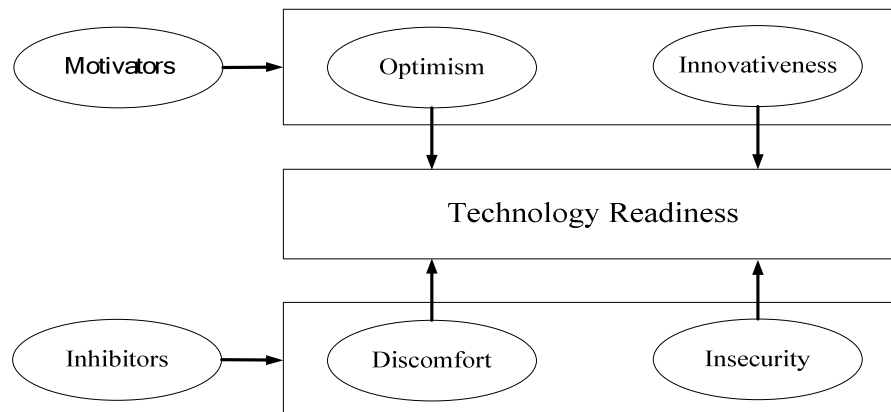


Figure 1. Contributors and inhibitors of technology readiness (Parasuraman, 2000).

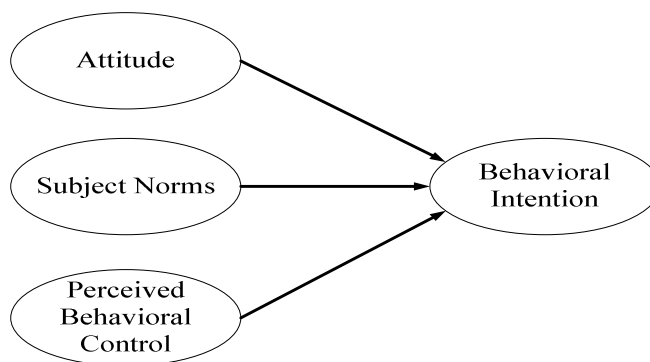


Figure 2. Theory of planned behavior (Ajzen, 1991).

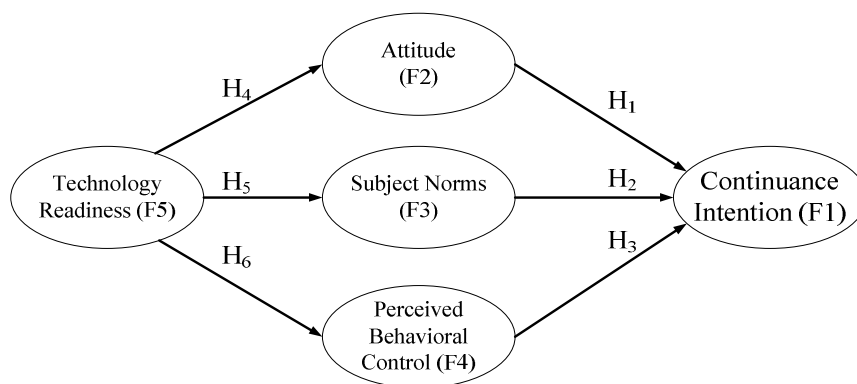


Figure 3. Conceptual framework.

that may facilitate or hinder the performance of the behavior (Ajzen, 2002).

HYPOTHESES DEVELOPMENT

This study theorizes that general TR belief is a causal determinant of specific cognitive appraisal of attitude,

subjective norms, and behavioral control, and it proposes the focal hypotheses H_4 , H_5 , and H_6 in this paper. In order to establish a comprehensive framework to integrate TR into TPB, H_1 , H_2 , H_3 , and H_4 , addressed by past studies (Ajzen, 1991; Ajzen, 2002; Parasuraman, 2000), are intertwined with H_4 , H_5 , and H_6 . The research model with all theoretical constructs is provided in Figure 3, whereas the hypothetical relationships among theoretical constructs

Table 1. Research hypotheses.

Hypothesis	Statement
H ₁	Attitude positively influences continuance intention.
H ₂	Subjective norm positively influences continuance intention.
H ₃	Perceived behavioral control positively influences continuance intention.
H ₄	Technology readiness positively influences attitude.
H ₅	Technology readiness positively influences subjective norm.
H ₆	Technology readiness positively influences perceived behavioral control.

constructs are summarized in Table 1. An extension of TR and TPB would be in more comprehensive manner to understand the acceptance behavior towards e-service.

