

Effects of Network Quality Attributes on Customer Adoption Intentions of Internet Banking

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ABSTRACT *With the liberalization and internationalization of the financial market and the entrance of Taiwan into the World Trade Organization (WTO), banks in Taiwan face a dual competitive pressure in the areas of service quality and administrative efficiency. This study replicated and expanded the Theory of Reasoned Action (TRA) to probe the attitude and subjective norm factors that would influence the adoption intention of Internet Banking (IB). Moreover, network quality attributes were also used to enhance the understanding of consumer attitude towards Internet banking based on TRA (named 'extended TRA'). Data were gathered from 425 potential users of Internet banking. Structural equation modelling was used to analyse the responses. The analytical results generally supported TRA and extended TRA to provide a good fit to the data. Extended TRA explains more of the variance in consumer attitude (66%) and behavioural intentions (54%) than those in TRA in the context of Internet banking. Additionally, attitude is significantly related to the intention to adopt internet banking, while subjective norm is not; network quality attributes including information quality, transaction speed, and security play significant roles in influencing attitude.*

KEY WORDS: Internet banking, quality attributes of network, theory of reasoned action, extended TRA, structural equation modelling

Introduction

The Internet has advanced rapidly since the mid 1990s. It has produced a paradigm shift that has greatly influenced business applications with services, products, communications, etc. A primary reason for the rise of the Internet as a business mechanism during the past decade is that the Internet was not only designed with an intuitive, graphical, and simple-to-use interface, but was also developed to provide information, foster awareness, and influence people's attitudes and behaviour.

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Banking is an information-intensive business and thus the Information Technology (IT) has become increasingly important in this industry. One of the first examples of the growing importance of the information technology in banking was the establishment of full-fledged virtual banking, the Security First Network Bank (Grandy, 1995). This bank was established in October 1995 in the United States and has subsequently attracted considerable attention and speculation in both the financial and IT communities.

Internet banking is a new type of information system that uses emerging techniques such as the Internet and the World Wide Web, and has changed how customers perform various financial activities in virtual space. Liao *et al.* (1999) identified a 'virtual bank' as a 'non-branch bank,' while 'virtual banking' refers to the provision of banking services via electronic media such as the ATM, telephone, personal computers, and/or the Internet. In cyberspace, the services no longer need to be physically present.

The development and acceptance of Internet banking as the new standard for commerce provides us with a powerful way that is projected to reduce the cost of conducting transactions online. Turban *et al.* (2000) indicated that Internet banking is extremely beneficial to customers, providing cost savings, reduced limitations of time and space, quick responses to complaints, and improved services. All of these benefits facilitate customers' banking online. For instance, a recent study of the US retail banking sector showed that the transaction costs associated with telephone banking dramatically reduce 60% of transaction costs for providing the same service via physical branches (Talmor, 1995).

Today, the Internet with special characteristics has altered the rules for marketing. Moreover, customers require flexibility, availability, creativity, and price advantage from the supplier or service provider. Although Internet banking may help banks reduce costs, other important issues also need to be considered, including the extent to which retail bank customers adopt new forms of banking, factors that influence customer adoption intention, and perception and adoption differences between different forms of banking. These issues are important in that their answers can not only help business managers detect the obstacles of physical services in the traditional competitive marketplace, but can also help to plan and market new forms of banking in the electronic marketplace. Thus, this study pursues better measures and models for use in predicting and explaining customer behaviour in Internet banking.

Background and Literature Review

The Evolution of Internet Banking

The velocity and dynamic nature of the global marketplace, in terms of the progress of the information technology, has driven a competitive incentive among companies in Taiwan to consolidate and reconcile their online services as a means of creating value that is sustainable over time. With Taiwan's entry into the World Trade Organization (WTO), foreign banks will enter Taiwan's domestic market and bring with them their advantages of capital and financial innovation, and banks in Taiwan thus will face dual competitive pressure in the areas of service quality and administrative efficiency. Coping with increasing competition and government financial liberalization, the Taiwan bank has gradually accelerated the establishment of new communication networks via Internet banking, telephone centres, and other digital channels to give greater recognition to customer needs.

In May 1999, Taiwan's Bureau of Monetary Affairs in the Ministry of Finance announced the Master Agreement of PC and Network Banking Services for commercial banks to offer e-banking services regarding how commercial banks should offer e-banking, such as fund transfers or account summaries. Until now, more than half of the banks have been permitted to build new communication networks via Internet banking. The most typical and also the largest Internet banking in Taiwan is ChinaTrust (<http://www.chinatrust.com.tw/>).

