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Determinants of behavioral intention to mobile banking

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ABSTRACT

With the improvement of mobile technologies and devices, banking users are able to conduct banking services at anyplace and at anytime. Recently, many banks in the world have provided mobile access to financial information. The reason to understand what factors contribute to users' intention to use mobile banking is important issue of research. The purpose of this research is to examine and validate determinants of users' intention to mobile banking. This research used a structural equation modeling (SEM) to test the causalities in the proposed model.

The results indicated strong support for the validity of proposed model with 72.2% of the variance in behavioral intention to mobile banking. This study found that self-efficiency was the strongest antecedent of perceived ease-of-use, which directly and indirectly affected behavioral intention through perceived usefulness in mobile banking. Structural assurances are the strongest antecedent of trust, which could increase behavioral intention of mobile banking. This research verified the effect of perceived usefulness, trust and perceived ease-of-use on behavioral intention in mobile banking. The results have several implications for mobile banking managers.

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1. Introduction

With the improvement of mobile technologies and devices, mobile banking has been considered as a salient system because of such attributes of mobile technologies as ubiquity, convenience and interactivity (Turban, King, Viehland, & Lee, 2006). Nowadays, users are able to conduct banking services at anyplace and at anytime and to connect banking service easily and quickly with mobile devices. Banking services are provided immediately and interactively in mobile banking.

Recently, many banks have provided mobile access to financial information throughout Europe, the United States, and Asia. In Korea, the presence of mobile technologies and devices has expanded dramatically. The percentage of cell phone users is increasing to 83% of the total population. With the increasing cell phone usage, 8.5% of cell phone users have used mobile banking and the percentage of usage is increasing (http://www.mic.go.kr). In the development of mobile banking, banks enable users to access account balances, pay bills, and transfer funds through cell phone or other mobile device, instead of visiting banks and internet banking based on computer.

This trend of mobile banking indicates a remarkable potential to the banking industry. Banks can retain existing banking users in providing a new system (mobile banking) into the existing systems and have an opportunity to convert cell phone users into banking users. Nevertheless, retaining mobile banking users and attracting new ones may not be easy (Devaraj, Fan, & Kohli, 2002; Gefen, Karahanna, & Straub, 2003a). Therefore, it is important to understand what factors contribute to users' intention to use mobile banking.

During the last two decades, many researchers have used Technology Acceptance Model (TAM) to explain an individual's acceptance of new Information Technology (IT) and verified that the perceived usefulness and the perceived ease-of-use are key constructs of individual acceptance (Adams, Nelson, & Todd, 1992; Agarwal & Karahanna, 2000; Davis, 1989; Davis, Bagozzi, & Warshaw, 1989; Doll, Hendrickson, & Deng, 1998; Hendrickson, Massey, & Cronan, 1993; Mathieson, 1991; Segars & Grover, 1993). However, these two factors may not exactly reflect the acceptance of mobile banking users (Hsu & Lu, 2004).

Suggesting that the effect of external variables on intention is mediated by key constructs, TAM has been extended. The primary issues of previous TAM research have been twofold: determinants of the key construct (Davis, Bagozzi, & Warshaw, 1992; Straub, 1995; Venkatesh & Davis, 2000) and another key construct of behavioral intention (Gefen, 2000, 2003; Gefen et al., 2003a; Moon & Kim, 2001; Pavlou, 2003; Suh & Han, 2002; Teo, Lim, & Lai, 1999; Wang & Benbasat, 2005). These researches have been developed, respectively and have resulted in several theoretical models. However, the explanatory power of these models was under

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40–60% of the variance in an individual's intention to use technology (Gefen et al., 2003a; Moon & Kim, 2001; Ong, Laia, & Wang, 2004; Pikkarainen, Pikkarainen, Karjaluoto, & Pahnila, 2004; Teo et al., 1999; Venkatesh, 2000; Venkatesh & Davis, 1996). To understand behavioral intention to mobile banking and to find the drivers of mobile banking acceptance, it is necessary to integrate these models.

The purpose of this research is to examine and validate determinants of users' intention in mobile banking, utilizing constructs from these researches in an integrated model. In particular, this research adopts trust as another key construct of behavioral intention because e-commerce transactions are just conducted without meeting face-to-face (Gefen et al., 2003a; Grazioli & Jarvenpaa, 2000; Luhmann, 1979). Specifically, this research adds self-efficacy, facilitating conditions, social influence and system quality as determinants of key constructs (perceived usefulness and perceived ease-of-use) and familiarity with bank, situational normality, structural assurances, and calculative-based trust as the determinants of trust (Gefen, 2003; Gefen & Straub, 2003; Gefen et al., 2003a; Gefen, Karahanna, & Straub, 2003b; Liu, Marchewka, Lu, & Yu, 2005). This research uses a structural equation modeling (SEM) to test the causalities in the proposed model.

2. Theoretical background

2.1. Technology acceptance model

TAM, proposed by Davis (1989) in adaptation of Theory of Reasoned Action (TRA), is a theoretical model for explaining users' acceptance of a new Information Technology (IT). According to TRA, an individual's behavioral intention, which results in actual behavior, is influenced by his/her subject norm and attitude, and the attitude is influenced by individual beliefs (Ajzen & Fishbein, 1980).

Base on the causality of TRA, TAM uses perceived usefulness and perceived ease-of-use as key determinants to explain users' acceptance of IT (Davis, 1989). Perceived usefulness is defined by Davis (1989) as "the prospective user's subjective probability that using a specific application system will increase his or her job performance within an organizational context" and perceived ease-of-use is defined as "the degree to which the prospective user expects the target system to be free of effort". Perceived usefulness is related to productivity but perceived ease-of-use is related to effort (Venkatesh, 1999). These two beliefs influence an individual's attitude that results in his/her behavioral intention, which finally influences his/her actual usage of IT (Davis, 1989). In addition, perceived ease-of-use affect perceived usefulness because the easier IT is to be used, the more useful it will be.

