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## モバイルバンキングへの利用意欲に影響する要因に関する一考察

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#### Abstract

Although millions of dollars have been spent on building mobile banking systems, reports on mobile banking systems have shown that potential users may not use the systems in spite of their availability. There is a need for research to identify the factors that determine users' acceptance of mobile banking. According to the technology acceptance model (TAM), perceived ease of use and perceived usefulness constructs are believed to be fundamental in determining the acceptance and use of various IT. These beliefs, however, may not fully explain the user's behavior toward the newly emerging mobile banking. Using the technology acceptance model (TAM) as a theoretical framework, this study introduces "perceived credibility" as a new factor that reflects the user's security and privacy concern in the acceptance of mobile banking, and examines the effect of computer self-efficacy on intention to use mobile banking. Data collected from 267 users in Taiwan were tested against the extended TAM using the structural equation modeling approach. The results strongly support the extended TAM in predicting users' intention to adopt mobile banking systems, and demonstrate the significant effect of computer self-efficacy on behavioral intention through perceived ease of use, perceived usefulness, and perceived credibility.

Key words: Mobile banking, Computer self-efficacy, Technology Acceptance Model (TAM).

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## 1. Introduction

Traditional branch-based retail banking remains the most widespread method of conducting banking transactions in Taiwan and other countries. However, the mobile and wireless technology is rapidly changing the way personal financial services are designed and delivered. For several years, commercial banks in Taiwan have tried to introduce mobile banking systems to improve their operations and reduce costs. Despite all the efforts aimed at developing better and easier mobile banking systems, these systems could easily remain unnoticed by customers, or were seriously underused in spite of their availability. However, only below one percent of banking transactions in Taiwan were conducted through the mobile handsets. On the other hand, there were 23 million mobile phone subscriptions in Taiwan in 2002, translating into 105.5 subscriptions for every 100 people, according to statistics by the Directorate-General of Budget, Accounting & Statistics (DGBAS). Mobile banking services are still in their infant stages, leaving a lot of room for development. Therefore, there is a need to understand users' acceptance of mobile banking and identify the factors that can affect their intention to use mobile banking.

The primary objective of this research is to extend the Technology Acceptance Model (TAM) in the context of mobile banking. We propose a new construct ('perceived credibility') to enhance understanding of an individual's acceptance behavior of mobile banking. This research also identifies the critical individual difference (i.e., computer self-efficacy) that has significant effect through the TAM framework on potential users' intention to use mobile banking. By explaining usage intention from users' perspectives, the findings of this research will not only help mobile banking authorities to develop better user-accepted mobile banking systems, but also provide insights into how to promote the new IT to potential users.

## 2. The Theoretical Background

Based on theories in social psychology, such as the theory of reasoned action (TRA) (Ajzen and Fishbein, 1980) and the theory of planned behavior (TPB) (Ajzen, 1985), the TAM has been validated as a powerful and parsimonious framework to explain users'

adoption of IT (Davis, 1989; Davis et al., 1989). TAM posits that user adoption of a new information system is determined by users' intention to use the system, which in turn is determined by users' beliefs about the system. TAM further suggests two beliefs-perceived usefulness and perceived ease of use-are instrumental in explaining the variance in users' intention. Perceived usefulness is defined as the extent to which a person believes that using a particular system will enhance his or her job performance, while perceived ease of use is defined as the extent to which a person believes that using a particular system will be free of effort. Among the beliefs, perceived ease of use is hypothesized to be a predictor of perceived usefulness. Furthermore, both types of beliefs are influenced by external variables.