METHODS

Subjects

A survey agency conducted a web-based survey to evaluate the research model for 40 days. The participants for this study were 488 undergraduate students from five universities in Taiwan. This study gathered student based for two reasons. First, the students will eventually be the most active and potentially influential consumers in the near future. Moreover, the issue of electronic commerce is important and critically related to students, which are quite a familiar issue to the sample group. Besides, recognizing the preferences and of potential customers are necessary. After eliminating incomplete responses through data filtering, we selected 405 usable responses as the sample finally. Adopting users with e-service experience rather than those without e-service experience facilitated the external validity of this study. We used the value of Cronbach's α for identifying the reliability of the questionnaires, and conducted factor analysis for convergent validity. The result of our pilot test showed the high reliability of all the questionnaires. After data collection, a two-step procedure proposed by Anderson and Gerbing (Anderson and Gerbing, 1988) is applied during the structural equation model (SEM) test. The first step involves developing an effective measurement model with confirmatory factor analysis (CFA), while the second step analyzes the structural model. Both SPSS 18 and AMOS 18 are adopted as the tools for analyzing the data.

Measures

To ensure the questionnaire satisfied the content validity, the items of questionnaire in the current study are modified from existing literature, and three steps were employed to choose items for measurement. First, the measurement items from the prior research were translated into Chinese. Second, three university professors who were proficient in English and familiar with EC and e-service, were asked to provide assistance in examining the appropriateness of the Chinese version of the scale, translated from the original English measurement items. Finally, a reexamination for the measurements was repeated throughout the pilot test. Moreover, to ensure desired balance and randomness in the questionnaire, three items were worded with proper negation and all items were randomly sequenced on the questionnaire in order to reduce the potential ceiling (or floor) effect that induces monotonous responses to the items designed to measure a particular construct. To take individual differences into account, this study integrated the construct of technology readiness with TPB to better explain

consumers' intentions to use e-services- online banking systems in particular. An integrated model of technology readiness and TPB is established to address the issue of user adoption of e-services.

The result of our pilot test showed the high reliability of all the questionnaires. All the questionnaires used in this survey have been validated in previous studies. This study employed the partly 14-item TRI scales (Parasuraman, 2000; Yen, 2005) to measure the two dimension of TR (i.e., 6 items for optimism, 5 items for innovativeness). The items of attitude (4 items), subjective norms (3 items) and perceived behavioral control (3 items) were adapted from Ajzen (1991). Each item question was scored on the Likert scale from 1 to 7, with a 1 rating indicating strong disagreement and a 7 rating indicating strong agreement.

Data analysis

Measurement model

The value of modification index (MI) was used to choose or drop indicator variables. A total of 4 indicator variables were removed. Each construct in the final measurement model is measured using at least three indicator variables. Nunnally (1978); Joseph et al. (1987) suggested that a construct can be regarded as high reliability if Cronbach's α is greater than 0.70. Results showed that each construct in this study had strong reliability with all Cronbach's α greater than 0.78 (shown in Table 2). The construct validity of the research instrument was assessed via confirmatory factor analysis (CFA) using AMOS 18. Model estimation was executed through the unweighted least squares method. To perform a CFA, all of the constructs and reflective indicators were depicted and composed as a measurement model in which all constructs were allowed to correlate with each other.

Convergent validity is the degree to which an operation is similar to (converges on) other operations that it theoretically should also be similar to. For example, if scores on a specific form a aggressiveness test are similar to people's scores on other aggressiveness tests, then convergent validity is high (there is a positively correlation between the scores from similar tests of aggressiveness). Convergent validity is achieved if different indicators used to measure the same construct obtain strongly correlated scores. In SEM, convergent validity can be assessed by reviewing the value of factor loadings, average variances extracted (AVE) and Cronbach's α (Fornell and Larcker, 1981). In this study, all factor loadings for indicators measuring the same construct are statistically significant (as shown in Table 2). Besides, all AVE and Cronbach's α for each construct are greater than 0.5 and 0.7, respectively. This shows that all indicators effectively measure their corresponding construct and support convergent validity (Fornell and Larcker, 1981; Anderson and Gerbing, 1988). Furthermore, using groups with e-service experience, rather than those without e-service experience, helps facilitate improved external validity of the current study. Six model goodness-of-fit criteria were examined: Goodness-of-Fit index (GFI), Adjusted Goodness-of-Fit Index

Table 2. Summary of measurement scales.