In the early stage of TAM research, the validity of TAM has been demonstrated in diverse technologies such as spreadsheet (Adams et al., 1992; Doll et al., 1998; Hendrickson et al., 1993; Mathieson, 1991) and e-mail (Adams et al., 1992; Segars & Grover, 1993). Davis et al. (1989) asserted that TAM was a simpler but more powerful model of predicting individual's acceptance of IT than TRA, although the perceived usefulness and perceived ease-of-use were only used. Venkatesh (1999) indicated that TAM was a robust, powerful and parsimonious model for predicting users' acceptance of IT. Mathieson (1991) found that TAM can be used to measure general levels of satisfaction across a range of users with diverse interests.

2.2. Determinants of TAM

TAM provides a quick and inexpensive way to gather information about individual's perceptions of a system. However, it is insufficient to explain an individual's technology acceptance just by the key constructs of TAM such as perceived ease-of-use and perceived usefulness (Mathieson, 1991). In order to explain users' acceptance in more details, TAM has been extended in addition to determinants of the key constructs, and another key construct of behavioral intention across a wide range of IT.

As shown in Table 1, the factor of acceptance of a new IT is manifold because technology, target customers and situation are different from each system (Moon & Kim, 2001). In the early stage of TAM research, the object of research is computers or application software and the focus is to find determinants of the key constructs. These researches use the variables of TRA and Theory of Planned Behavior (TPB) such as subjective norm, facilitating conditions and self-efficacy.

Although subjective norm was dropped by Davis et al. (1989) in the development of TAM, it was found to have influence on perceived usefulness and behavioral intention in initial TAM research. Previous research indicted that subjective norm did not affect behavioral intention in individual-oriented IT such as word process, but affected behavioral intention in group-oriented IT such as computer resource center (Taylor & Todd, 1995), e-mail (Gefen & Straub, 1997), and online game (Hsu & Lu, 2004). Venkatesh and Davis (2000) demonstrated that subjective norm had a direct or indirect impact on perceived usefulness in operation systems. Venkatesh, Morris, Davis, and Davis (2003) redefined social influence from subjective norm in TRA and image in Innovation Diffusion Theory (IDT) and demonstrated that social influence had a direct impact on behavioral intention in voluntary context.

The self-efficiency and facilitating conditions deriving from perceived behavioral control in TPB are also used as the determinants of the key constructs. Behavioral control is divided into self-efficacy (internal control) and facilitating conditions (external control), which play a critical role in the early stage of users' experience with a system (Venkatesh, 2000). Facilitating conditions refers to the time and physical condition in conducting a particular behavior. It has a direct effect on perceived ease-of-use in e-store (Venkatesh, 2000) and behavioral intention in financial services and retail electronics (Venkatesh et al., 2003). Self-efficacy is a belief that one has the capabilities to execute the particular behavior. It is an antecedent of perceived ease-of-use in WWW (Agarwal & Karahanna, 2000), operating system (Venkatesh & Davis, 2000), and online shopping (Vijayasarathy, 2004).

With the rapid growth of Internet and e-commerce in 2000s, TAM researches are turning to focus on another key construct of behavioral intention. Instead of application software and legacy systems, the object of research has been changed into Internet-based applications such as WWW, online shopping, online auction, online game and online banking. In that the purpose of Internet usage is for pleasure, enjoyment and leisure, previous research has considered perceived playfulness, perceived enjoyment and flow experience as a key construct of behavioral intention in addition to perceived usefulness and perceived ease-of-use. Perceived enjoyment affects behavioral intention and actual usage in WWW (Heijden, 2004; Teo et al., 1999) and e-learning (Lee, Lee, & Kwon, 2005). Perceived playfulness in WWW (Moon & Kim, 2001) and flow experience in online game (Hsu & Lu, 2004) affects behavioral intention. In the context of e-commerce, especially, trust is considered a key construct of behavior, due to the fact that e-commerce transactions are just conducted through Internet without meeting face-to-face (Gefen et al., 2003a; Grazioli & Jarvenpaa, 2000; Luhmann, 1979).

2.3. Trust

Trust refers to "an individual belief that others will behave based on an individual's expectation" (Grazioli & Jarvenpaa, 2000; Luhmann, 1979) and "an expectation that others one

Table 1
Research of extended TAM.

Studies	Technologies		TAM	Antecedents
Taylor and Todd (1995)	Computing Resource Center (CRC)	786 Users	PU Ease-of-use Attitude Behavioral intention Behavior	Subjective norm Perceived behavioral control
Igbaria, Guimaraes, and Davis (1995)	Micro computer	214 MBA	PU, PEOU Perceived usage Variety of use	User characteristics User training User experiences System characteristics (Quality), Organizational support End user computing support Management support
Igbaria, Zinatelli, Cragg, and Cavaye (1997)	Personal computing	358 User in small firms	PU, PEOU System usage	Intraorganizational factors Internal computing support, Internal computing training Management support Extraorganizational Factors External computing support External computing training
Venkatesh and Davis (1996)	Chartmaster/Pendraw, WordPerfect/Lotus, e-mail/Gopher	108 Students	PU, PEOU Behavioral intention	System (Direct experience)
Gefen and Straub (1997)	E-mail	392 Users	PU, PEOU USE PU, PEOU Intention to use Usage behavior	Social presence-information richness (Gender) Subjective norm Image Job relevance Output quality Result demonstrability (experience, voluntariness)
Venkatesh and Davis (2000)	Operating system	156 (4 Organizations)		
Venkatesh et al. (2003)	Financial services & Retail electronics	133	Behavioral intention Use behavioral	Performance expectancy Effort expectancy Social influence Facilitating conditions (gender, age, experience, voluntariness of use)
Wixom and Todd (2005)	Data warehousing	465 Users	PU, PEOU Attitude Intention	Information quality Completeness Accuracy Format Currency System quality Reliability Flexibility Integration Accessibility Timeliness Information satisfaction System satisfaction
Teo et al. (1999)	WWW	1370 Users	PU, PEOU Internet usage	Perceived enjoyment
Agarwal and Karahanna (2000)		270 Students	PU, PEOU Behavioral intention to use	Playfulness Personal innovativeness Self-efficacy Cognitive absorption
Gefen and Straub (2003)		202 MBA	PU, PEOU Intended purchase	Intended inquiry
Lin and Lu (2000)		139 Undergraduate students	PU, PEOU Attitude Intention	Information quality Response time System accessibility
Moon and Kim (2001)		152 Graduate students	PU, PEOU Attitude Behavioral intention Actual usage	Perceived playfulness
Shih (2004b)		203 Office workers	PU, PEOU Attitude	Relevance Perceived performance
Hsu and Chiu (2004)		239 MBA	Perceived usefulness Attitude Intention E-service usage	Subjective norm Interpersonal norm Social norm Perceived behavioral control Web-specific self-efficacy Perceived controllability Perceived risk Perceived playfulness General internet self-efficacy