Several important external variables that have received more and more attention in the context of TAM research are individual differences, such as computer self-efficacy (Agarwal and Prasad, 1999; Venkatesh and Morris, 2000; Hong et al., 2001). Consistent with practice in the information systems research literature (e.g., Alavi & Joachimsthaler, 1992; Harrison & Rainer, 1992), individual differences refer to user factors that includes traits such as personality and demographic variables, as well as situational variables that account for differences attributable to circumstances such as experience and training. Although there are points of similarity in prior research in terms of specific individual difference variables considered to be germane influences on the acceptance of a new information technology (IT), it is evident from the mixed empirical results obtained in prior work that the “process” through which individual differences influence IT acceptance are not well understood (c.f., Agarwal and Prasad, 1999; Venkatesh and Morris, 2000). As Chen et al. (2000) noted, the effects of individual differences on the use of the new IT are yet to be found out. Furthermore, there has been no such empirical research to explicate how individual differences influence the usage intention of mobile banking through TAM variables. Davis et al. (1989) suggested that the internal psychological variables (i.e., the beliefs) that are central to TAM fully mediate the effects that all other variables in the external environment may have on an individual's use of an innovation. Motivated by the insights from prior work about the potential existence of mediating variables, it is now possible to propose a richer explanation of how individual differences influence users' adoption of mobile banking systems via intervening TAM variables.

### 3. Research Model and Hypotheses

#### 3.1. Research model

Although TAM has been applied to a wide range of IT (e.g., Jackson et al., 1997; Venkatesh & Davis, 2000), none has investigated the adoption behavior of mobile banking using the TAM framework. Most of the prior studies have aimed at relatively simple IT, such as personal computer, e-mail system, and word processing and spreadsheet software. However, caution needs to be taken when applying the findings developed for the earlier generations of IT to the new virtual environment (Chen et al., 2000). Besides, the target user groups of mobile banking usually have more diversified education and socioeconomic background than those of other information systems. Thus, it is imperative to examine the acceptance of new technologies with different user populations in different contexts. As a wireless technology, the usage context of mobile banking is quite different from that of the stand-alone application software. As Moon and Kim (2001) noted, factors affecting the acceptance of a new IT are likely to vary with the technology, target users, and context. Therefore, the traditional TAM variables (i.e., perceived ease of use and perceived usefulness) may not fully reflect the users' intention to adopt mobile banking, necessitating a search for additional factors that better predict the acceptance of mobile banking.

Recent research reveals that that users' perceived credibility of Web systems has a striking influence on user willingness to engage in online exchanges of money and personal sensitive information (e.g., Hoffman et al., 1999; Friedman, et al., 2000). Most users who decline to provide sensitive information to mobile banking systems for banking transaction purposes report it is because they do not trust those collecting the data. The lack of perceived credibility is manifested in people's concerns that the mobile banking system (and/or the hackers intruding the system) will transfer their personal information or money to third parties without their knowledge or permission. Consequently, a new construct ('perceived credibility') is included in the extended TAM, while it is not present in the original TAM, to enhance our understanding of an individual's acceptance behavior of mobile banking services in the wireless context.

An important individual difference variable, called computer self-efficacy, has been examined in the IT acceptance literature (e.g., Compeau & Higgins, 1995; Compeau et al.,

1999; Hong et al., 2001). Computer self-efficacy is defined as the judgment of one's ability to use a computer (Compeau & Higgins, 1995). Continuing research efforts on computer self-efficacy can be observed in recent IS studies (Hong et al., 2001; Chau, 2001), which confirm the critical role that computer self-efficacy plays in understanding individual responses to information technology. Therefore, it is imperative to examine how the individual difference variable (i.e., computer self-efficacy) influences the usage intention of mobile banking through extended TAM variables.

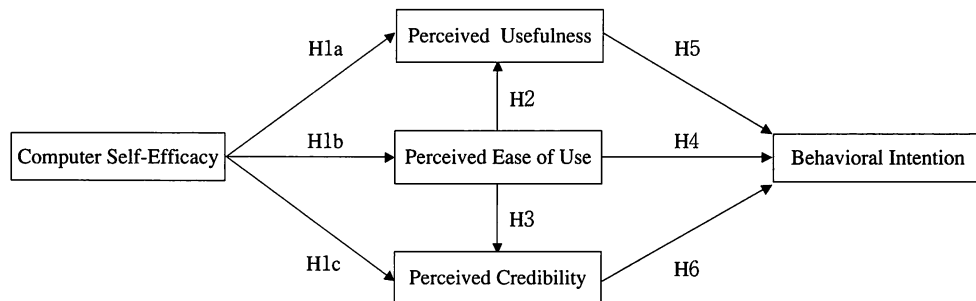


Figure 1 : The Research Model

The research model tested in this study is shown in Figure 1. In the extended model, like many other studies of TAM (e.g., Lu & Gustafson, 1994; Chau, 1996; Hong et al., 2001), the “attitudes” construct is taken out to simplify the model. The proposed research model includes one individual differences variable (computer self-efficacy) and three beliefs variables (perceived ease of use, perceived usefulness, and perceived credibility), the selections of which are supported by prior studies in the information systems literature.