Recently, the acceptance of the Internet as a business platform has set the pace for rapid growth in new applications of commerce in a variety of settings. The Internet Data Corporation (IDC) indicated that, by the year 2005, there would be nearly one billion Internet users, about 15% of the world's population. IDC further predicted that those users would promote more than \$5 trillion of business in the Internet commerce by 2005. According to the fourth Internet user behaviour survey conducted by ACNielsen Online (2001), Taiwan has 17 million Internet users (trailing, in Asia, only behind South Korea with about 53 million Internet users, and behind China with 25 million Internet users). Conversely, few Internet users perform financial transactions in virtual space. Apparently, the technology side has evolved considerably, while Internet banking, especially in business and marketing, remains in the early evolutionary stage, but still retains a considerable space for growth in Taiwan.

The Theory of Reasoned Action

Research that synthesizes existing studies on user acceptance of information technology thus may enhance customer understanding and encourage more use of Internet banking as well as inform us about the current status of Internet banking and suggest future direction in the field.

The technology acceptance model (TAM) was proposed by Davis *et al.* (1989), based upon principles originally articulated by Fishbein & Ajzen (1975) as the Theory of Reasoned Action (TRA). The extension of TRA into a theory of planned behaviour (TPB) was proposed by Ajzen (1991). The Theory of Reasoned Action (Fishbein, 1967; Fishbein & Ajzen, 1975) is one of the most widely studied models of attitude and behaviour from a number of perspectives, including educational, cognitive, industrial, and organizational psychology. The technology acceptance model is a general model, suggesting that individual social behaviour is motivated by an individual's behavioural attitude. TAM (Davis *et al.* 1989) focuses on the attitudinal explanations of intention to use a specific technology or service. In many ways, TAM corresponds to rational or utilitarian theories of media choice and use. When applied to the explanation of use or adoption behaviour, TRA includes four general concepts: Behavioural attitudes, Subjective norm, Intention to use, and Actual use (see Figure 1). The inclusion of Subjective norm in TRA represents an important addition when compared to TAM. With the Subjective norm concept, TRA includes elements of social influence found in social explanations of media use.

In TRA, Attitude is equated with the attitudinal belief that performing a behaviour will lead to a particular outcome, weighted by an evaluation of the desirability of that outcome. Subjective norms are formed as the individual's normative beliefs concerning a particular referent weighted by the motivation to comply with that referent. Suh & Han (2002) conducted an investigation based on the TAM model to analyse customer acceptance of Internet banking. They also proposed another belief, trust, to enhance understanding of customer acceptance of Internet banking.

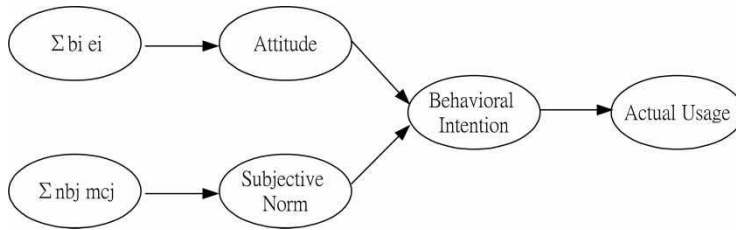


Figure 1. The pure form of the theory of reasoned action

Research Model and Hypotheses

Although a backward look over the past ten or so years reveals that technology has made tremendous progress, it is not always clear that there is much customer adoption of Internet banking in Taiwan. While Internet banking is no longer a new phenomenon in Taiwan, our understanding of user behaviour is still limited. In light of the above discussion related to the more appropriate theoretical framework of user behaviour, it is evident that problems may arise when the study fails to consider the Internet (or the web) perspective related to the acceptance of technology. Given the characteristics of the Internet, it is imperative that researchers, developers, and business managers understand the major determinants of customer attitude and adoption intention.

Research on web quality attributes for measuring Internet shopping or services, not included in the original TRA, falls into four broad categories: information quality, transaction speed, user-friendliness, and security. Four web quality attributes were introduced to improve the understanding of consumer attitudes and adoption intentions in the following sub-sections. Figure 2 displays the present research model, namely, extended TRA (ETRA). The area within the dotted line denotes the original TRA.

Information Quality

The proliferation of the web potential for business, together with its profuse customer information, have offered an alternative sales channel for a growing number of firms.

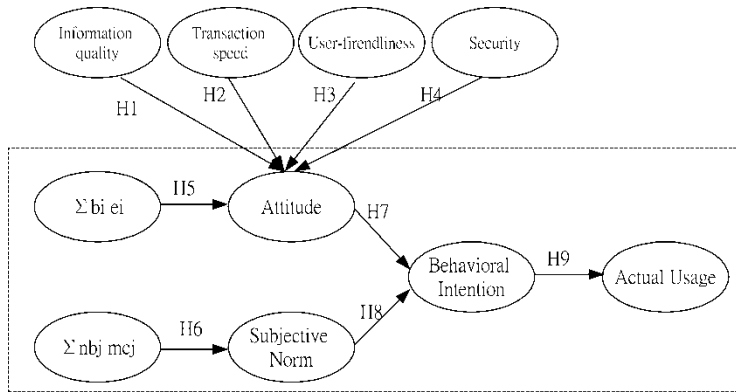


Figure 2. extended TRA model

Research has demonstrated that operational precision is a significant quality consideration in products and services involving computer technology (Davis *et al.*, 1992). Since the Internet has become a major area for marketing and transactions, individuals would expect accuracy in the information they receive on the Internet. Therefore, the following proposition is presented.

