Effect of trust on customer acceptance of Internet banking

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Abstract

Two beliefs, ease of use and usefulness, have been considered to be fundamental in determining the acceptance of various IS in the past decades. These beliefs may not, however, fully explain the users' behavior in an emerging environment such as Internet banking. In this study, we introduce trust as another belief that has an impact on the acceptance of Internet banking. We collected 845 cases on the Web to survey users' behavior towards Internet banks. The results of statistical analyses using structural equation modeling indicate that trust has a significant impact on the acceptance of Internet banking.
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1. Introduction

In the past decades, much research has paid attention to the perceived usefulness and perceived ease of use as the determinants of the individual's acceptance of IS [1,23,38,40,44]. These constructs are the salient beliefs underpinning the Technology Acceptance Model (TAM) [8]. The TAM is one of the most widely used models for explaining the factors that have an impact on user acceptance of IS. Many studies have demonstrated the validity of the TAM across a wide range of IS [9–11,38,40]. However, the factors contributing to the acceptance of new IS are likely to vary with the technology, target users, and context [31]. Internet banking is very different from traditional IS. That is, Internet banking uses emerging technologies, such as the Internet and WWW, and enables customers (users of Internet banking) to perform financial activities in virtual space. Research on customer acceptance of Internet banking may, therefore, enhance the understanding of a customer's beliefs to make him/her use Internet banking, and show how these beliefs affect Internet banking customer behavior.

In spite of the recent proliferation of Electronic Commerce (EC), customers have a tendency to be reluctant to provide sensitive personal information to Web sites [24,35]. Customers are generally comfortable providing Web sites with general information such as preferences. They are, however, very uncomfortable when asked to provide more sensitive information such as credit card numbers. These feelings are due not only to the defects of the Internet and EC security, but also to the customers' distrust of them. Many technologies for the Internet and EC security such as data encryption and digital

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signatures became more advanced in the 1990s. They have reduced the possibility of Internet security breaches. Nevertheless, highly publicized cases involving major security lapses have served to heighten the public concern over the Internet and EC security. The customers' concerns reduce his/her trust in EC, and thus are the major obstacles to the growth of EC.

This situation is particularly conspicuous in the case of Internet banking, which is one of the areas of EC. This is because customers are more concerned about EC security when they process more sensitive personal information. Internet banking sites are one of the locations where the most sensitive personal information is manipulated, that is, financial information. Customers are concerned about the security issues of Internet banking and the customer's concerns inhibit his/her use of Internet banking. Therefore, unlike traditional IS, the perceived usefulness and perceived ease of use may not fully reflect customer acceptance of Internet banking.

We will adopt the TAM as the base model for this study, and adjust the model to reflect the characteristics of Internet banking. We will propose another belief, trust, to enhance the understanding of customer acceptance of Internet banking. We used a Structural Equation Modeling (SEM) approach to validate the research model. This paper will help researchers, developers, and managers to understand the major determinants of customer acceptance of Internet banking.

The next section will introduce the conceptual background of this study, including the TAM and trust within the Internet banking environment. Our research model and hypotheses will be explained in Section 3. The research design and survey results will be presented in the fourth and fifth sections, respectively. The final section will explain the implications of this study and further research directions.

2. Research background

2.1. Technology Acceptance Model (TAM) applied to Internet banking

The TAM was developed to explain the effect of the user's perception of system characteristics on the user acceptance of IS [8]. The TAM is based on the Fishbein and Ajzen's Theory of Reasoned Action (TRA) model [10]. The TRA model is a general model, which suggests that an individual's social behavior is motivated by his/her attitude towards the behavior. According to the TRA model, an individual's attitude towards a behavior is a function of his/her beliefs about the consequences of performing the behavior and the evaluation of those consequences.

The TAM adopts the TRA model's causal relationships to explain an individual's IS acceptance behavior. The TAM shows that two particular beliefs, perceived usefulness and perceived ease of use, are most relevant to IS acceptance behaviors. Davis [8] defined perceived usefulness as ''the degree to which an individual believes that using a particular system would enhance his/her job performance,'' and perceived ease of use as ''the degree to which an individual believes that using a particular system would be free of physical and mental effort.'' Consistent with the TRA model, the TAM states that the two beliefs determine the attitude towards using IS. Behavioral intention to use is, in turn, determined by the attitude towards using IS. Finally, behavioral intention to use leads to actual IS use.

Although many studies have demonstrated the validity of the TAM across a wide range of IS [9–11,38,40], the TAM lacks task focus [12]. One of the major constructs of the TAM, perceived usefulness, implicitly includes the task concept, but the TAM does not include any explicit constructs for the users' task environments. It is necessary, therefore, to further explore user task characteristics that may alter user acceptance.

With the proliferation of the Internet and WWW, various researchers have applied and adjusted the TAM to the WWW environment to overcome the TAM's lack of task focus. Morris and Dillon [33] applied the TAM to the WWW context, and produced the same results as the TAM. Recent studies of user acceptance of the WWW have paid attention to perceived playfulness [1,31,42] because the WWW is used for pleasure as well as for work. While the construct did not have a significant effect on the use of IS in the workplace context [21], the studies verified that perceived playfulness has a

significant impact on user acceptance in the WWW context. There are differences in opinion among researchers about the role of perceived playfulness. Teo et al. [42] and Moon and Kim [31] asserted that perceived playfulness is one of the beliefs that have an impact on the user acceptance of the WWW, while Agarwal and Karahanna [1] showed that perceived playfulness is the antecedent of perceived usefulness and perceived ease of use.