### 3.2. Hypotheses

In light of the above discussion, the following hypotheses were constructed for testing in this study:

- H1a: Computer self-efficacy will have a positive effect on perceived usefulness of the mobile banking systems.
- H1b: Computer self-efficacy will have a positive effect on perceived ease of use of the mobile banking systems.
- H1c: Computer self-efficacy will have a negative effect on perceived credibility of the mobile banking systems.

banking systems.

H2: Perceived ease of use will have a positive effect on perceived usefulness of the mobile banking systems.

H3: Perceived ease of use will have a positive effect on perceived credibility of the mobile banking systems.

H4: Perceived ease of use will have a positive effect on behavioral intention to use the mobile banking systems.

H5: Perceived usefulness will have a positive effect on behavioral intention to use the mobile banking systems.

H6: Perceived credibility will have a positive effect on behavioral intention to use the mobile banking systems.

## **4. Research Design and Method**

### **4.1 Measures of the Constructs**

To ensure the content validity of the scales, the items selected must represent the concept about which generalizations are to be made. Therefore, items selected for the constructs were mainly adapted from prior studies to ensure content validity. One advantage of using TAM to examine mobile banking acceptance is that it has a well-validated measurement inventory (Davis, 1989). Items for the perceived ease of use and perceived usefulness were taken from the previous validated inventory and modified to fit the specific technology studied. The items to measure behavioral intention were taken from previous applications of TAM (Agarwal & Prasad, 1999; Venkatesh & Davis, 1996). Three items for the computer self-efficacy construct were adapted from the original instrument of computer self-efficacy developed by Compeau and Higgins (1995). Finally, perceived credibility was measured by two statements specifically developed for this study. Likert scales (1~7), with anchors ranging from “strongly disagree” to “strongly agree” were used for all questions except for the items measuring computer self-efficacy. The anchors of the items measuring computer self-efficacy ranged from “not at all confident” to “totally confident.” The Appendix lists the items used in this study.

## 4.2 Data Collection Procedure

Data for this study were collected using a questionnaire survey administered in Taiwan during 2003. A questionnaire was mailed to 405 random customers, who have mobile phones and have conducted banking transactions, via the marketing departments of four main providers of wireless telecommunication-service in Taiwan. The questionnaire consists of the measures (see Appendix) and a request for demographic information. We received 267 usable responses. Forty-six percent of the 267 respondents were male and the majority (75 percent) was between twenty and forty years of age.

## 5. Data Analysis and Results

### 5.1 Measurement Model

A confirmatory factor analysis using LISREL 8.3 was conducted to test the measurement model. Seven common model-fit measures were used to assess the model's overall goodness of fit: the ratio of  $\chi^2$  to degrees-of-freedom (df), goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), normalized fit index (NFI), non-normalized fit index (NNFI), comparative fit index (CFI), and root mean square residual (RMSR). As shown in Table 1, all the model-fit indices exceeded their respective common acceptance levels suggested by previous research, thus demonstrating that the measurement model exhibit a fairly good fit with the data collected. The measurement model also demonstrated adequate reliability, convergent validity, and discriminant validity<sup>1)</sup>. Thus, we could proceed to evaluate the structural model.

**Table 1:** Fit Indices for Measurement and Structural Models

Fit Indices	Recommended value	Measurement model	Structural model
$\chi^2/df$	$\leq 3.00$	2.34	2.36
Goodness-of-fit (GFI)	$\geq 0.90$	0.92	0.92
Adjusted goodness-of-fit (AGFI)	$\geq 0.80$	0.88	0.88
Normed fit index (NFI)	$\geq 0.90$	0.96	0.96
Non-normed fit index (NNFI)	$\geq 0.90$	0.98	0.98
Comparative fit index (CFI)	$\geq 0.90$	0.99	0.99
Root mean square residual (RMSR)	$\leq 0.10$	0.025	0.031

1) The details of statistical analysis regarding reliability, convergent validity, and discriminant validity are available from the corresponding author upon request.