(*continued on next page*)

Table 1 (*continued*)

Studies	Technologies		TAM	Antecedents
Hsu and Lu (2004)	Online game	233 Users	PU, PEOU Attitude Intention	Social influences Critical mass, social norms Flow experience
Ong et al. (2004)	E-learning	140 Engineers	PU, PEOU Behavioral intention	Computer self-efficacy Perceived credibility
Saadé and Bahli (2005)		102 Students	PU, PEOU Intention to use	Temporal dissociation Focused immersion Heightened enjoyment Cognitive absorption
Lee et al. (2005)		544 Undergraduate students	PU, PEOU Behavioral intention	Perceived enjoyment
Heijden (2004)	Movie site	1144 Users	PU, PEOU Intention to use	Perceived enjoyment
Venkatesh (2000)	New applications in 4 organizations	246 Employees	PU, PUOU Behavioral intention to use	Anchors Computer self-efficacy Perceptions of external control Computer anxiety Computer playfulness Adjustments Perceived enjoyment Objective usability
Gefen et al. (2003a)	Online shopping	179 Students	PU, PEOU Intended use	Habit
Vijayasarathy (2004)		281 Consumers	PU, PEOU Attitude Intention	Compatibility Privacy Security Normative beliefs Self-efficacy
Shih (2004a)		212 Web users	PU, PEOU, ATT User acceptance	User satisfaction Web security and Access costs Perceived information quality Perceived system quality Perceived service quality
Shang, Chen, and Shen (2005)		1128 Users	PU, PEOU Behavior	Cognitive absorption Fashion involvement
Liao, Shao, Wang, and Chen (1999)	I-banking	323 Web user		Security Accuracy Speed User friendliness User involvement User experience Convenience
Wang et al. (2003)		123 Users	PU, PEOU Behavioral intention	Computer self-efficacy Perceived Credibility
Pikkarainen et al. (2004)		268	PU, PEOU Online banking use	Perceived enjoyment Information on online banking Security and privacy Quality of internet connection
Yu, Ha, Choi, and Rho (2005)	t-Commerce	1001 Users	PU, PEOU Attitude Behavioral intention	Perceived enjoyment Normative belief from family and friends Subject norm Trust
Wu and Wang (2005)	m-Commerce	310 Users	PU, PEOU Intention to use Actual use	Perceived risk Compatibility Cost

chooses to trust will not behave opportunistically by taking advantage of the situation" (Gefen et al., 2003a). In online shopping, users feel fearful to transact with e-venders in that transaction are conducted through Internet. Hoffman, Novak, and Peralta (1999) indicated that the critical obstruction in e-commerce was the fear, including the lack of standards for secure payment, the lack of profitable business models, and consumers' fear of distributing their personal data. Trust helps decrease these fears and facilitate transaction in e-commerce by reducing fraud, uncertainties and potential risks (Gefen, 2000, 2003; Gefen et al., 2003a; Pavlou, 2003; Suh & Han, 2002; Wang & Benbasat, 2005).

As shown in Table 2, numerous recent researches indicate that trust is another key construct of TAM. Most research found that trust influenced behavioral intention (Gefen & Straub, 2003; Gefen et al., 2003a; Gefen et al., 2003b; Kim & Prabhakar, 2004; Liu et al., 2005; Suh & Han, 2002; Wang & Benbasat, 2005), but the causality between trust and perceived usefulness, perceived ease-of-use is different. Pavlou (2003) asserted that trust influenced perceived usefulness and perceived ease-of-use in e-commerce. However, Suh and Han (2002) indicated that perceived usefulness affect trust in Internet banking. It is generally accepted that trust affected perceived usefulness but perceived ease-of-use affected trust (Gefen et al., 2003a; Wang & Benbasat, 2005).

2.4. Determinants of trust

Trust research has focused on determinants of trust as shown in Table 2. In the past decades, trust has been considered as an important issue not only in research unrelated to TAM but also TAM research. The former proposes determinants of trust as feedback profile (Ba & Pavlou, 2002), lack of dependability (Gefen, 2002), reputation, security (Koufaris & Hampton-Sosa, 2004), propensity

Table 2
Research of trust-based TAM.

Studies	Technologies		Antecedents of trust	Factor
Ba and Pavlou (2002)	Online auction (eBay)	95 Users, 682 Sellers	Feedback profile Trust in seller (Product price) Price premiums	
Gefen (2002)	ERP	135 Users	Perceived responsiveness Lack of dependability Client trust Engagement success	
Pavlou (2003)	E-commerce	155 Customers	Reputation Perceived risk	Satisfaction with past transactions PU, PEOU Trust Intention to transact
Gefen (2000)	Online shopping	217 Students	Familiarity Disposition to trust	Trust Inquire Purchase
Gefen et al. (2003b)		317 Users	Familiarity Disposition	Trust PU, PEOU Purchase intentions
Gefen and Straub (2003)		161 MBA students		Trust Social presence PU, PEOU Purchase intentions
Gefen et al. (2003a)		213 Students	Calculative-based trust Institution-based situational normality Institution-based structural assurances Knowledge-based familiarity	Trust PU, PEOU Intended use
Liu et al. (2005)		212 Students	Privacy	Trust Intention
Koufaris and Hampton-Sosa (2004)	Online company	212 Students	Perceived reputation Perceived security control Perceived willingness to customize Trust propensity Initial trust in company	PEOU PU
Suh and Han (2002)	I-banking	845 Users		Trust PU, PEOU Attitude Behavioral intention Actual usage
Kim and Prabhakar (2004)		180 Adopters, 86 nonadopters	Propensity to trust Relational content Tie strength Structural assurances	Trust in bank Initial trust Adoption
Wang and Benbasat (2005)	Online recommendation	120 Students		Trust in agent PU, PEOU Intention to adopt

to trust, structural assurances and word-of-mouth (Kim & Prabhakar, 2004). The letter proposes determinants of trust as satisfaction with past transactions and reputation (Pavlou, 2003), social presence (Gefen & Straub, 2003), familiarity and disposition (Gefen, 2003; Gefen et al., 2003b).