The most common use of the Internet and WWW is simply for browsing and entertainment [36]. Unlike the general use of the Internet and WWW, customers perform commercial activities in the EC environment, including Internet banking. The EC environment requires customers to provide more sensitive information, such as credit card number, than does the WWW in general. Moreover, using Internet banking, customers manipulate the most sensitive information, financial information. Nevertheless, as far as we are aware, little research has focused on investigating the factors that have an impact on customer acceptance of Internet banking.

2.2. Trust in the Internet banking environment

There are so many different definitions of trust across research areas. This has made the concept confused. Based on the literature of various areas, McKnight and Chervany [30] classified the definition of trust into four types: disposition to trust, institution-based trust, trusting belief, and trusting intention. Disposition to trust is the extent to which one displays a consistent tendency to be willing to depend on others in general across a broad spectrum of situations and persons. They derived this type of trust primarily from psychology, which says that actions are molded by certain childhood-derived attributes that become more or less stable over time. Institution-based trust means one believes that the conditions conducive to situational success in an endeavor or aspect of one's life are in place. This type of trust was derived primarily from sociology, which says that actions are not determined by factors within the person, but by the environment or situation. Trusting belief is where one believes that the other party has one or more characteristics beneficial to oneself. Trusting intention means that one is willing to depend on, or intends to depend on, the

other party even though one cannot control that party. Trusting belief and trusting intention came primarily from social psychology, which says that interactions between people and cognitive–emotional reactions to such interactions determine behavior. In this study, we use the term trust from the viewpoint of trusting belief.

Trust refers to the belief that the promise of another can be relied upon and that, in unforeseen circumstances, the other will act in a spirit of goodwill and in a benign fashion toward the trustor [17]. The customer's trust is, therefore, a confident belief in the supplier [7,16]. In many cases, the trust is based on previous interactions, although a supplier's previous behavior cannot guarantee that he/she will act as expected [16]. Customers' trust will increase if a supplier has behaved previously as expected.

Trust has three characteristics: ability, benevolence, and integrity [29,30]. Ability means that a trustor believes that a trustee has the power to do for him/her what he/she needs done. Benevolence is the extent to which a trustee is believed to want to do good to a trustor, aside from an egocentric profit motive. Integrity means that a trustor believes that a trustee makes good-faith agreements, tells the truth, acts ethically, and fulfills promises. McKnight and Chervany [30] presented one other characteristic, predictability. Mayer et al. [29], however, asserted that trust must go beyond predictability because one does not trust the other party who is highly predictable to ignore the needs of others and act in a self-interested fashion. This study adopts the trust characteristics presented by Mayer et al. [29].

Carrying on commerce with suppliers involves customers in a highly uncertain situation, which can inhibit customers' intentions to carry on commerce [16]. The uncertainty is due to the fact that suppliers are inevitably independent and not fully predictable, while there is an inborn need among customers to understand suppliers' actions. Without reducing the uncertainty, customers cannot carry on commerce with suppliers. Trust is one of the most effective uncertainty reduction methods [16,18].

The question of trust may be even more important in the Internet banking environment than it is in the offline banking environment [37]. This is because the cultivation of trust is particularly important where

uncertainty and risk are inherent and where contracts and warranties are often absent [7,17]. In the Internet environment, remote users in all corners of the world are allowed to access critical files on computers and information transferred via the Internet. Internet banking is, therefore, inherently risky from the viewpoint of security. Moreover, Internet banking is highly uncertain, because the parties involved in a transaction are not in the same place [6]. Customers cannot, therefore, observe a teller's behavior directly, and so cannot depend on things like physical proximity, handshakes, and body signals of the teller. Because of the importance of trust in Internet banking, customer trust is a major factor influencing the growth of Internet banking.

Internet banking is a new kind of IS, but, from the marketing perspective, it is also a new kind of channel where a bank makes contact with its customers. Researchers in the marketing area have considered trust as one of the key constructs of relationship marketing [7,13,16,28,32,34]. They have empirically verified that customer trust has an impact on store loyalty, which can be defined as a customer's enduring desire to maintain a valued relationship with a store [28]. The most commonly used constructs for store loyalty are the proportion of purchase, purchase intention, and attitude. The con-

structs are the same as the major ones of TAM. Therefore, by extending TAM with trust, we can examine whether trust also has an impact on the loyalty of the new sales channel, Internet banking.

3. Research model and hypotheses

The research model for this study investigates the factors that have an influence on customer acceptance of Internet banking. We present an additional belief, trust, to the original TAM in order to reflect the characteristics of the Internet banking environment. Fig. 1 presents our research model. The part within the dotted line is the original TAM.

Internet banking is of great benefit to customers: time and cost saving, no dependence on location and time of day, quick responses to complaints, and provision of more services [43]. All of these benefits enhance the performance of customers' banking activities. A customer will, therefore, expect enhancement of the performance of his/her banking activities when he/she uses Internet banking. Trust is determined by four basic beliefs: competence belief, dependence belief, disposition belief, and fulfillment belief [41]. Among these, competence belief means that the customer should believe that a supplier is
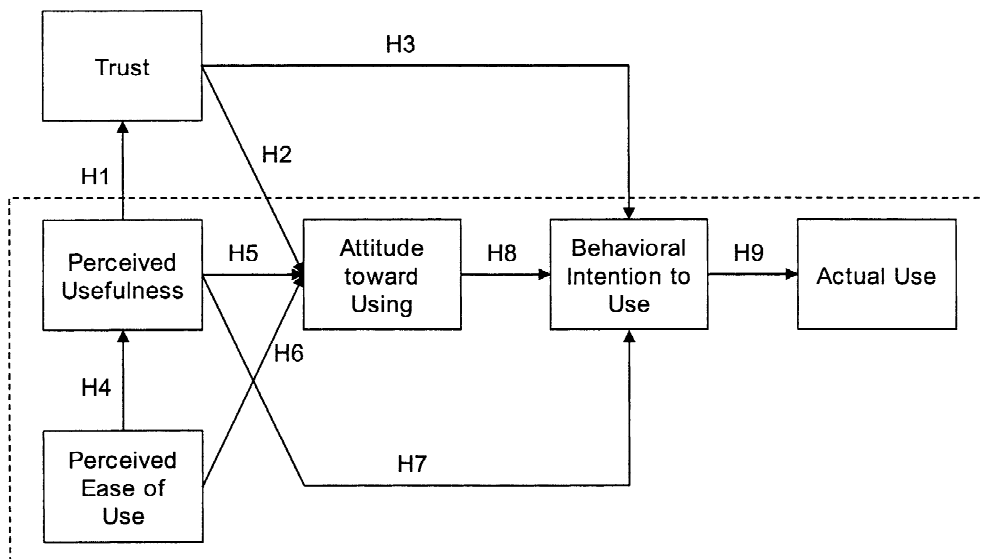