Proposition 1

Information quality positively influences consumer attitudes toward Internet banking.

This study introduced a Likert seven-point semantic differential scale with four items to measure the importance to users of: (a) providing correct information (QUALITY1); (b) providing complete information (QUALITY2); (c) rapidly updating information (QUALITY3); and (d) belief in the information provided (QUALITY4).

Transaction Speed

The advent of web technology constitutes a new medium of commerce that puts the customer in a position to directly and quickly interact with the web services of the bank and never communicate with any employees. According to Lin & Lu (2001), despite the popularity of the Internet, many people resist using the Internet due to a low response time arising from poor website designs and heavy traffic loads. Turban *et al.* (2000) also indicated that Internet banking could respond to complaints more quickly. Extending these observations to Internet banking, we present the following proposition.

Proposition 2

Transaction speed positively influences consumer attitudes toward Internet banking.

Three attributes included: (a) faster than branch banking (SPEED1); (b) efficient interactions (SPEED2); and (c) quick response (SPEED3). These were used in terms of a seven-point Likert scale, to measure the importance of attributes to users.

User-friendliness

The Internet has already built up a critical mass (Timmers, 1999), which attracts not only more users but also providers. Therefore, from the viewpoint of technology, ease of use is generally considered an important quality attribute in technical computer services (Davis *et al.*, 1989; Liao & Cheung, 2002). Accordingly, transactions conducted via traditional branch banking only involve communication with operators, increasing the importance of issues such as ease of resource use and available help information. Obviously, user-friendliness sheds some light on the behaviour intention of Internet banking. Thus, we present the following proposition.

Proposition 3

User-friendliness positively influences consumer attitudes toward Internet banking.

A Likert seven-point semantic differential scale was used to measure this quality attribute and was applied to the following three items: (a) clear and easy-to-follow instructions

(FRIEND1); (b) comprehensive HELP menus (FRIEND2); and (c) simple operating procedures (FRIEND3).

Security

Instead of a direct physical experience with the services or products, the virtual nature of the web medium seeks to retain traditional customer trust by graphic display. Van Slyke & Belanger (2003) pointed out that in e-business, security must go both ways: (1) the user identity needs to be verified so the merchant knows this is a legitimate user; and (2) the merchant identity must be verified so the user knows the merchant is legitimate. According to Parasuraman *et al.* (1988), Van Gorder (1990) and Liao & Cheung (2002), reliability is essential to product or service quality. Applying this reasoning to Internet banking, we present the following proposition.

Proposition 4

Security positively influences consumer attitudes toward Internet banking.

A seven-point Likert scale was used as the response format. The respondents were queried on how closely this attribute agreed with: (a) authorization (SECURE1); and (b) security awareness of Internet banking (SECURE2).

This paper also verifies the following TRA-related hypotheses in the context of Internet banking.

- Hypothesis 5. Attitudinal belief has a significant impact on the Attitude of TRA.
- Hypothesis 5(1). Attitudinal belief has a significant impact on the Attitude of ETRA.
- Hypothesis 6. Normative belief has a significant impact on the Subjective norm of TRA.
- Hypothesis 6(1). Normative belief has a significant impact on the Subjective norm of ETRA.
- Hypothesis 7. Attitude has a significant impact on the Behavioural intention of TRA.
- Hypothesis 7(1). Attitude has a significant impact on the Behavioural intention of Extended TRA.
- Hypothesis 8. Subjective norm has a significant impact on the Behavioural intention of TRA.
- Hypothesis 8(1). Subjective norm has a significant impact on the Behavioural intention of ETRA.
- Hypothesis 9. Behavioural intention has a significant impact on the Actual usage of TRA.
- Hypothesis 9(1). Behavioural intention has a significant impact on the Actual usage of ETRA.

Research methodology

Subjects

This study consists of two parts, administering a survey and testing the hypotheses in the proposed model with the survey data using the structural equation modelling method. To determine user intentions to adopt Internet banking and actual usage, a

survey was conducted during the first half of 2003. Data were gathered on personal banking customers of 53 Taiwanese banks across Taiwan, which also provide Internet services. Participants in this study were all customers at the bank where the data collection took place. Participation in the study was voluntary but limited to those customers who had at least one account with a bank.

Measurements

A questionnaire, using a seven-point scale, was employed to gather data for the constructs of the research model. Items from previous studies were modified for adaptation to the Internet banking context. The measures of Actual use, Behavioural intention to use, Attitude toward use, and Subjective norms were based on scales developed by Ajzen & Fishbein (1980). Four constructs of network quality attributes – Information quality, Transaction speed, User-friendliness, and Security – were extended from Zmud (1978), DeLone & McLean (1992), and Liao & Cheung (2002).