In the development of trust-based TAM, Gefen et al. (2003a) proposed that determinants of trust were calculative-based trust, knowledge-based familiarity, institution-based situational normality and institution-based structural assurances. The results indicated that calculative-based trust, institution-based situational normality and institution-based structural assurances affected trust. To integrate the extended TAM and the trust-based TAM, this research uses theoretical framework proposed by Gefen et al. (2003a).

3. Research model and hypotheses

This research model is integrated based on the extended TAM and the trust-based TAM. The determinants of perceived ease-of-use and perceived usefulness are self-efficacy, facilitating conditions, social influence and system quality. The determinants of trust are familiarity with bank, situational normality, structural assurances and calculative-based trust. This research hypothesizes that these determinants have a positive effect on perceived ease-of-use, perceived usefulness and trust, which influence behavioral intention in mobile banking. The research model is depicted in Fig. 1.

3.1. TAM

This research model adopts the causality of TAM, that is, belief influences behavioral intention. Users are actually willing to use mobile banking when they perceive it to be useful and helpful for the efficiency of their work. However, users will not use it when they perceive it to be difficult to use, even if it may be useful for their work. The more useful and easier mobile banking is, the more it will be used. In order to help understand the explanatory power of perceived ease-of-use and perceived usefulness on behavioral

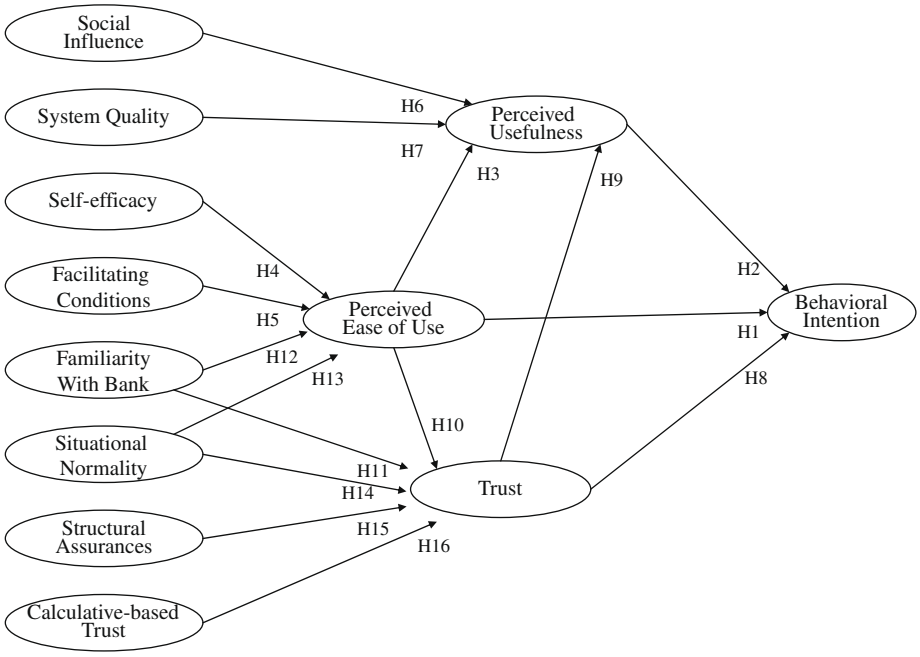

Fig. 1. Research model.

intention, this research proposes that these two constructs have a direct effect on behavioral intention with attitude excluded (Agarwal & Karahanna, 2000; Gefen et al., 2003a; Taylor & Todd, 1995; Venkatesh, 2000; Venkatesh & Davis, 2000). Accordingly, this research proposes the following hypotheses:

H1: The perceived ease-of-use will positively affect behavioral intention of mobile banking.
H2: The perceived usefulness will positively affect behavioral intention of mobile banking.
H3: The perceived ease-of-use will positively affect perceived usefulness of mobile banking.

3.2. Determinants of TAM

The determinants of perceived ease-of-use are self-efficacy and facilitating conditions. Self-efficacy is defined as a belief that an individual has the capabilities to execute the particular behavior with IT (Compeau & Higgins, 1995a; Compeau & Higgins, 1995b; Venkatesh, 2000). Empirical study indicates that self-efficacy has a positive effect on perceived ease-of-use (Agarwal & Karahanna, 2000; Ong et al., 2004; Venkatesh, 2000; Venkatesh & Davis, 1996; Wang, Wang, Lin, & Tang, 2003). In the context of mobile banking, users will perceive mobile banking to be easy to use when they recognize that they have a high self-efficacy.

Facilitating conditions is defined as the external environments of helping users overcome barriers and hurdles to use a new IT (Bergeron, Rivard, & De Serre, 1990; Lu, Yu, Liu, & Yao, 2003; Venkatesh & Davis, 1996). Users will perceive mobile banking service to be easy to use when they recognize that there are environmental conditions to help them learn how to use mobile banking service, although they cannot use it skillfully. Accordingly, this research proposed the following hypotheses:

H4: Self-efficacy will positively affect the perceived ease-of-use.
H5: Facilitating conditions will positively affect the perceived ease-of-use.

The determinants of perceived usefulness are social influence and system quality. Social influence is defined as "a person's perception that most people who are import to him think he should or should not perform the behavior in question" (Fishbein, Ajzen, & Belief, 1975). Although Davis et al. (1989) dropped subjective norm from TAM, much empirical research indicates that social influence have a positive effect on perceived usefulness (Gefen & Straub, 1997; Hsu & Lu, 2004; Taylor & Todd, 1995; Venkatesh & Davis, 2000). Users will perceive mobile banking to be useful when they see colleagues, friends and family members use it and get a recommendation of using it from them.

In the context of mobile banking, system quality refers to perceived network speed and system stability. System quality affects intention and customer satisfaction (DeLone & McLean, 1992; DeLone & McLean, 2003). Users will perceive it to be useful if the mobile banking services are provided accurately and with high speed. Accordingly, this research proposes the following hypotheses:

H6: The social influence will positively affect perceived usefulness.
H7: The system quality will positively affect perceived usefulness.