Fig. 1. Research model.

useful for accomplishing his/her goal. Lee and Turban [27] asserted that the perceived performance level is positively associated with customer trust in the shopping mall context. Based on the operational definition of usefulness, the assertion can be restated that a customer will trust a supplier if he/she perceives the supplier to be useful.

Hypothesis 1. *A customer's perceived usefulness has a positive impact on his/her trust in Internet banking.*

The TRA model asserts that attitudes towards a behavior are determined by relevant beliefs. The TAM accepts this assertion [10]. The TAM posits that perceived usefulness and perceived ease of use have a direct effect on the attitude towards using IS. In the marketing area, various studies have found that trust has an impact on attitude. Macintosh and Lockshin [28] showed that a customer's store trust is positively related to his/her store attitude. They viewed store attitude as one of the components of store loyalty. Grazioli and Jarvenpaa [17] argued that a customer's attitude is determined by his/her trust in the context of an Internet shopping mall. Trust is, therefore, another belief that has an impact on attitude.

Hypothesis 2. *A customer's trust has a positive impact on his/her attitude towards using Internet banking.*

Researchers in the marketing area have empirically verified the causal relationship between trust and behavioral intention. Crosby et al. [7] showed that the quality of the relationship has a positive impact on the anticipation of future interaction in the service sales context. They viewed trust in the salesperson as one of the dimensions of the relationship quality. Doney and Cannon [13] found that customer trust is related to intentions to use the vendor in the future, while it is not related to actual use in the firm-to-firm context. Gefen [16] suggested that trust in an EC vendor increases people's intention to use the vendor's Web site.

Hypothesis 3. *A customer's trust has a positive impact on his/her intention to use Internet banking.*

We also verify the following TAM-related hypotheses in the context of Internet banking because our research model is based on the TAM. As far as we are aware, there is little research examining hypotheses in the Internet banking context.

Hypothesis 4. *A customer's perceived ease of use has a positive impact on his/her perceived usefulness of Internet banking.*

Hypothesis 5. *A customer's perceived usefulness has a positive impact on his/her attitude towards using Internet banking.*

Hypothesis 6. *A customer's perceived ease of use has a positive impact on his/her attitude towards using Internet banking.*

Hypothesis 7. *A customer's perceived usefulness has a positive impact on his/her intention to use Internet banking.*

Hypothesis 8. *A customer's attitude towards using Internet banking has a positive impact on his/her intention to use it.*

Hypothesis 9. *A customer's intention to use Internet banking has a positive impact on his/her actual use of it.*

4. Research methodology

Customers are more concerned about EC and Internet security when they process more sensitive personal information. Because trust is more important where risk is inherent [7,17], trust is needed more when customers process more sensitive information. Internet banking sites are among those that manipulate the most sensitive personal information, including financial information. We therefore chose Internet banking as our research domain.

4.1. Subjects

The data for this study were made available via a Web survey of Internet banking users. We created a site for the Web survey. Then, Internet banking users

of five major banks in Korea were requested to participate in the survey. In total, 845 cases were gathered over about 2 weeks, from September 3 to September 19, 2001. There are no missing data in the sample because participants could not submit their responses with missing values.

Forty-nine percent of the respondents were male, and 51 percent were female. Almost all respondents were in their twenties or thirties. The respondents were engaged in various occupations. About half of the respondents had experience with Internet banking for over 1 year, while 94 percent of the respondents had experience using the Internet for over 1 year. Detailed descriptive statistics relating to the respondents' characteristics are shown in Table 1.

4.2. Measurements

A questionnaire, using a seven-point scale, was employed to collect data for the constructs of the research model. Items from previous studies were modified for adaptation to the Internet banking context. All items are shown in Appendix A. The

measures of actual use, behavioral intention to use, attitude towards using, perceived usefulness, and perceived ease of use were adapted from various studies related to the TAM [1,9–11,26,31,44].

In this study, the measures of trust were based on several studies in the marketing area which examined the relationship between trust and various constructs [13,16,17,32,45]. We collected the measurement items from these studies and merged items with the same meaning. Finally, we used six measurement items for trust, which encompassed the three trust characteristics presented by Mayer et al. [29]: ability, benevolence, and integrity. T1 and T6 represent customer's general trust. T2 measures the ability of the Internet banking site, and T3 measures the integrity of the site. T4 and T5 are for the benevolence of the site.

A pilot test of the measures was conducted by graduate students majoring in MIS. Individuals indicated their agreement or disagreement with the survey items using a seven-point scale. The wording of items was modified based on the results of the pilot test and the advice of MIS professors.