Attitudinal belief is the confidence of an individual that using Internet banking will enable personal banking transactions to be completed faster and more conveniently. The association indicates the importance to individuals of completing their banking transactions quickly and conveniently. Moreover, normative belief describes individual perception of the views of friends or colleagues regarding their Internet banking use. Evaluations are the key influence on the referent group's opinions.

For the purpose of content validity, an expert panel consisting of three MIS professors reviewed and revised the questionnaire. The modification to the instrument was then pilot tested with 20 graduate students majoring in the MIS field. Individuals indicated their agreement or disagreement with the survey items using a seven-point scale.

Results

A total of 425 usable responses were obtained, with no missing data. Forty-nine percent of the respondents were male, and 51 percent were female. Moreover, 81 percent of the respondents had over one year of experience of using the Internet. In terms of experience with Internet banking, 34 percent of the respondents had more than one experience, and approximately 65 percent had usage frequency of at least once a week. Tables 1 and 2 list detailed descriptive statistics relating to the demographic characteristics of Taiwanese customers and all measured items, respectively.

For the purposes of cross validity, this study adopted Cudeck & Browne's suggestion (1983), using cross-validation to assess the model fit. Most of the respondents were randomly assigned into a calibration sample of 300 respondents and the remainder were assigned into a validation sample of 125 respondents.

Measurement Model

The procedure used to test the fitness of the measurement model and the hypothesized paths in each of the two models described above (see Figures 1 and 2) were tested using the Lisrel 8.3 package (Joreskog & Sorbom, 1993). A matrix of correlation between the variables was input to Lisrel 8.3 using the maximum likelihood estimated. As suggested by Bagozzi & Heatherton (1994), each scale was divided to provide two

Table 1. Profiles of respondents

| Item | Value | Frequency | Percentage |
|---------------------------------------|-----------|-----------|------------|
| Gender | Male | 206 | 48.6 |
| | Female | 219 | 51.4 |
| Degree of Internet experience | <1 year | 79 | 18.6 |
| | 1–3 | 115 | 27.1 |
| | 4–6 | 159 | 37.4 |
| | >6 year | 72 | 16.9 |
| Degree of Internet banking experience | 0 times | 332 | 66.4 |
| | 1–5 | 68 | 13.6 |
| | 6–10 | 27 | 5.4 |
| | >10 times | 73 | 14.6 |
| Usage frequency of Internet banking | <1 week | 278 | 65.4 |
| | 2–3 | 55 | 12.9 |
| | 3–4 | 24 | 5.6 |
| | >1 month | 68 | 16.1 |

indicators of each latent variable. In conducting the analysis, the errors in equations for the determinants of intention were specified as free parameters, and the independent constructs were allowed to co-vary.

The test of construct validity is important to stabilize the measure dimensionality while conducting measure development (DeVellis, 1991). The fit of the indicator to the construct and construct reliability and validity were tested for the measurement model. First, reliability was initially examined by computing Cronbach's alpha coefficient for each construct. All the values of Cronbach's alpha in Table 4 range from 0.67 to 0.93, exceeding the critical value (0.6) recommended by Nunnally (1967). We also calculated composite reliability, which ranged from 0.68 to 0.91, all above the cut-off value of 0.7 (Straub, 1989). Discriminant and convergent validity of the scales was then examined. Convergent validity is reflected in the magnitude of the trait loading (Byrne, 1998). As indicated in Table 3, all estimated standard loadings were significant at the $P \leq 0.01$ level, suggesting good convergent validity. To assess the discriminant validity – the extent to which different constructs diverge from one another – we used Fornell & Larcker's (1981) criteria: average variance extracted (AVE) for each construct should be greater than the squared correlation between constructs. The correlation matrix of the study's construct on the right-hand side of Table 4 showed that our measurement model met this condition.

Structural Model

For explanation, the total coefficient of determination (TCD) R^2 for structural equations was shown herein. Furthermore, t-statistics for examining the correlation *between* the latent constructs and the correlation *among* latent constructs were used to test path links. t-statistics exceeded the critical value (1.96) for the 0.05 significance level as well as the 0.01 significance level (critical value=2.576) (Reisinger & Turner, 1999).