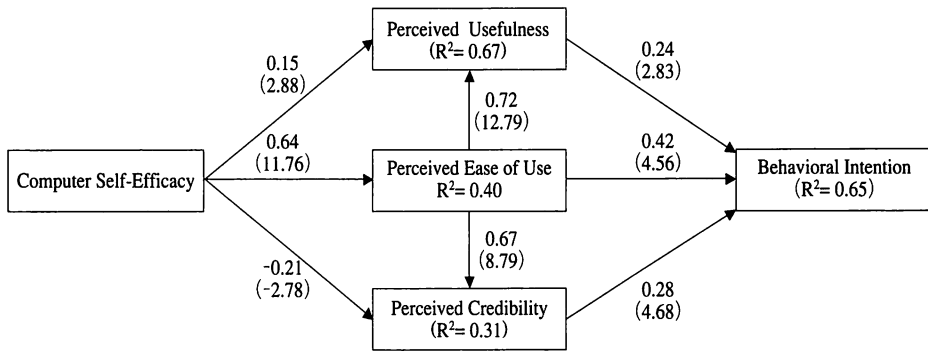


## 5.2 Structural Model

A similar set of fit indices was used to examine the structural model (see Table 1). Comparison of all fit indices with their corresponding recommended values provided evidence of a good model fit ( $\chi^2/df= 2.36$ , GFI = 0.92, AGFI = 0.88, NFI = 0.96, NNFI = 0.98, CFI = 0.99, RMSR = 0.031). Thus, we could proceed to examine the path coefficients of the structural model.

Properties of the causal paths, including standardized path coefficients, t-values, and variance explained for each equation in the hypothesized model are presented in Figure 2. As expected, hypotheses H4, H5, and H6 were supported in that perceived ease of use, perceived usefulness, and perceived credibility all had a significant positive effect on behavioral intention. Altogether, they accounted for 65 percent of the variance in behavioral intention with perceived ease of use ( $\beta = 0.42$ ) contributing more to intention than both perceived usefulness ( $\beta = 0.24$ ) and perceived credibility ( $\beta = 0.28$ ). Besides, hypotheses H2 and H3 were also supported. Perceived ease of use had a positive effect on both perceived usefulness ( $\beta = 0.72$ ) and perceived credibility ( $\beta = 0.67$ ). The total effect of perceived ease of use on behavioral intention was 0.78 ( $= 0.42 + 0.72 * 0.24 + 0.67 * 0.28$ ).

As for the paths from the individual difference variable to the three TAM factors, the results were significant. All three hypotheses concerning the effects of computer self-efficacy on perceived usefulness, perceived ease of use, and perceived credibility were supported (H1a, H1b, H1c). Computer self-efficacy had a positive effect on both perceived usefulness and perceived ease of use, and had a negative effect on perceived credibility. The total effect of computer self-efficacy on behavioral intention was 0.48 ( $= 0.15 * 0.24 + 0.64 * 0.72 * 0.24 + 0.64 * 0.42 + 0.64 * 0.67 * 0.28 + (-0.21) * 0.28$ ).



Note: t-values for standardized path coefficients are described in parentheses.

Figure 2: Hypotheses Testing Results

## 6. Discussion

This study focused on the extended technology acceptance model to illustrate the process by which the individual differences variable (i.e., computer self-efficacy) influence technology acceptance. Most empirical studies of TAM have examined relatively simple end-user technologies. It is not clear whether the constructs and relationships embodied in TAM would be equally applicable to more complex technologies. This study is pioneering effort in applying TAM to the newly emerging context of mobile banking systems, which have become available and popular only recently. Using the technology acceptance model (TAM) as a theoretical framework, this study introduces 'perceived credibility' as a new TAM factor that reflects the user's intrinsic belief in the acceptance of mobile banking, and examines the effect of computer self-efficacy on intention to use mobile banking.