Table 1
Descriptive statistics of respondents' characteristics

Measure	Value	Frequency	Percentage
Gender	Male	414	48.99
	Female	431	51.01
Age	<20	5	0.59
	20–29	384	45.44
	30–39	365	43.20
	40–49	82	9.70
	>50	9	1.07
Occupation	Student	90	10.65
	Clerical employee	325	38.46
	Specialist	107	12.66
	Technician	82	9.70
	Housewife	97	11.48
	Other	144	17.04
Primary place of Internet use	Office	547	64.73
	Home	289	34.20
	Other	9	1.07
Degree of Internet experience	<1 year	54	6.39
	>1 year	791	93.61
Degree of Internet banking experience	<1 year	424	50.18
	>1 year	421	49.82

5. Results

The SEM approach was used to validate the research model. This approach was chosen because of its ability to test causal relationships between constructs with multiple measurement items [22]. The SEM approach also has the capability of testing the measurement characteristics of constructs [19]. LISREL 8.12 was used to perform the analysis.

SEM allows researchers to choose the input matrix from two types of matrices: the variance–covariance matrix and the correlation matrix. Interpretation of the results is difficult when using the variance–covariance matrix, while this matrix provides valid comparisons between different populations or samples [19]. We chose the correlation matrix as the input matrix, because we used a single sample and the correlation matrix has gained widespread use. Following Chin's [4] recommendation, the correlation matrix used for the analysis is shown in Table 2, which also shows the standard deviation of each item in the diagonal.

5.1. Reliability and validity of measurement items

Internal consistency reliability is a statement about the stability of individual measurement items across replications from the same source of information [39]. Internal consistency reliability was assessed by computing Cronbach's alpha. The alpha coefficients for each construct of this study are presented in Table 3. The values range from 0.774 (for actual use) to 0.973 (for perceived usefulness). Hair et al. [19] suggested that the lowest limit for Cronbach's alpha be 0.70, while Straub [39] suggested 0.80 as the limit. All constructs in our research model demonstrated acceptable reliability because the construct with the lowest alpha coefficient, actual use, displayed marginally satisfactory reliability.

Construct validity indicates whether or not the measures chosen are true constructs describing the event [39]. The techniques for assessing the construct validity of an instrument can be classified into two categories: classical and contemporary [3]. The classical approach uses techniques including multitrait-multimethod (MTMM) analysis and exploratory factor analysis. The contemporary approach uses the SEM technique and Confirmatory Factor Analysis

(CFA). In this study, we used the contemporary approach for assessing convergent validity and discriminant validity. Convergent validity is the degree to which multiple attempts to measure the same concept are in agreement. Discriminant validity is the degree to which the measures of different concepts are distinct.

CFA was used to examine the convergent validity of each construct. This was done by specifying a single factor model for each of the constructs. Table 3 also shows the factor loadings of the measurement items. All items surpass the recommended level for factor loading, 0.60 [5]. Table 4 shows the overall model fit indices for each CFA model. Among the many overall model fit indices, those included in Table 4 are recommended by Kline [25] to be reported. The table also shows the recommended level of each index from previous studies [14,19,20,22]. All chi-square statistics are found to be significant, indicating that the actual and proposed model differ considerably [19]. The chi-square statistic is, however, not appropriate for this study because the statistic is too sensitive to sample size [2,22]. If the sample size is large such as in this study ($N = 845$), the statistic may be significant even though differences between the actual and proposed model are slight. Almost all other indices surpass the recommended level, suggesting that the items of each construct reflect a single factor.

Discriminant validity can be tested by using a chi-square difference test where the chi-square statistics for two models are compared [5]. Each model includes two constructs of interest. In one model, the correlation between the two constructs is fixed at 1.00, assuming that the constructs are identical. The other model freely estimates the correlation between the constructs. If the constructs are truly different, the difference in the correlation between the first and second models would be significant. Because the difference in the degree of freedom between the models is one, a chi-square difference greater than 3.84 suggests that the two constructs in each model are significantly distinct. We tested discriminant validity among three beliefs: trust, perceived usefulness, and perceived ease of use. The results of discriminant validity testing are shown in Table 5. The chi-square differences range from 1700.507 (between trust and perceived ease of use) to