Then, five recommended fit indices, suggested by Hair *et al.* (1995) and Steiger (1990), were used to measure the overall model fit. These were described as follows: (1) Normed Chi-square (Chi-square/df) – where the recommended level was between

Table 2. Descriptive statistics each construct and item

| Construct (code) | Items | Mean | S.D. |
|----------------------|--|------|------|
| Information | | | |
| QUALITY1 | Provide correct information | 4.63 | 0.99 |
| QUALITY2 | Provide complete information | 4.46 | 1.03 |
| QUALITY3 | Update information quickly | 4.89 | 1.09 |
| QUALITY4 | I believe in the information provided | 4.53 | 1.03 |
| Transaction speed | | | |
| SPEED1 | Faster than branch banking | 4.27 | 1.08 |
| SPEED2 | Efficiency interactive | 4.35 | 1.06 |
| SPEED3 | Quick response from Internet banking | 4.48 | 1.11 |
| User-friendliness | | | |
| FRIEND1 | Clear and easy-to-follow instructions | 4.76 | 1.05 |
| FRIEND2 | Comprehensive HELP menus | 4.87 | 0.91 |
| FRIEND3 | Simple operating procedures | 4.45 | 1.06 |
| Security | | | |
| SECURITY1 | Authorization | 4.53 | 1.22 |
| SECURITY2 | Security awareness of Internet banking | 4.16 | 1.22 |
| Behavioral intention | | | |
| INT1 | Plan to use Internet banking | 4.62 | 1.31 |
| INT2 | Intend to use it within the next 3 months | 4.72 | 1.30 |
| INT3 | Add Internet banking to my favorite links | 4.57 | 1.38 |
| Actual usage | | | |
| USAGE1 | Usage amount (usage times) | 1.72 | 1.13 |
| USAGE2 | Usage frequency (week) | 1.00 | 1.53 |
| Attitude | | | |
| ATT1 | Using Internet banking would be a wise idea | 5.18 | 1.09 |
| ATT2 | Using Internet banking is a good idea | 4.78 | 1.12 |
| ATT3 | I like to use Internet banking | 4.96 | 1.06 |
| Subjective norm | | | |
| SN1 | People important to me would think that using IB would be a wise idea | 4.23 | 1.05 |
| SN2 | People important to me would think that using IB is a good idea | 4.04 | 1.00 |
| SN3 | People important to me would think I should use IB | 4.08 | 0.98 |
| SN4 | My family important to me would think that using IB would be a wise idea | 4.43 | 0.95 |
| SN5 | My family important to me would think that using IB is a good idea | 4.33 | 0.96 |
| SN6 | My family important to me would think I should use IB | 4.39 | 0.97 |
| PBC | | | |
| PBC1 | I would be able to operate IB | 4.34 | 1.22 |
| PBC2 | I have the resources to use IB | 4.81 | 1.21 |
| PBC3 | I have the knowledge to use IB | 4.83 | 1.15 |
| PBC4 | I have the ability to use IB | 4.95 | 1.16 |

Table 3. Measurement model analysis (Convergent Validity)

| Indicator | Loading | T-test | Indicator | Loading | T-test |
|-----------|----------------------|--------|-----------|-----------------|--------|
| | Information quality | | | Attitude | |
| QUALITY1 | 0.79 | – | ATT1 | 0.78 | – |
| QUALITY2 | 0.85** | 15.53 | ATT2 | 0.88** | 16.13 |
| QUALITY3 | 0.62** | 10.81 | ATT3 | 0.83** | 15.32 |
| QUALITY4 | 0.79** | 14.4 | | Subjective norm | |
| | Transaction speed | | SN1 | 0.63** | – |
| SPEED1 | 0.65 | – | SN2 | 0.64** | 9.89 |
| SPEED2 | 0.81** | 11.03 | SN3 | 0.65** | 10.02 |
| SPEED3 | 0.83** | 11.21 | SN4 | 0.93** | 13.06 |
| | User-friendliness | | SN5 | 0.95** | 13.29 |
| FRIEND1 | 0.74 | – | SN6 | 0.94** | 13.15 |
| FRIEND2 | 0.7** | 10.31 | | BIEI | |
| FRIEND3 | 0.49** | 7.48 | BIEI1 | 0.62 | – |
| | Security | | BIEI2 | 0.82** | 11.35 |
| SECURITY1 | 0.75 | – | BIEI3 | 0.83** | 11.45 |
| SECURITY2 | 0.87** | 12.25 | BIEI4 | 0.86** | 11.72 |
| | Behavioral intention | | BIEI5 | 0.78** | 10.98 |
| INT1 | 0.75 | – | BIEI6 | 0.75** | 10.68 |
| INT2 | 0.86** | 14.68 | | NBMC | |
| INT3 | 0.87** | 14.92 | NBMC1 | 0.77 | – |
| | Actual usage | | NBMC2 | 0.81** | 11.3 |
| USAGE1 | 1 | – | | | |
| USAGE2 | 0.6** | 5.98 | | | |

** $P \leq 0.01$.

1.0 and 2.0 – was the most appropriate parsimonious fit measure for the model fit; (2) Goodness-of-fit index (GFI), which is an indicator of the relative amount of variances and covariance jointly accounted by the mode (a marginal acceptance level is 0.9); (3) Root-mean-square error of approximation (RMSEA), where a marginal acceptance level is 0.08; (4) Relative fit index (RFI) (a marginal acceptance level is 0.9); and (5) Adjusted goodness-of-fit index (AGF), which takes values between 0 and 1: the closer to unity, the better the model fit.