3.3. Trust

In e-commerce context, trust is defined as a belief that vendors are willing to behave based on an individual's expectation (Grazioli & Jarvenpaa, 2000; Luhmann, 1979) and to avoid an opportunistic behavior (Gefen et al., 2003a; Hosmer, 1995; Williamson, 1985). Trust helps reduce fraud and potential risk caused by opportunistic behavior (Pavlou, 2003) and provides users the ultimate benefits such as getting more reliable banking services from honest banks (Gefen et al., 2003a). When users trust banks, they will perceive mobile banking to be useful and they are willing to use it.

In addition, a key factor to creating trust in e-commerce is perceived ease-of-use (Gefen et al., 2003a). Users recognize that online vendors are not honest if it is difficult to use the online vendor's

web site. When mobile banking is easy to use, uses will perceive mobile banking to be trustworthy. Accordingly, this research proposes the following hypotheses:

H8: The trust of mobile banking service will positively affect behavioral intention.
H9: The trust of mobile banking service will positively affect perceived usefulness.
H10: Perceived ease-of-use will positively affect the trust of mobile banking service.

3.4. Determinants of trust

To demonstrate causality between trust and determinants of trust, this research adopts the theoretical framework proposed by Gefen et al. (2003a), which suggested that the determinants of trust were familiarity with mobile banking, situational normality, structural assurances, and calculative-based trust. Familiarity is defined as "an understanding, often based on previous interactions, experiences, and learning of what, why, where and when others do what they do" (Luhmann, 1979; Gefen, 2000). Gefen (2000) indicated that familiarity with e-vendor was derived from experience and knowledge from previous successful interactions, including the process of purchase in e-commerce transaction. This familiarity leads to higher levels of trust (Blau, 1964; Gefen et al., 2003a). In addition, familiarity increases the understanding of how to use mobile banking services as a result of previous experience (Gefen et al., 2003a). The more familiar users are with mobile banking, the more they will perceive it to be easy to use.

H11: Familiarity with bank will positively affect trust.
H12: Familiarity with bank will positively affect perceived ease-of-use.

Trust-related research indicates that trust is built by institutional factors such as guarantees, safety nets, or other impersonal structures (Gefen et al., 2003a; Shapiro, 1987). McKnight, Cummings, and Chervany (1998) classified institutional factors into situational normality and structural assurances. Situational normality is referred to "how normal or customary the situation appears to be" (Baier, 1986; Gefen et al., 2003a; Lewis & Weigert, 1985). If a process of mobile banking is similar with that of off-line banking or internet banking or other mobile business, trust will be improved (McKnight et al., 1998). In addition, users will perceive it to be easy to use when users' previous knowledge of how to use banking services is in a typical manner (Gefen et al., 2003a).

H13: Situational normality will positively affect trust of mobile banking.
H14: Situational normality will positively affect perceived ease-of-use of mobile banking.

Structural assurances refer to "safety nets such as legal resourse, guarantees, and regulations existed in a specific context" (Gefen et al., 2003a; McKnight et al., 1998; Shapiro, 1987). In the context of financial transaction, structural assurances are even more important (Kim & Prabhakar, 2004). When users receive structural assurances from mobile banking, trust will be increased (McKnight et al., 1998; Gefen et al., 2003a).

H15: Structural assurances will positively affect trust.

Calculative-based trust refers to "rational assessments of the costs and benefits in the relationship" (Coleman, 1990; Gefen et al., 2003a; Shapiro, Sheppard, & Cheraskin, 1992; Williamson, 1993). Users will trust mobile banks when they believe mobile banks have nothing to gain by breaking customer trust and do not deceive them (Gefen et al., 2003a).

H16: Calculative-based trust will positively affect trust.

To test the hypothesis, this research uses a two-stage methodology proposed by Gerbing and Anderson (1988), in which the measurement model and structural model are developed and evaluated separately. Firstly, the confirmatory factor analysis (CFA) is used to establish the convergent and discriminant validity of the constructs. In this analysis, the unreliable items are eliminated, one at a time by several criteria (Bagozzi, 1994; Baumgartner & Homburg, 1996; Hair, Anderson, Norman, & Black, 1995; Steenkamp & van Trijp, 1991). When the measurement model is developed and satisfying, structural model is used to identify the casualty among theoretical factors.

4. Research method

4.1. Measurement

This research has developed multi-item measures for each construct through the following process. Firstly, a draft of the questionnaire was prepared by reviewing the literature. All of the items were translated into Korean and slightly modified to suit the context of mobile banking. The scale of items was measured on a seven point Likert scale, ranging from strongly disagree (1) through neutral (4) to strongly agree (7).

Secondly, we conducted field interviews with managers of banking company and made modifications accordingly. They were asked to assess the terminology, clarity of instructions and response format. The questionnaire was modified and pretested on some customers ($n = 30$) so that further problems with the measures and response format could be detected.

Improved by the literature review and field interviews, 38 items for 12 variables are finally selected. For TAM, perceived ease-of-use is measured by three items (PEOU1–3), perceived usefulness by four items (PU1–4) and behavioral intention by three items (IU1–3). For the determinants of TAM, social influence is measured by four items (SOC1–4), system quality by two items (SEV1–2), facilitating conditions by three items (FAC1–3) and self-efficiency by four items (SEL1–4). For trust and the determinants, trust is measured by three items (TRU1–3), calculative-based trust by three items (CAL1–3), familiarity with bank by three items (FAM1–3), structural assurances by three items (STR1–3) and situational normality by three items (SIT1–3).

4.2. Data collection

To test the model, a web-based survey was employed. We developed the web-questionnaire page by using a Active Server Page (ASP). The main data was collected from customers who used mobile banking service within WooriBank in Korea. We announced the pop-up message in the web site, which explained the objectives of the research and contained the link to the Web-Survey. The respondents were offered several presents as an incentive.

The web-based survey yielded 910 usable responses. The demographic statistics indicated that male (64.9%) was more than female (35.1%) and the same was true for marriage. Age of the respondents was twenties (38.8%) and thirties (43.0), most of the respondents being employees (64.6%) with 41.1% having an income of one to two million. Period of the cell phone usage was over three years (70%) and contents of mobile commerce were downloading bell

Table 3
Profile of respondents.