Table 2
Correlation matrix of measurement items

	T1	T2	T3	T4	T5	T6	PU1	PU2	PU3	PU4	PU5	PU6	PEU1	PEU2	PEU3	PEU4	PEU5
T1	1.096																
T2	0.628	1.280															
T3	0.673	0.651	1.190														
T4	0.631	0.689	0.714	1.266													
T5	0.672	0.636	0.700	0.761	1.190												
T6	0.750	0.631	0.710	0.733	0.817	1.121											
PU1	0.593	0.503	0.571	0.489	0.505	0.565	1.189										
PU2	0.607	0.514	0.577	0.500	0.507	0.560	0.896	1.144									
PU3	0.592	0.507	0.570	0.487	0.493	0.547	0.869	0.881	1.140								
PU4	0.582	0.489	0.565	0.481	0.497	0.551	0.837	0.859	0.920	1.164							
PU5	0.571	0.496	0.574	0.478	0.482	0.544	0.851	0.868	0.900	0.898	1.178						
PU6	0.598	0.548	0.574	0.550	0.547	0.627	0.801	0.807	0.828	0.834	0.839	1.111					
PEU1	0.519	0.426	0.504	0.442	0.462	0.492	0.533	0.549	0.567	0.541	0.531	0.558	1.207				
PEU2	0.547	0.486	0.536	0.476	0.472	0.505	0.624	0.634	0.655	0.648	0.648	0.675	0.784	1.187			
PEU3	0.518	0.456	0.511	0.458	0.506	0.506	0.572	0.582	0.595	0.600	0.588	0.608	0.749	0.793	1.175		
PEU4	0.574	0.491	0.544	0.522	0.547	0.563	0.520	0.526	0.513	0.497	0.497	0.547	0.719	0.698	0.742	1.180	
PEU5	0.564	0.504	0.541	0.517	0.519	0.560	0.548	0.547	0.561	0.534	0.544	0.590	0.764	0.765	0.739	0.836	1.179
A1	0.616	0.495	0.546	0.468	0.508	0.563	0.626	0.611	0.636	0.618	0.626	0.657	0.519	0.558	0.525	0.510	0.539
A2	0.625	0.525	0.555	0.472	0.490	0.572	0.660	0.642	0.671	0.650	0.657	0.679	0.519	0.588	0.543	0.518	0.543
A3	0.665	0.540	0.591	0.522	0.552	0.630	0.630	0.615	0.631	0.622	0.609	0.677	0.525	0.580	0.540	0.538	0.588
A4	0.658	0.567	0.591	0.517	0.549	0.618	0.655	0.632	0.668	0.637	0.642	0.694	0.546	0.591	0.550	0.540	0.575
A5	0.587	0.554	0.511	0.506	0.499	0.557	0.557	0.543	0.545	0.533	0.551	0.605	0.436	0.493	0.447	0.467	0.495
BI1	0.644	0.521	0.568	0.502	0.519	0.602	0.676	0.666	0.706	0.687	0.683	0.717	0.573	0.609	0.564	0.520	0.578
BI2	0.618	0.509	0.560	0.502	0.498	0.565	0.651	0.653	0.680	0.651	0.664	0.674	0.550	0.575	0.544	0.511	0.550
BI3	0.634	0.501	0.556	0.494	0.503	0.574	0.634	0.631	0.657	0.633	0.645	0.660	0.562	0.588	0.544	0.507	0.547
BI4	0.590	0.556	0.534	0.561	0.541	0.617	0.481	0.477	0.493	0.515	0.503	0.580	0.431	0.471	0.418	0.467	0.476
U1	0.086	0.044	0.020	0.034	0.036	0.071	0.018	0.017	0.006	−0.006	0.003	0.041	0.097	0.038	0.080	0.062	0.079
U2	0.033	0.014	−0.015	0.001	0.005	0.026	−0.051	−0.049	−0.058	−0.062	−0.085	−0.057	0.052	−0.026	0.032	−0.008	0.031
U3	0.150	0.108	0.059	0.071	0.052	0.088	0.104	0.094	0.105	0.082	0.097	0.097	0.176	0.147	0.141	0.124	0.181
	T1	T2	T3	T4	T5	T6	PU1	PU2	PU3	PU4	PU5	PU6	PEU1	PEU2	PEU3	PEU4	PEU5

Table 2. Continued

	A1	A2	A3	A4	A5	BI1	BI2	BI3	BI4	U1	U2	U3
T1												
T2												
T3												
T4												
T5												
T6												
PU1												
PU2												
PU3												
PU4												
PU5												
PU6												
PEU1												
PEU2												
PEU3												
PEU4												
PEU5												
A1	1.118											
A2	0.872	1.141										
A3	0.841	0.841	1.137									
A4	0.835	0.852	0.893	1.091								
A5	0.703	0.720	0.787	0.791	1.250							
BI1	0.710	0.723	0.733	0.741	0.607	1.096						
BI2	0.676	0.678	0.686	0.699	0.595	0.856	1.105					
BI3	0.669	0.686	0.692	0.704	0.612	0.850	0.871	1.146				
BI4	0.581	0.583	0.643	0.626	0.617	0.646	0.602	0.652	1.291			
U1	0.078	0.051	0.051	0.069	0.072	0.063	0.136	0.187	0.081	1.568		
U2	0.021	0.005	0.022	0.039	0.042	0.004	0.051	0.072	0.039	0.528	1.575	
U3	0.151	0.119	0.125	0.131	0.143	0.138	0.191	0.242	0.156	0.647	0.472	1.164
	A1	A2	A3	A4	A5	BI1	BI2	BI3	BI4	U1	U2	U3

Table 3
Convergent validity and internal consistency reliability

Construct	Item	Factor loading	Cronbach's alpha
Trust	T1	0.798	0.930
	T2	0.753	
	T3	0.817	
	T4	0.846	
	T5	0.882	
	T6	0.894	
Perceived usefulness	PU1	0.912	0.973
	PU2	0.926	
	PU3	0.958	
	PU4	0.946	
	PU5	0.943	
	PU6	0.877	
Perceived ease of use	PEU1	0.863	0.940
	PEU2	0.871	
	PEU3	0.863	
	PEU4	0.863	
	PEU5	0.891	
Attitude towards using	A1	0.902	0.955
	A2	0.911	
	A3	0.939	
	A4	0.942	
	A5	0.819	
Behavioral intention to use	BI1	0.917	0.917
	BI2	0.929	
	BI3	0.934	
	BI4	0.683	
Actual use	U1	0.851	0.774
	U2	0.621	
	U3	0.761	

2124.027 (between trust and perceived usefulness). The differences are much larger than the 3.84 threshold, indicating that each pair of constructs is indeed distinct.

In the SEM approach, the validity of each construct can be assessed by evaluating the measurement model fit after we assess the overall fit of the path model [19], as well as through CFA presented in this section. The results of the measurement model fit will be presented in Section 5.3.

5.2. Assessment of overall model fit

After assessing the reliability and validity with CFA, we tested the overall fit of the path model. The overall model fit evaluates the correspondence of the actual or observed input matrix with that predicted from the proposed model. Table 6 shows a summary of the overall fit indices of our path model.

The chi-square statistic is found to be significant (chi-square = 1922.000, $P = 0.0$). The chi-square statistic, however, is not appropriate for this study as stated in Section 5.1. All other overall model fit indices surpassed the recommendation suggested by a previous study. We were assured, therefore, that our research model is an adequate representation of the entire set of causal relationships.