Theory of Reasoned Action

The fit statistics indicate that the TRA model provides a good fit to the data ($\chi^2_{176} = 220.09$, $p < 0.01$; RFI = 0.94; GFI = 0.94; CFI = 0.99; RMSEA = 0.029). In terms of predictive power, the variance in all four dependent variables (R^2_{BI} , R^2_{Usage} , R^2_A and R^2_{SN}) of the TRA model are equal to 0.46, 0.20, 0.59 and 0.78, respectively.

Path coefficients are as hypothesized in each case ($I < 0.05$ in all instances). Attitudinal and Normative structure are significant determinants of Attitude and Subjective norm, respectively. Additionally, Attitude is a significant determinant of Behavioural intention, while Subjective norm is not. Furthermore, Behavioural intention is a significant determinant of Actual usage (see Figure 3). Hypotheses 5, 6, 7 and 9 thus are accepted.

Table 4. Composite reliability, Cronbach's alpha and discriminate validity test

| | Attitude | SN | BI | AU | IQ | TS | UF | Security | BIEI |
|---------------------------|----------|------|------|------|------|------|------|----------|------|
| Attitude | 0.83 | 0.46 | 0.7 | 0.29 | 0.54 | 0.3 | 0.36 | 0.53 | 0.69 |
| Subjective norm (SN) | | 0.8 | 0.29 | 0.09 | 0.18 | 0.24 | 0.23 | 0.31 | 0.26 |
| Behavioral intention (BI) | | | 0.83 | 0.43 | 0.55 | 0.31 | 0.37 | 0.55 | 0.7 |
| Actual usage (AU) | | | | 0.78 | 0.3 | 0.17 | 0.2 | 0.3 | 0.38 |
| Information quality (IQ) | | | | | 0.77 | 0.61 | 0.64 | 0.62 | 0.61 |
| Transaction speed (TS) | | | | | | 0.77 | 0.76 | 0.61 | 0.5 |
| User-friendliness (UF) | | | | | | | 0.65 | 0.62 | 0.59 |
| Security | | | | | | | | 0.81 | 0.61 |
| BIEI | | | | | | | | | 0.78 |
| NBMC | | | | | | | | | |
| Composite reliability | 0.87 | 0.91 | 0.87 | 0.75 | 0.85 | 0.81 | 0.68 | 0.79 | 0.9 |
| Cronbach's alpha | 0.89 | 0.93 | 0.88 | 0.81 | 0.84 | 0.8 | 0.67 | 0.8 | 0.9 |

The main diagonal shows the square root of the AVE.

AVE = average variance extracted = Σ of standard loading² / Σ of standard loading² + Σ of ϵ

Convergent validity = AVE \geq 0.5

Discriminant validity = AVE / (Correlation)²

where (Correlation)² = highest (Correlation)² between factors of interest and remaining factors.

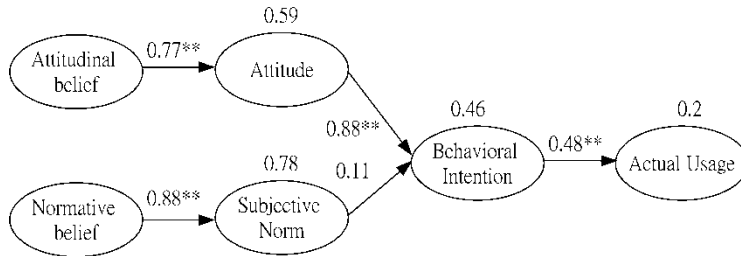


Figure 3. TRA path analysis (**Significant at $\alpha = 0.01$)

An additional analysis was performed to identify the indirect and total effects on Attitude, Subjective norm, Behavioural intention, and Actual usage. Table 5 illustrates that only Attitudinal belief had significant indirect and total effect on Behavioural intention and Actual usage at the $\alpha = 0.01$ level.

Extended TRA

The fit statistics indicate that the extended TRA model provides a good fit to the data ($\chi^2_{176} = 637.23, p < 0.01$; RFI = 0.90; GFI = 0.90; CFI = 0.97; RMSEA = 0.035). In terms of predictive power, the variance in all four dependent variables ($R^2_{BI}, R^2_{Usage}, R^2_A$ and R^2_{SN}) of the extended TRA model equalled 0.50, 0.18, 0.66 and 0.77, respectively.

Path coefficients are as hypothesized in each case ($p < 0.05$ in all instances). Attitudinal and Normative structure are significant determinants of Attitude and Subjective norm, respectively. Moreover, same as in the TRA model, Attitude is a significant determinant of Behavioural intention, while Subjective norm is not. Furthermore, Behavioural intention is a significant determinant of Actual usage (shown in Figure 4). Hypotheses 1, 2, 4, 5(1), 6(1), 7(1) and 9(1) are therefore accepted.