Measure	Items	Frequency	Percentage
Gender	Male	591	64.9
	Female	319	35.1
Marriage	Single	450	49.5
	Married	460	50.5
Age	Under 10	11	1.2
	20–29	353	38.8
	30–39	391	43.0
	40–49	136	14.9
	Over 50	19	2.1
Occupation	Student	83	9.1
	Employee	588	64.6
	Private business	104	11.4
	Housewife	52	5.7
	Other	83	9.1
Monthly income	Under 1 million won	108	11.9
	1–2 million won	374	41.1
	2–3 million won	242	26.2
	Over 3 million won	186	20.5
Period of cell phone usage	Under 1 year	83	9.1
	1–2 year	65	7.2
	2–3 year	125	13.7
	3–4 year	286	31.4
	Over 4 year	351	38.6
Content of mobile commerce	Bell sound	310	34.1
	Game	80	8.8
	Connection sound	75	8.2
	Music	60	6.6
	Information provision	119	13.1
	Other	266	29.2
Period of mobile banking usage	Under 1 month	144	15.8
	1–2 Month	101	11.1
	2–3 Month	107	11.8
	3–4 Month	210	23.1
	Over 4 month	348	38.2
Total		910	100

sounds (34.1%). Period of mobile banking usages was over 3 months (61.3%). The profiles of respondents were summarized in Table 3.

5. The results

5.1. Measurement model

The validity of the measurement model is evaluated by investigating convergent validity, reliability and discriminant validity. Firstly, we conducted unconstrained confirmatory factor analysis by using AMOS 5.0 to evaluate convergent validity for twelve constructs, which included eight determinants and four dependent variables. The purpose of convergent validity is to ensure unidimensionality of the multiple-item constructs and to eliminate unreliable items (Bollen, 1989). The convergent validity is evaluated by investigating the value of standardized factor loadings and standardized residual covariance (SRC). Items should load at least 0.60 on their respective hypothesized component and all loadings need to be significant ($p < 0.05$, $t > = 2.0$) (Bagozzi & Yi, 1998; Sujan, Weitz, & Kumar, 1994). Items with at least ±2.57 within SRC matrix should be deleted from the model (Calantone & Zhao, 2000; Salisbury, Parson, Pearson, & Miller, 2001). The result found that 9 items were eliminated; SOC2, FAC1, SEL1, PU4, PEOU3, CAL3, FAM3, STR2, SIT3.

After elimination, the value of standardized factor loading for each item to its respective construct was significant ($p < 0.05$), and all loadings ranged from 0.807 to 0.967, as shown in Appendix 1. The fit statistics for initial model were weak, but that for the finial models were good. The chi-square of the model at 636.522 with d.f. of 311, the ratio of chi-square to d.f. at 2.047, GFI at 0.954, AGFI at 0.935, NFI at 0.979, CFI at 0.989, RMR at 0.055 and RMSEA at 0.034 were acceptable.

Secondly, reliability for all items of a construct should be evaluated jointly by investigating composite reliability (CR) and the average variance extracted (AVE). For a construct to possess good reliability, CR should be at least 0.60 and the AVE should be at least 0.5 (Bagozzi, 1994; Baumgartner & Homburg, 1996; Hair et al., 1995; Steenkamp & van Trijp, 1991). As shown in Appendix 1, CR and AVE in final model were over 0.723 and over 0.544.

Finally, we tested the discriminant validity, whose purpose is to identify if the constructs differ from each other (Bollen, 1989; Chin, Gopal, & Salisbury, 1997). We conducted on a chi-square difference test where the chi-square measurements with two analyses were compared. One analysis uses constrained model in which the correlation between two constructs set 1.0 and the other uses unconstrained model in which the correlation is freely estimated (Bollen, 1989; Jöreskog & Sörborm, 1989). Thus, the difference in degrees of freedom between the two models is 1. When the value of chi-square difference is over 3.84 with d.f of 1 ($p < 0.05$), the two constructs are statistically different. The 12 constructs paired against one another were tested and all constructs were different ($p < 0.05$). The correlation between TRU and STR was exampled, which is the highest as shown in Table 4. The constrained model produced a chi-square of 102.2 with 5 d.f. compared with 55.0 with 4 for the unconstrained model. The difference was 47.2 with 1 d.f. which suggests that the two constructs were different.

Table 4
AMOS standardized correlation matrix.

	SOC	SEL	SEV	FAC	CAL	FAM	STR	SIT	PEU	TRU	PU
SOC											
SEL	0.139										
SEV	0.355	0.676									
FAC	0.259	0.728	0.700								
CAL	0.231	0.567	0.666	0.560							
FAM	0.391	0.435	0.518	0.493	0.623						
STR	0.326	0.565	0.705	0.572	0.807	0.748					
SIT	0.325	0.665	0.745	0.681	0.749	0.683	0.843				
PEU	0.172	0.832	0.782	0.814	0.637	0.520	0.652	0.754			
TRU	0.268	0.549	0.682	0.540	0.758	0.690	0.868	0.815	0.628		
PU	0.171	0.755	0.741	0.698	0.708	0.541	0.692	0.789	0.818	0.694	
BI	0.210	0.699	0.691	0.642	0.691	0.561	0.729	0.767	0.738	0.744	0.802