The findings of this study strongly support the appropriateness of using extended TAM to understand people's intention to adopt mobile banking services. The significant effects of perceived usefulness, perceived ease of use, and perceived credibility on behavioral intention were observed, with perceived ease of use exerting a stronger influence than both perceived usefulness and perceived credibility. We also found the new TAM variable ('perceived credibility') to have a stronger influence on behavioral intention than the traditional TAM variable ('perceived usefulness') in the mobile banking context. Given that the usage of mobile banking is completely voluntary, and the target user group consists of a large number

of people with diversified backgrounds, the findings of the study suggest that in order to attract more users to use mobile banking, it is not enough to make the system easy to interact with. It is of paramount importance to develop mobile banking systems with valuable functions and trustworthy protection of security and privacy for the users. In addition, the mobile banking authorities need concern less with directly influencing behavioral intentions. As suggested by our extended TAM, these internal psychological processes should result if belief formation is appropriately managed. Thus, management attention might more fruitfully focus on the “development” of belief. Especially, the mobile banking authorities should employ training and promotion approaches to develop customers' usefulness, ease of use, and credibility beliefs, which in turn influence customers' behavioral intention to adopt mobile banking services.

Our results provide evidence of the significant effects of individual difference variable (i.e., computer self-efficacy) on behavioral intention through perceived ease of use, perceived usefulness, and perceived credibility. Consistent with our hypotheses, users who have higher computer self-efficacy are likely to have more positive usefulness and ease of use beliefs, but have more negative credibility belief about the mobile banking systems. This finding also supports prior research that has found a significant direct relationship between computer self-efficacy and perceived ease of use (Igarria & Iivari, 1995; Venkatesh, 2000; Venkatesh & Davis, 1996; Hong et al., 2001) and extends its generalizability to mobile banking contexts. While computer self-efficacy had a negative effect on perceived credibility, its total effect on behavioral intention is positive. Hence, bank management can increase customers' usage intentions through computer self-efficacy and three mediating TAM variables. In order to increase the computer self-efficacy of customers, the mobile banking authorities can organize training courses on various computer and wireless applications to increase the customers' familiarity with computing technologies. Even if these courses are not directly related to the mobile banking itself, they can still help the customers to develop positive usefulness and ease of use beliefs about the system more easily.

## **7. Conclusions**

This research is a response to the call for user-oriented research in mobile banking

services. Utilizing the extended technology acceptance model as a theoretical framework, the critical individual difference variable, computer self-efficacy, was proposed to have significant influence on the intention to use mobile banking through perceived usefulness, perceived ease of use, and perceived credibility. The contributions of this study to technology acceptance research are twofold. First, it has successfully applied extended TAM in a new IT context (i.e., mobile banking systems) that is very different from the systems examined in prior studies. Perceived ease of use, perceived usefulness, and perceived credibility were found to be significant antecedents of the intention to use a mobile banking system. Second, the individual difference variable (i.e., computer self-efficacy) was found to be an important determinant of perceived ease of use, perceived usefulness, and perceived credibility of the mobile banking systems.

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## Appendix

### Perceived ease of use

- PEU1 My interaction with the mobile banking systems is clear and understandable.
- PEU2 Learning to use the mobile banking systems is easy for me.
- PEU3 It would be easy for me to become skillful at using the mobile banking systems.
- PEU4 I would find the mobile banking systems easy to use.

### Perceived usefulness

- PU1 Using the mobile banking systems would improve my performance in conducting banking transactions.
- PU2 Using the mobile banking systems make it easier for me to conduct banking transactions.
- PU3 I would find the mobile banking systems useful in conducting my banking transactions.

### Perceived credibility

- PC1 Using the mobile banking systems would not divulge my personal information.

PC2 I would find the mobile banking systems secure in conducting my banking transactions.

#### Behavioral intention

BI1 Assuming that I have access to the mobile banking systems, I intend to use it.

BI2 I intend to increase my use of the mobile banking systems in the future.

#### Computer self-efficacy

I could conduct my banking transactions using the mobile banking systems...

CSE1 ...if I had only the system manuals for reference.

CSE2 ...if I had seen someone else using it before trying it myself.

CSE3 ...if I could call someone for help if I got stuck.

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