Table 6 identified the indirect and total effects on Attitude, Subjective norm, Behavioural intention, and Actual usage. The results revealed that Information quality, Transaction speed, Security, and Attitudinal belief have significant indirect and total effects on Behavioural intention and Actual usage (at $\alpha = 0.01$).

Table 5. Total effect, direct effect and indirect effect in the TRA model

| Latent (endogenous) | Latent (exogenous) | Indirect effect | Direct effect | T-value | Total effect |
|----------------------|--------------------|-----------------|---------------|---------|--------------|
| Attitude | Attitudinal belief | | 0.77** | 9.31 | 0.77 |
| Subjective norm | Normative belief | | 0.88** | 5.03 | 0.88 |
| Behavioral intention | Attitudinal belief | 0.67** | | 6.84 | 0.67 |
| | Normative belief | 0.10 | | 0.90 | 0.10 |
| Actual usage | Attitudinal belief | 0.32** | | 5.36 | 0.32 |
| | Normative belief | 0.05 | | 0.90 | 0.05 |

**Significant at $\alpha = 0.01$.

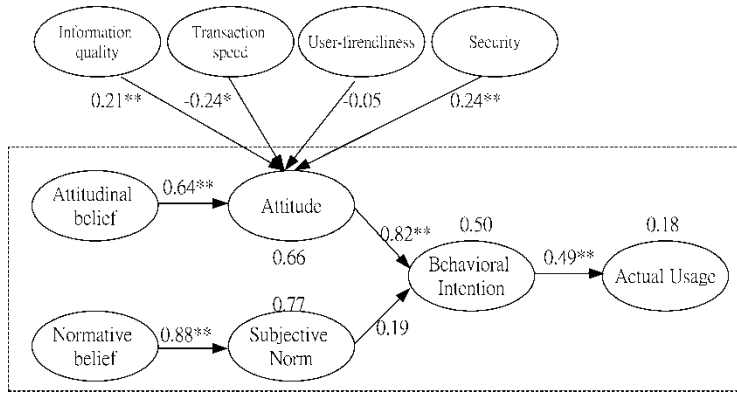


Figure 4. Extended TRA path analysis (**Significant at $\alpha = 0.01$, *Significant at $\alpha = 0.05$)

Cross-validation in Covariance Structure Modelling

The Cross-Validation Index (CVI) suggested by Cudeck & Browne (1983) was used to test the model structure of TRA and extended TRA. The computation of CVI measures the distance between the restricted variance-covariance matrix for the calibration sample and the unrestricted variance-covariance matrix for the validation sample. According to this, the smallness of the CVI value better estimated the predictive validity of the model.

Table 7 compared the analytical results of cross-validation of the TRA and the extended TRA models. Although both of the TRA and ETRA models seemingly showed the highest

Table 6. Total effect, direct effect and indirect effect in the ETRA model

| Latent (endogenous) | Latent (exogenous) | Indirect effect | Direct effect | T-value | Total effect |
|----------------------|---------------------|-----------------|---------------|---------|--------------|
| Attitude | Information quality | | 0.21** | 2.93 | 0.21 |
| | Transaction speed | | -0.24* | -2.52 | -0.24 |
| | User-friendliness | | -0.05 | -0.49 | -0.05 |
| | Security | | 0.24** | 3.31 | 0.24 |
| | Attitudinal belief | | 0.64** | 8.07 | 0.64 |
| Subjective norm | Normative belief | | 0.88** | 5.86 | 0.88 |
| Behavioral intention | Information quality | 0.17** | | 2.94 | 0.17 |
| | Transaction speed | -0.20* | | -2.45 | -0.20 |
| | User-friendliness | -0.04 | | -0.49 | -0.04 |
| | Security | 0.20** | | 2.94 | 0.20 |
| | Attitudinal belief | 0.53** | | 6.12 | 0.53 |
| | Normative belief | 0.17 | | 1.56 | 0.17 |
| Actual usage | Information quality | 0.08** | | 2.81 | 0.08 |
| | Transaction speed | -0.10* | | -2.37 | -0.10 |
| | User-friendliness | -0.02 | | -0.49 | -0.02 |
| | Security | 0.10** | | 2.80 | 0.10 |
| | Attitudinal belief | 0.26** | | 5.09 | 0.26 |
| | Normative belief | 0.08 | | 1.54 | 0.08 |

**Significant at $\alpha = 0.01$, *Significant at $\alpha = 0.05$.

Table 7. Cross-validation of TRA and ETRA

| Structure model | Cross-validation statistics |
|-----------------|--|
| TRA | Cross-Validation Index (CVI) = 28.239 90 Percent Confidence Interval for CVI = (26.67; 29.86) |
| Extended TRA | Cross-Validation Index (CVI) = 20.81 90 Percent Confidence Interval for CVI = (19.42; 22.26) |

potential for replication across samples from the same population, Cudeck & Brown (1983) cautioned that researchers should not choose, and need to take into account, the plausibility of the model and the substantive meaningfulness of the model parameters. In fact, two models of CVI value fell in the 90% interval of confidence. These models enable accurate location of specific parameter estimates.