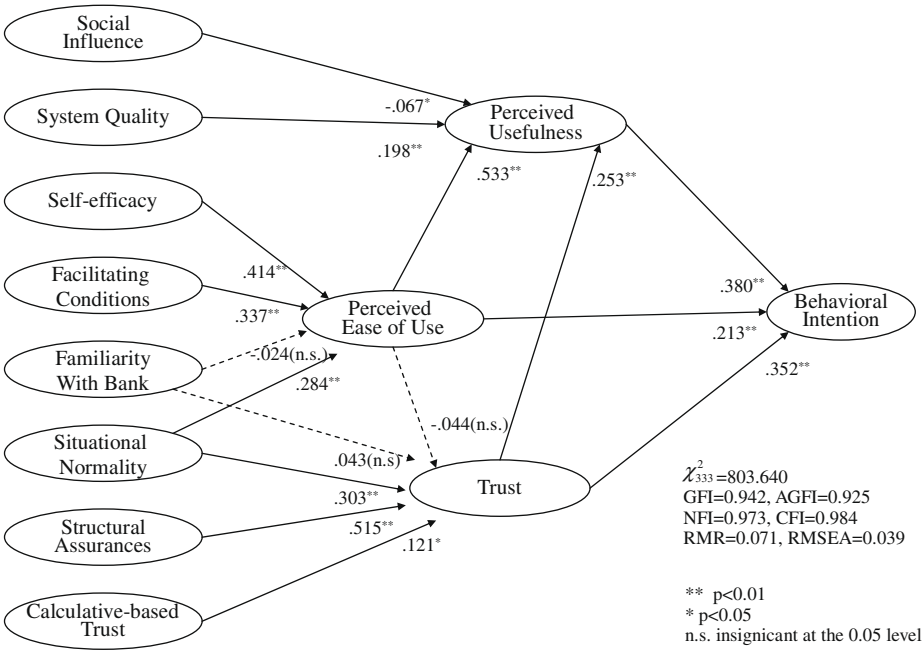

Fig. 2. Results of structural equation model.

5.2. Structural model

After the measurement model was satisfying, the structural model was evaluated and it was well converged. The results indicated that the chi-square of the structural model at 803.640 with d.f. of 333, the ratio of chi-square to d.f. at 2.413, GFI at 0.942, AGFI at 0.925, NFI at 0.973, CFI at 0.984, RMR at 0.071 and RMSEA at 0.039 were acceptable. Squared multiple correlations were: perceived ease-of-use, 83.3%; perceived usefulness, 74.7%; Trust, 79.7%; Behavioral intention, 72.7%.

The results of structural model analysis were given in Fig. 2. All the paths are significant except four hypotheses. For the determinants of TAM, path coefficients from familiarity with bank (FAM) to perceived ease-of-use (PEOU) and social influence (SOC) to perceived usefulness (PU) were not significant. For trust and the determinants, familiarity with bank (FAM) and perceived ease-of-use (PEOU) to trust (TRU) were not significant.

In addition, the percent of variation in Trust, PEOU, PU, and BI explained by our proposed model is 79.7%, 83.3%, 74.7%, 72.7%, respectively. The results indicated that the integrated model is significantly higher than previous models (Gefen et al., 2003a; Moon & Kim, 2001; Ong et al., 2004; Pikkarainen et al., 2004; Teo et al., 1999; Venkatesh, 2000; Venkatesh & Davis, 1996).

6. Discussion

Over the past decades, TAM has been extended to explain an individual's behavior of acceptance of a new IT (as show Table 1). To examine determinants of user's intention in mobile banking, this research has developed an integrated model from the extended TAM and the trust-based TAM and demonstrates the validity of this model. The results indicate strong support for the validity of integrated model with 72.2% of the variance in behavioral intention of mobile banking.

This research generally supports the results of previous extended TAM and trust-based TAM research (Gefen, 2000, 2003; Gefen et al., 2003a; Pavlou, 2003; Suh & Han, 2002; Wang & Benbasat, 2005). The results indicate that key determinants of behavioral intention in mobile banking are perceived usefulness ($\beta = 0.380$), trust ($\beta = 0.352$) and perceived ease-of-use ($\beta = 0.213$). First of all, perceived usefulness is proposed as the most important construct. Users are willing to use mobile banking

if they find it useful for their work. Consistent with previous trust-based TAM research, trust is crucial in increasing behavioral intention of mobile banking as well as key construct of TAM. Thus, mobile banks need to pay attention to the way of increasing trust.

Perceived usefulness is directly affected by perceived ease-of-use ($\beta = 533$), trust ($\beta = 0.253$) and system quality ($\beta = 198$) except social influence. Perceived ease-of-use is the most important construct on perceived usefulness. Consistent with TAM research, perceived ease-of-use affects directly or indirectly affects behavioral intention through perceived usefulness (Agarwal & Karahanna, 2000; Hsu & Lu, 2004; Igbaria et al., 1995; Ong et al., 2004; Taylor & Todd, 1995). This research suggests that mobile banks need to consider how to use mobile banking services easily. In addition, mobile banks need to try to be trustworthy and provide services accurately and with high speed. On the contrary, social influence is found to have little effect on perceived usefulness. This is consistent with previous research, which indicated that social influence has no influence on perceived usefulness and behavioral intention of financial services in voluntary context (Venkatesh & Davis, 2000; Venkatesh et al., 2003). In mobile banking used in voluntary context, users are not affected by referent groups but by individual's necessity.

Perceived ease-of-use is directly affected by self-efficiency ($\beta = 414$), facilitating conditions ($\beta = 337$) and situational normality ($\beta = 0.284$) except familiarity with banks. The self-efficiency and facilitating conditions are derived from behavioral control, in which they are internal and external control (Venkatesh, 2000). This is consistent with past findings that these control constructs directly affected perceived ease-of-use. This research suggests that enhanced self-efficacy can increase perceived ease-of-use when users feel more comfortable about mobile banking. In that self-efficiency is built up based on an individual's judgment about how easy or difficult a new system is used, we suggest that mobile banks need to design and develop user-friendly systems and interface (Venkatesh, 2000; Venkatesh & Davis, 1996; Venkatesh et al., 2003). Enhancing this internal control (self- efficiency) is related to external control (facilitating conditions). Facilitating conditions refer to organizational and technical infrastructure to support use of the system and to remove barriers to use (Venkatesh, 2000). Mobile banks need to provide with guidance in the selection of the systems and specialized instruction concerning the system (Venkatesh et al., 2003).

Contradictory to the results of previous trust research (Gefen, 2000, 2003; Gefen et al., 2003a, 2003b), familiarity with banks does not affect perceived ease-of-use. Gefen et al. (2003a) asserted that familiarity does not have a direct effect on trust, but have a direct effect on perceived ease-of-use. Familiarity can be divided into knowledge-based and interaction-based familiarity. However, they used only interaction-based familiarity because variable about knowledge-based familiarity was dropped in the development of measurement model. Thus, we suppose that knowledge-based familiarity can be related to trust and interaction-based familiarity can be related to perceived ease-of-use. On the contrary, this research uses only knowledge-based familiarity because interaction-based familiarity (FAM3) was dropped. We suggest that it is necessary to demonstrate the familiarity in more details in future research.