Constructs	Indicators	Factor loading	Cronbach's α (Reliability)
F1	CI1	0.83	0.81
	CI2	0.67	
	CI3	0.80	
F2	ATT1	0.84	0.88
	ATT2	0.76	
	ATT3	0.78	
	ATT4	0.82	
F3	SN1	0.78	0.78
	SN2	0.57	
	SN3	0.83	
F4	PBC1	0.87	0.87
	PBC2	0.74	
	PBC3	0.88	
F5	TR1	0.81	0.91
	TR2	0.78	
	TR3	0.76	
	TR4	0.83	
	TR5	0.72	
	TR6	0.73	
	TR7	0.59	
	TR8	0.72	
	TR9	0.61	
	TR10	0.46	
	TR11	0.50	

Note: F1 = Continuance intention; F2 = Attitude; F3 = Subjective norm; F4 = Perceived behavioral control; F5 = Technology readiness

Table 3. Goodness-of-fit indices

Fit index	Measurement model	Structural model
GFI (>0.90)	0.96	0.96
AGFI (>0.90)	0.95	0.95
RFI (>0.90)	0.95	0.94
NFI (>0.90)	0.95	0.95
PGFI (>0.50)	0.77	0.77
PNFI (>0.50)	0.83	0.82

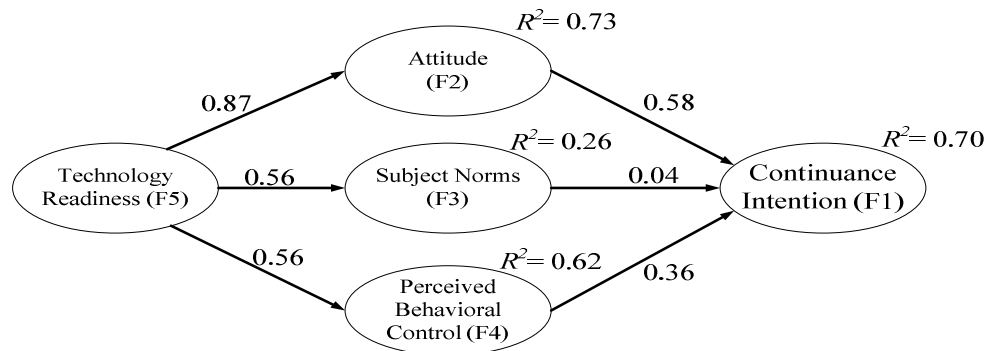
(AGFI), Relative Fit Index (RFI), Normed Fit Index (NFI), Parsimony Goodness-of-Fit Index (PGFI) and Parsimonious Normed Fit Index (PNFI) (Bentler, 1989; Browne and Cudeck, 1993; Hartwick and Barki, 1994; Hair et al., 2010). The overall goodness-of-fit indexes for the measurement model presented in Table 3 (GFI, AGFI, RFI and NFI all greater than 0.9; PGFI and PNFI all greater than 0.5) indicated that the fits of the model were satisfactory (Bentler, 1989; Bentler and Bonnett, 1980; Hair et al., 2010).

Structural model

The structured equation model (SEM) was used to test the six hypotheses proposed in this study. The hypothetical model (as shown in Figure 3 and Table 1) was depicted using visual tools provided by AMOS. Each indicator was connected to its theoretical construct in a reflective manner as well as linked accordingly to the hypothesis. Exogenous constructs including technology readiness,

Table 4. Summary of hypothesis testing results.

Hypothesis	Path coefficients	Supported?
H ₁	0.58	Yes
H ₂	0.04	No
H ₃	0.36	Yes
H ₄	0.87	Yes
H ₅	0.56	Yes
H ₆	0.90	Yes

**Figure 4.** Estimated model.

attitude, subjective norm, perceived behavioral control and continuance intention were freely correlated. For the SEM model in this research, GFI is 0.96, AGFI is 0.95, RFI is 0.94, NFI is 0.95, PGFI is 0.77 and PNFI is 0.82 (Table 3). All fit indexes have suggested adequate model fit between the research model and the empirical data. Based on the entire sample, one path is not supported (H₂ is not supported) while the remaining paths are all significant at the 0.01 level (H₁, H₃, H₄, H₅ and H₆ are supported). Properties of the causal paths, including standardized path coefficients and hypotheses testing results in the hypothesized model are presented in Table 4 and Figure 4.