Discussion and Conclusions

Given our analytical results, both of these models exhibited a reasonable fit to the data. To identify the best model, this study evaluated the models based on reasonable fit and explanatory power (Taylor & Todd, 1995). Table 8 shows the fit statistics and R^2 is used for each dependent construct to assess predictive power. The explanatory power of dependent constructs in the extended TRA model was not always better in the TRA model. However, network quality attributes significantly increase the explanatory power of Attitude (from 0.59 to 0.66) and Behavioural intention (from 0.46 to 0.54). Thus, with the determinants of consciously intended behaviour, the tenet stipulated in this study is that not only theory of reason action, from social psychology, but also network quality attributes need to be considered.

This study verified the research model by surveying Internet banking users to probe possible influences on adoption intention of Internet banking based on the TRA and the extended TRA models. TRA and extended TRA were used to illustrate complex inter-relationships between belief structures and determinants of intentions. The analytical results can provide useful and interesting interpretations to help Internet banking providers refine their strategic planning and enhance their competitive advantage. The research model developed in this study can also be applied to other kinds of electronic commerce.

Table 8. Fit indices for each of the hypothesized models

| Fit | TRA | ETRA | R^2 | TRA | ETRA |
|--------------------------------|--------|--------|------------|------|------|
| Df | 176 | 463 | R_{BI}^2 | 0.46 | 0.54 |
| χ^2 | 220.09 | 637.23 | R_{AU}^2 | 0.20 | 0.18 |
| Norm Chi-square | 1.25 | 1.38 | R_A^2 | 0.59 | 0.66 |
| RMSEA (0.08 or less is better) | 0.029 | 0.035 | R_{SN}^2 | 0.78 | 0.77 |
| RFI (above 0.9 is good fit) | 0.94 | 0.90 | | | |
| GFI (greater than 0.9) | 0.94 | 0.90 | | | |
| CFI (above 0.9 is good fit) | 0.99 | 0.97 | | | |

Generally, practitioners not only predict a new technology acceptability, but also diagnose the causes of impediments before making a decision on technology investment. Therefore, positive or negative signs of factors in the path provide valuable information for practitioners using a new technology.

Importantly, the path from quality attribute of network – transaction speed –negatively influenced attitude, and user-friendliness failed to achieve significance. In our study, only 34% of the sample respondents had already adopted Internet banking services; the remaining customers (66%) were used to using tellers to process their transactions. One possible explanation is that there are many accessible automated teller machines (ATM) for customers to use around the bank. Thus, the call for a vast set of Internet banking services, a practice not hitherto favoured, is still silent. User-friendliness of the web-page design failed to achieve a significant relationship with Consumer attitude in this study and may not be an important criterion for customers. A possible reason for the lack of the impact of user-friendliness may be owing to the fact that customers in this study had been using the Internet for some time. From the original theoretical mode, this study witnessed the consistency results with Triandis (1971) and Pare & Elam (1995) that subjective norms have their largest impact during the attitude formation process, and tend to become less important over time.

Likewise, the path from Subjective norm to Behavioural intention also failed to achieve significance in either model. More than 80% of the sample respondents had at least one year of Internet experience, and they may have higher operating ability and knowledge to operate Internet banking services. However, in this study, only 34% of the respondents had already adopted Internet banking services. Although the Internet offers a wider range of information and communication resources than people have ever had, the banking service is a solid personal-oriented activity. Therefore, direct interaction with Internet banking, with the customer actually in doubt, creates unusual security risks for transaction fraud, and loss or theft of vital information. Therefore, in order to develop sound competitive marketing strategies, it would seem advisable for Internet banking managers not only to rely on general indicators of TRA when analysing the customer behaviour intent, but also to seek to improve their measurements of customers' perceptions of the characteristics of the core services related to information quality and security they offer.

Despite this, since this study was not limited to respondents with experience in using Internet banking, it may be difficult to measure the differences between Subjective norm and Behavioural intentions. Consequently, further research is needed to understand the group difference to discriminate the variation in Subjective norm and Behavioural intention for pre-behaviour and post-behaviour users. In addition, the findings of this research must be interpreted with caution. First, the parameter estimates obtained can be interpreted only in the context of the variables included in the proposal model. Although the results provide conceptual inferences, it would be more useful in practice if these factors could be measured with more objective indicators instead of self-rating instruments. However, the implementation approaches are often impractical because obtaining access to system-monitored usage data is difficult and some information may be tagged confidential. Second, cross-validation could aid avoiding problems with significance levels when hypotheses are formulated and tested using the same data. Thus, there is clearly a need for future research to cross-validate the final model with new data.

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