Trust is directly affected by structural assurances ($\beta = 0.515$), situational normality ($\beta = 0.303$), and calculative-based trust ($\beta = 0.121$) except familiarity with bank. In the context of financial transaction such as mobile banking, institutional-based trust such as structural assurances and situational normality has higher effect on trust than other determinants (Gefen et al., 2003a; Kim & Prabhakar, 2004; McKnight et al., 1998). Mobile banks need to provide with a banking process similar to internet banking or other mobile business, statements of guarantees, help desk, and a certificate. Especially, to reinforce structural assurances, cellular phone embedded with IC-chip has been used in Korea.

Contradictory to the results of previous trust research, familiarity with bank and perceived ease-of-use do not affect trust. In online shopping, most of e-retailers are start-up companies which are not well-known. Users are willing to trust e-retailers if users get more knowledge about them and their website are easy to use (Gefen et al., 2003a; Koufaris & Hampton-Sosa, 2004). In comparison with online shopping, mobile banking services are provided by the existing banks whose trust has already been established. Thus, users do not consider familiarity and ease-of-use any more in mobile banking.

7. Conclusion and limitation

This research integrates the fragmented models such as the extended TAM and the trust-based TAM into a unified model of mobile banking. This model is empirically demonstrated by using the actual data from mobile banking users in WooriBank. First, this study finds that explanatory power of the suggested model is much higher than others and the validity of the model was strongly supported. Secondly, this study verified the effect of perceived usefulness, trust and perceived ease-of-use on behavioral intention in mobile banking. From the overview, we propose that the key significant path to behavioral intention is twofold: self-efficiency → perceived ease-of-use → perceived usefulness → behavioral intention, and structural assurances → trust → behavioral intention.

This study finds that self-efficiency is the strongest antecedent of perceived ease-of-use, which directly and indirectly affected behavioral intention through perceived usefulness. For user to perceive it easy to use, mobile banks need to develop the methods to enhance self-efficacy. We suggest that mobile banks need to make users feel more comfortable, develop user-friendly interface and provide with guidance and specialized instruction about mobile banking.

This study finds that structural assurances are the strongest antecedent of trust, which could increase behavioral intention of mobile banking. Although mobile banking is a new information communication technology, trust of banking has already been established for a long time through previous successful experience with off-line and internet banking. To increase trust, mobile banks need to make users free from fearfulness when they transact with banks through mobile banking. In addition, to reduce fraud, uncertainties and potential risks and to facilitate transaction in mobile banking, mobile banks need to develop structural assurances.

Notwithstanding the above findings, this research has some limitations which should be dealt with in future works. First, although the sample of this research included about 900 actual data from mobile banking users, it was surveyed within one bank. It is limited to generalize the findings to whole banking industry. Secondly, in the development of measurement, interaction-based familiarity was dropped. As mentioned above, it is necessary to demonstrate the familiarity in more details in future research. Thirdly, although we developed an integrated model of mobile banking, future research should extend this model with inclusion of diverse theoretical model and diverse antecedent.

In future research, it is necessary to investigate the causality between an individual's acceptance and outcomes and to demonstrate the long-term effects of mobile banking. In addition, the future research should compare mobile banking with internet banking due to the difference of environment, technologies and device. Finally, mobile banking consists of banks, telecommunication companies and mobile devices, therefore, it is necessary to survey with inclusion of all of them and to compare with them to investigate what is different.

Appendix A

Results of measurement model

Items	Wording	Estimate	CR	AVE
	Behavioral intention			
BI1	I intend to use mobile banking continuously in the future.	0.937	0.895	0.740
BI 2	I will recommend others to use mobile banking.	0.943		
BI 3	I will frequently use mobile banking in the future.	0.938		
	Perceived ease-of-use			
PEOU1	mobile banking is easy to use	0.967	0.883	0.790
PEOU2	Learning to operate mobile banking is easy	0.944		
	Perceived usefulness			
PU1	Using this mobile banking enhances the efficiency of my banking activities.	0.938	0.900	0.751
PU2	Using this mobile banking make it easier to do my banking activities.	0.955		
PU3	Using this mobile banking make it enables me to accomplish my banking activities more quickly.	0.939		
	Trust			
TRU1	I believe Wooribank is trustworthy.	0.916	0.860	0.672
TRU2	I believe Wooribank keeps its promises and commitments.	0.942		
TRU3	I believe Wooribank considers customers' profit as top priority	0.854		
	Self-efficiency			
SEL2	I do not feel difficulties to use mobile banking	0.933	0.880	0.710
SEL3	I do not need some people to use mobile banking	0.962		
SEL4	I have a confidence to use mobile banking	0.939		
	Facilitating condition			
FAC2	I have the person available for assistance with mobile banking use	0.807	0.742	0.592
FAC3	I have the knowledge necessary to use mobile banking	0.947		
	Social influence			
SOC1	I use mobile banking because people think I should use mobile banking	0.833	0.781	0.544
SOC3	I use mobile banking because it is very famous	0.918		
SOC4	I use mobile banking because many people use mobile banking	0.890		
	System quality			
SEV1	Mobile banking systems is stable to use	0.882	0.745	0.593
SEV2	The speed of mobile banking systems is quick and fast to use	0.875		
	Familiarity with bank			
FAM1	I am familiar with Wooribank through magazines, newspaper or TV	0.859	0.749	0.599
FAM2	I am familiar with Wooribank through visiting its website and getting information about it	0.897		
	Structural assurances			
STR1	I feel safe conducting business with Wooribank because the better business bureau will protect me.	0.883	0.790	0.653
STR3	I feel safe conducting business with Wooribank because of its statements of guarantees and ethics charter.	0.903		
	Situational normality			
SIT1	The steps required to use mobile banking services are typical of offline banking services.	0.86	0.723	0.566
SIT2	The information requested of me at mobile banking is the type of information most similar offline banking request	0.843		
	Calculative-based trust			
CAL1	Wooribank has nothing to gain by being dishonest in its interactions with me.	0.945	0.840	0.724
CAL2	Wooribank has nothing to gain by not caring about me.	0.907		

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