FINDINGS AND CONCLUSIONS

Findings

Several implications can be obtained from the study results. First, two of antecedent constructs (attitude and perceived behavioral control) in TPB have direct influences on continuous usage intention. Among these relationships, attitude toward the behavior and perceived behavior control are two major influencers on individual's behavioral intention to adopt e-service. Furthermore, attitude indicates more importance than perceived behavior control in determining behavioral intention to use e-service. The result quite conforms to the findings reported with business-based setting in prior research. Second, subjective norm does not produce significant impacts on continuously behavioral intention to use in this research. Several empirical studies have shown that subjective norms have a positive and direct impact on

behavioral intention, but this influence is usually weaker than that of attitude and perceived behavioral control (Ajzen and Fishbein, 1980; Armitage and Conner, 2001). It indicates that the effect of "word-of-mouth" has no significant influence on continuance intention. Besides, the effect of perceived behavioral control on continuance intention is much greater than subjective norms. Since continuance intention determined by perceived behavioral control, some consideration concerning certain facilitating mechanisms to help customers use online services with ease might be useful for promoting customers' retention (Liao et al., 2007).

Finally, users' technology readiness has the strong influence on TPB's factors in this study. Users seem to confront IT more openly and positively and are less likely to focus on its negative aspects. The more positive optimism and innovativeness of customers own, the higher of attitude and continuance intention of e-service that are generated. Moreover, as e-service spreads and labor costs rise, more enterprises will offer customers with self-service opportunities, replacing manual labor with technologies (e.g. Lin and Hsieh, 2006; Lin and Hsieh, 2007). This means that e-service service providers should stimulate more certainly the positive drivers of TR in order to reach the business goals for satisfying customers and increasing benefits. We represented the initial study to empirically integrate and examine the relationships among TR, attitude, subjective norms, and perceived behavioral control toward e-service. In the integrated model of TR and TPB, the total variance

explained in continuous intention increase to 70%. This result reveals that integrating the theoretical constructs of TPB with TR can definitely increase the accuracy of an integrated model to predict and explain customers' behavioral intentions. Technology readiness was theorized to be four causal antecedents of attitude, subjective norms and perceived behavioral control. We were able to show that personality makes a difference in the adoption process of IT and this may help to explain how its adoption may be influenced by the personality of users as well as the characteristics of the technology; personality characteristics as measured in the TRI have a significant effect on technology adoption. A large sample survey from users that own e-service experience was employed to empirically examine the integrated model in this research. Due to the growth of e-service in the e-commerce environment, it is essential for researchers to understand customer usage and perceptions of e-service. E-service allows (or forces) customers to offer their own service encounters via the interaction of web-service or machines rather than by interacting with a firm's service personnel.

LIMITATIONS AND FUTURE RESEARCH

We hoped this issue will further stimulate additional research in this research area. Several future research directions proposed as follows: First, this study was conducted with a cross-sectional research approach, so additional research efforts are needed to evaluate the validity of the proposed model and our findings. Longitudinal evidences might be enhanced to collect temporal data so that our understanding of the causality and interrelationships between variables, factors which could be important to user acceptance of e-services. Second, although all constructs and items applied in this research revealed high reliability and validity, we adopted a 10-item scale selected from a 36-item TR scale in this research. Still, Parasuraman and Colby (Parasuraman and Colby, 2001) suggested comparatively few items of TRI should be permitted. Furthermore, Yen (Yen, 2005) also adopted simplified TRI measurement and Chen and Chen (2009) found TR's inhibitors are not significant influencers. Hence, we need more empirical evidence to discuss that 36-item TRI scale may revised to be a shorter measurement.

This study has several limitations existing in relating to the measurement and interpretation of results. The first limitation is the potentiality of a common method bias by adopting a single questionnaire to measure all constructs. Secondly, this study was conducted a single-country setting and five universities in Taiwan. Therefore, the generalizability of the findings might be limited. Additional researches across different regions or countries will be claimed for generalizing the research findings. The third limitation is that we should survey the possible influence caused by some situational factors (such as e-service usage rate) may be taken into consideration in the future.

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