5.3. Assessment of measurement model fit

For more rigorous validity testing, the psycho-

Table 4
Overall model fit indices of CFA for convergent validity

Construct	Chi-square	P value	d.f.	GFI	AGFI	RMSR	NFI	NNFI	CFI
Recommended value		>0.05		>0.80	>0.80	<0.08	>0.90	>0.90	>0.90
Trust	139.365	0.000	9	0.947	0.877	0.027	0.965	0.945	0.967
Perceived usefulness	176.587	0.000	9	0.932	0.842	0.014	0.976	0.961	0.977
Perceived ease of use	173.773	0.000	5	0.922	0.767	0.028	0.954	0.911	0.956
Attitude toward using	125.242	0.000	5	0.939	0.818	0.020	0.974	0.950	0.975
Behavioral intention	22.715	0.000	2	0.987	0.937	0.013	0.992	0.979	0.993

Table 5
Chi-square difference test

	Model with fixed correlation		Model with freely estimated correlation			Chi-square difference
	d.f.	Chi-square	Correlation coefficient	d.f.	Chi-square	
Trust− perceived usefulness	54	2627.621	0.678	53	503.593	2124.027
Trust− perceived ease of use	44	2103.395	0.695	43	402.888	1700.507
Perceived usefulness− perceived ease of use	44	2538.097	0.702	43	498.374	2039.723

metric properties of the research model were assessed by evaluating the measurement model fit. The convergent validity of the measurement items can be assessed by item reliability, composite reliability, and the variance extracted measure [3]. Item reliability indicates the amount of variance in an item due to the underlying construct rather than to error. Composite reliability depicts the degree to which the items indicate the common construct. The variance extracted measure reflects the amount of variance in the items captured by the construct.

The result of the test of convergent validity is shown in Table 7. The table also shows the recommended value of each measure suggested by Chau [3] and Hair et al. [19]. The item reliabilities of all items except two, BI4 and U2, surpassed the recommended level of 0.50. Composite reliabilities ranged from 0.791 (for actual use) to 0.974 (for perceived usefulness). Only the composite reliability of actual use is slightly less than the recommended value of 0.80. Variance extracted measures ranged from 0.562 (for actual use) to 0.860 (for perceived

usefulness), which exceeds the recommended level of 0.50. The result therefore demonstrates the convergent validity of the measurement items.

Discriminant validity can be evaluated by comparing the squared correlation between two constructs with their respective variance extracted measure. Discriminant validity is demonstrated if the variance extracted measures of both constructs are greater than the squared correlation [15]. We tested discriminant validity among three beliefs. Table 8 shows the squared correlation of each pair of constructs. The variance extracted measures of each construct are in the diagonal. Comparison of the squared correlation with the variance extracted measures shows that all squared correlations between two constructs are less than the variance extracted measures of both constructs. Discriminant validity was, therefore, demonstrated.

5.4. Assessment of structural model fit

Having assessed the overall model and the mea-

Table 6
Overall model fit indices of the research model

	Score	Recommended value
Chi-square	1922.000	
P value	0.000	>0.05 [19]
Degree of freedom	368	
Goodness-of-fit index (GFI)	0.851	>0.80 [14]
Adjusted goodness-of-fit index (AGFI)	0.824	>0.80 [14]
Root mean square residual (RMSR)	0.067	<0.08 [22]
Normed fit index (NFI)	0.931	>0.90 [19]
Non-normed fit index (NNFI)	0.932	>0.90 [20]
Comparative fit index (CFI)	0.943	>0.90 [20]

Table 7
Measurement model fit indices for convergent validity

Construct	Item	Item reliability	Composite reliability	Variance extracted
Recommended value		>0.50	>0.80	>0.50
Trust	T1	0.668	0.932	0.696
	T2	0.576		
	T3	0.680		
	T4	0.699		
	T5	0.754		
	T6	0.798		
Perceived usefulness	PU1	0.834	0.974	0.860
	PU2	0.858		
	PU3	0.914		
	PU4	0.889		
	PU5	0.885		
	PU6	0.781		
Perceived ease of use	PEU1	0.744	0.940	0.759
	PEU2	0.782		
	PEU3	0.753		
	PEU4	0.725		
	PEU5	0.790		
Attitude towards using	A1	0.796	0.956	0.814
	A2	0.814		
	A3	0.862		
	A4	0.871		
	A5	0.655		
Behavioral intention to use	BI1	0.851	0.927	0.763
	BI2	0.845		
	BI3	0.848		
	BI4	0.485		
Actual use	U1	0.708	0.791	0.562
	U2	0.382		
	U3	0.595		

surement model, we examined the estimated co-efficients of the causal relationships between constructs, which would validate the hypothesized effects. Fig. 2 illustrates the estimated coefficients and their significance for the structural model. The

Table 8
Comparison of squared correlation and variance extracted

	(1)	(2)	(3)
Trust (1)	0.696		
Perceived usefulness (2)	0.472	0.973	
Perceived ease of use (3)	0.238	0.504	0.940

coefficients of determination (R^2) for each endogenous construct are also shown.

Hypotheses 1 and 4 examined the impact of one customer's belief on another: perceived usefulness on trust, and perceived ease of use on perceived usefulness. Perceived usefulness had a significant impact on trust ($\beta = 0.687$, $t = 18.006$, $P < 0.01$). The impact of perceived ease of use on perceived usefulness was also significant ($\gamma = 0.710$, $t = 18.933$, $P < 0.01$). We therefore accept Hypotheses 1 and 4.

Hypotheses 2, 5, and 6 were about the impact of the customer's belief on the attitude toward using
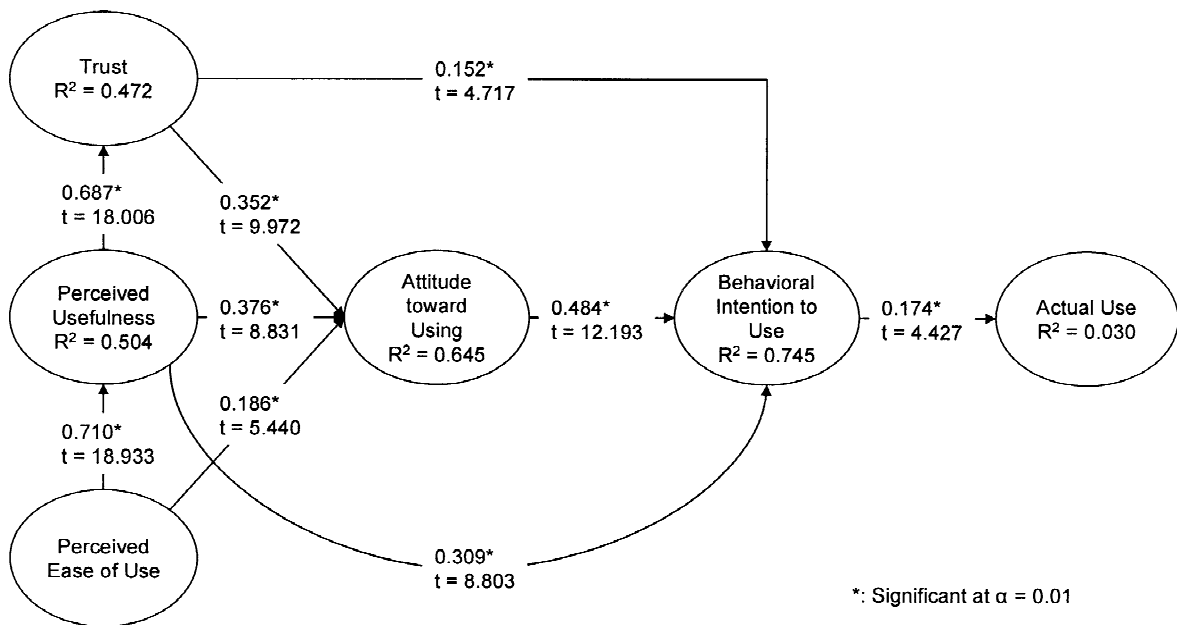
Fig. 2. Structural model fit.

Internet banking. It is observed that trust had an impact on the customer's attitude towards using Internet banking at the 0.01 significance level ($\beta = 0.352$, $t = 9.972$). As suggested by the original TAM, the positive impacts of perceived usefulness ($\beta = 0.376$, $t = 8.831$, $P < 0.01$) and perceived ease of use ($\gamma = 0.186$, $t = 5.440$, $P < 0.01$) on the attitude towards using Internet banking were confirmed here. The three beliefs explained 64.5% of the variance in attitude towards using Internet banking ($R^2 = 0.645$). Hence, we accept Hypotheses 2, 5, and 6.

In Hypotheses 3, 7, and 8, we investigated the impact of trust, perceived usefulness, and attitude on the behavioral intention to use Internet banking. Seventy-five percent of the variance in behavioral intention to use Internet banking was explained by trust, perceived usefulness, and attitude ($R^2 = 0.745$). The attitude towards using Internet banking had a significant impact on behavioral intention ($\beta = 0.484$, $t = 12.193$, $P < 0.01$). Also, trust ($\beta = 0.152$, $t = 4.717$, $P < 0.01$) and perceived usefulness ($\beta = 0.309$, $t = 8.803$, $P < 0.01$) had a significant impact on the behavioral intention. The positive impacts of perceived usefulness and attitude, as suggested by the TAM, were confirmed. Moreover, trust had a

significant positive impact on behavioral intention to use Internet banking. Hypotheses 3, 7, and 8 are therefore accepted.

A customer's actual use of Internet banking was influenced by his/her behavioral intention to use. In our study, it was observed that behavioral intention to use had a positive impact on actual use of Internet banking at the 0.01 significance level ($\beta = 0.174$, $t = 4.427$). The result supports the suggestion of the TAM. We therefore accept Hypothesis 9.

An additional analysis was performed to identify the indirect and total effects on attitude, behavioral intention, and actual use. The results are presented in Table 9. All belief constructs, including trust, had significant indirect and total effects on attitude, behavioral intention, and actual use at $\alpha = 0.01$.

6. Conclusion

In this study, we found that trust is one of the most significant beliefs in explaining a customer's attitude towards using Internet banking. As suggested by the TAM, customer perception of the usefulness and ease of use also affect attitude

Table 9
Indirect and total effect on attitude, behavioral intention, and actual use

Independent construct	Attitude toward using		Behavioral intention to use		Actual use	
	Indirect	Total	Indirect	Total	Indirect	Total
Trust		0.352* (9.972)	0.171* (8.158)	0.322* (9.241)	0.056* (4.057)	0.056* (4.057)
Perceived usefulness	0.242* (9.256)	0.618* (14.866)	0.403* (11.902)	0.712* (18.045)	0.124* (4.377)	0.124* (4.377)
Perceived ease of use	0.439* (13.322)	0.624* (17.088)	0.596* (17.014)	0.596* (17.014)	0.103* (4.362)	0.103* (4.362)
Attitude towards using				0.484* (12.193)	0.084* (4.238)	0.084* (4.238)
Behavioral intention to use						0.174* (4.427)

Note: *significant at $\alpha = 0.01$. The *t*-values are shown in parentheses.

significantly. At the same time, behavioral intention to use Internet banking is highly related to attitude, perceived usefulness, and trust. These results imply that customers rely on trust in on-line environments that are processing sensitive information.

6.1. Contributions and implications

From the viewpoint of technology acceptance at the level of the individual, this study has extended the TAM by considering the characteristics of the Internet banking environment. This study has verified that an additional belief, trust, is one of the most important determinants of customer acceptance of Internet banking. Moreover, trust had a more direct effect on a customer's attitude than perceived ease of use in the Internet banking context, while perceived ease of use had a greater total effect on a customer's actual use.

Studies of system usability have been performed from both the objective and subjective points of view [31]. Studies focusing on objective aspects have emphasized system performance, such as execution time and error rates. Researchers with a subjective viewpoint have stated that the principal barrier to user acceptance is the lack of user friendliness of systems. This means that the traditional approaches towards increasing system usability have focused on

usefulness and ease of use. Internet banking, however, is used for individuals' financial activities in virtual space. Although the usefulness and ease of use are important as under the traditional IS environment, the trust concept will play an important role in increasing the usability under the Internet banking environment. Researchers and practitioners should, therefore, consider trust issues as well as usefulness and ease of use in environments where sensitive information is manipulated on-line.

Tan and Thoen [41] presented four reasons why people develop trust when using the EC environment: social indicators, understanding, communality, and personal experience. Social indicators mean certification or anything else on the WWW accepted by most people. Hence, Internet banking practitioners can make their sites more publicly trusted by using control systems such as the SET protocol and specifying this fact on their sites. Moreover, they should consider using trust seals such as Trust-e and WebTrust. A trust seal is a means of assuring that the site possesses some desirable property that has been verified by a trusted third party [17]. To improve customers' understanding, Internet banking practitioners can introduce their control systems on their sites. Communality is the phenomenon where a person trusts those who are trusted by other members of his community. To reduce the uneasy feeling toward Internet banking held by many members of

society, Internet banking practitioners can advertise the safety of their sites and announce publicly the efforts to maintain this safety. There is clearly no need to say that Internet banking practitioners should strengthen the control of their sites to reduce customers' negative experiences.

In this study, we used data from a Web survey of Internet banking users to verify the research model. Although many studies have applied and extended the TAM in the context of various IS, including WWW and EC, as far as we are aware few studies have examined the TAM under the Internet banking environment. The result supports all causal relationships hypothesized in the TAM. This means that the TAM is an appropriate model for explaining customer acceptance in the Internet banking context.

6.2. Limitations and further research issues

This study verified the research model by surveying Internet banking users. We chose Internet banking as our research domain because Internet banking manipulates the most sensitive personal information. The research model of this study can, however, be applied to other kinds of EC such as Internet shopping malls. To examine the applicability of the model to other kinds of EC, research on applying it to other domains should be performed. Moreover, we collected data from personal customers of five major banks in Korea. The research model should be applied to medium- and small-sized banks and to business customers. These efforts will increase the external validity of our research model.

Extending the TAM, this study focused on the impact of a new belief, trust, on customer acceptance of Internet banking. The research model did not, therefore, consider other beliefs and the precedents of trust. Teo et al. [42] and Moon and Kim [31] presented perceived playfulness as one of the beliefs that influence WWW acceptance. Gefen [16] presented some factors said to have an impact on trust such as familiarity and disposition to trust. Grazioli and Jarvenpaa [17] verified empirically that the level of trust in an Internet shopping mall is determined by the presence of trust mechanisms. Further research considering these factors could enhance the understanding of customer acceptance of Internet banking.

Appendix A

Trust: *Likert scale of strongly disagree to strongly agree*

T1	This Internet banking site is trustworthy
T2	I trust in the benefits of the decisions of this Internet banking site
T3	This Internet banking site keeps its promises and commitments
T4	This Internet banking site keeps customers' best interests in mind
T5	This Internet banking site would do the job right even if not monitored
T6	I trust this Internet banking site

Perceived usefulness: *Likert scale of strongly disagree to strongly agree*

PU1	Using this Internet banking site enhances the productivity of my banking activities
PU2	Using this Internet banking site has a critical role in supporting my banking activities
PU3	Using this Internet banking site makes it easier to do my banking activities
PU4	Using this Internet banking site enables me to accomplish banking activities more quickly
PU5	Using this Internet banking site improves my performance of banking activities
PU6	I find this Internet banking site useful for my banking activities

Perceived ease of use: *Likert scale of strongly disagree to strongly agree*

PEU1	It is easy for me to learn how to utilize this Internet banking site
PEU2	I find it easy to get this Internet banking site to do what I want it to do
PEU3	It is easy to remember how to use this Internet banking site
PEU4	My interaction with this Internet banking site is clear and understandable
PEU5	I find this Internet banking site easy to use

Attitude toward using: *Likert scale of strongly disagree to strongly agree*

A1	Using this Internet banking site is a good idea

A2	Using this Internet banking site is a wise idea	
A3	Using this Internet banking site is a pleasant idea	
A4	Using this Internet banking site is a positive idea	
A5	Using this Internet banking site is an appealing idea	

Behavioral intention to use: *Likert scale of strongly disagree to strongly agree*

BI1	I intend to continue using this Internet banking site in the future
BI2	I expect my use of this Internet banking site to continue in the future
BI3	I will frequently use this Internet banking site in the future
BI4	I will strongly recommend others to use this Internet banking site

Actual use

U1 *How many times do you use this Internet banking site in a week*?

Not at all	Less than once a week	About once a week	Two or three times a week	Several times a week	About once a day	Several times a day

U2 *How many hours do you spend using this Internet banking site every month*?

<1 h	1–5 h	5–10 h	10–15 h	15–20 h	20–25 h	>25 h

U3 *How frequent is your use of this Internet banking site*?

Extremely infrequent	Quite infrequent	Slightly infrequent	Neither	Slightly frequent	Quite frequent	Extremely frequent

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