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Mobile Banking Adoption: An Examination of Technology Acceptance Model and Theory of Planned Behavior

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Abstract

This study aims at extending our understanding regarding the adoption of mobile banking through integrating Technology Acceptance Model (TAM) and Theory of Planned Behavior (TPB). Analyzing survey data from 119 respondents yielded important findings that partially support research hypotheses. The results indicated a significant positive impact of attitude toward mobile banking and subjective norm on mobile banking adoption. Surprisingly, the effects of behavioral control and usefulness on mobile banking adoption were insignificant. Furthermore, the regression results indicated a significant impact of perceived usefulness on attitude toward mobile banking while the effect of perceived ease of use on attitude toward mobile banking was not supported. The paper concludes with a discussion of research results and draws several implications for future research.

Keywords: *Mobile banking, theory of planned behavior, technology acceptance model, technology adoption, banks*

1. Introduction

In a dynamic environment, many banks seek new strategies that facilitate online information sharing and transactions. Linking banking business to customers through mobile devices such as mobile phones or PDAs is one of these competitive strategies. Mobile banking refers to using mobile devices to provide financial information, communication and transactions to customers such as checking account balances, transferring funds and accessing other banking products and services from anywhere, at any time (Ensor, *et al*., 2012; ITU, 2012). While mobile becomes a popular access point, there are many emergent benefits of mobile banking for both banks and customers. Services provided through mobile banking include sending and receiving messages and instructions, access (pre-paid or subscription) to a mobile service, and M-banking application installed on user's SIM card to facilitate deposits, withdraws and money transfer between parties (Hernandez, 2011).

Customers will be able to obtain immediate and interactive banking services anytime and anywhere which, in turn, initiate great value for them (Mallat *et al*., 2004). Mobile banking service can also increase the amount of data processing and improve operational performance. Moreover, adoption of mobile banking has significant impact on reducing costs and facilitating change in retail banking (Laukkanen and Lauronen, 2005). Cruz *et al*. (2010) and Dasgupta *et al*. (2011) suggested that mobile banking has great potential to provide reliable services to people living in remote areas where internet facility is limited.

Statistics suggest that adoption of mobile banks services is escalating. About more than sixty percent of banks worldwide have planned to offer mobile banking services in 2010 considering that

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users of mobile banks in United States only may already be reached 11 million households in 2009 (Sripalawat *et al*., 2011). Advances in information and communication technology today have made mobile banking adoption possible in many countries as long as limitations such as lack of availability, poor wireless product quality and insufficient technology infrastructure are encountered (World Bank, 2009). Developing countries such as United Arab Emirates (UAE), South Africa, Kenya, and Botswana have also started to realize mobile banking and have already adopted its services (Bandyopadhyay, 2010).

Therefore, there is a need to understand mobile banking adoption through examining factors that influence user's intention to use mobile banking. This may guide strategic planning and inform decision making in commercial banks when introducing or developing mobile banking service to customers in different contexts.

This study aims at examining the factors that influence adoption of mobile banking among mobile users in United Arab Emirates (UAE); more specifically it investigates the role of technology acceptance model (TAM) and theory of planned behavior (TPB) in predicting mobile banking adoption. The paper is structured as follows: First, mobile banking literature is reviewed. Second, the context of UAE is explored. Third, research framework and hypotheses are developed. This is followed by research method and design. Research findings are presented and discussed in the subsequent sections. Finally, the paper concludes with a discussion and implications for future research.

2. Literature Review

Over the past decade, researchers have focused on internet or online banking, whereas research focusing on mobile banking is relatively insufficient and receives little attention (Puschel *et al*. 2010; Suoranta and Mattila, 2004).

Laforet and Li (2005) investigated the barriers to Chinese consumer adoption of online banking. They indicated that security was the most important factor that motivates adoption. Also, they indicated perception of risks, computer and technological skills, lack of awareness and understanding of the benefits, and Chinese traditional cash-carry banking culture as the main barriers to adoption.

Suoranta and Mattila (2004) indicated that demographics, perceived risk and attributes pertaining to innovation diffusion such as relative advantage, complexity, compatibility and trial-ability affect the adoption of mobile banking in Finland.

Ho *et al*. (20080 investigated the effects of self-service technology on customer value and customer readiness within Internet banking. Luarn and Lin (2005), Gu et.al (2009) and Zhou (2011) validated determinants of intention to use mobile banking thorough trust-based TAM model. For example, Zhou (2011) indicated that structural assurance and information quality are the main factors affecting initial trust which, in turn, affects perceived usefulness, and both factors predict the usage intention of mobile banking.

Amin *et al*. (2008) examined the factors that determine intention to use mobile banking among BIM Bank's customers. They found that perceived usefulness, perceived ease of use, perceived credibility, the amount of information on mobile banking and normative pressure are significant factors in explaining the acceptance of mobile banking. In the same vein, Koenig-Lewis *et al*. (2010) indicated that compatibility, perceived usefulness, and risk are significant indicators for the adoption of m-banking services.

Riquelme and Rios (2010) found that usefulness, social norms, and social risk are factors that influence the intention to adopt mobile banking services the most. They also indicated that ease of use and social norms have a stronger influence on female respondents than male, whereas relative advantage has a stronger effect on perception of usefulness on male respondents.

Palani and Yasodha (2012) revealed that education, gender and income play an important role in shaping customer's perceptions about mobile banking services offered by Indian Overseas Bank.

The current study provides a basis for further refinement of models through integrating constructs of technology acceptance model (TAM) and theory of planned behavior (TPB) to predict mobile banking adoption in UAE. Next, the

information communication technology in UAE is explored.

3. Background of the UAE Context

The UAE is a Middle Eastern country situated in the southeast of the Arabian Peninsula in Southeast Asia on the Persian Gulf, comprising seven emirates: Abu Dhabi, Dubai, Sharajah, Ajman, Ras al-Khaimah, Fujairah and Ummal-Quwain. The economy of UAE is largely dependent on oil and gas production. It became a highly prosperous country after foreign investment began funding the desert-and-coastal nation in 1970s. Accordingly, the UAE has witnessed a magnificent standard-of-living increase in the last three decades resulted from oil revenues. With a relatively small area (83,600 square kilometers), the population has reached 7.891 million as estimated in 2011 and the UAE's per capita gross national income is on par with those of some West European nations ($40,760 in 2011) (World Bank, 2011). To maintain the impressive growth, the UAE went for a large-scale technology transfer and adoption to be one of the most technologically sophisticated countries in the Middle East. According to Dutta amd Mia (2011), the United Arab Emirates economy has risen in the rankings in recent years, reflecting the increasingly competitive role ICT as the country ranked a high 3rd for government readiness, 5th and 21st for individual readiness and usage, respectively, 18th for ICT-friendly market environment, 28th for ICT infrastructure and 6th for the most affordable ICT services prices worldwide.

4. Research Framework and Hypotheses

Theory of planned behavior (TPB) and TAM are among models that have gained attention and confirmation in a wide array of areas and applications to understand end-user's intention to use new technology and systems (Armitage and Conner, 2001; Venkatesh and Davis, 2000). Although TPB and TAM have been widely applied to examine adoption and acceptance of IT, neither TPB nor TAM has been found to provide consistently superior explanations or predictions of behavior (Chen *et al*., 2007; Taylor and Todd, 1995; Venkatesh *et al*., 2003). This may be due to the various factors that influence technology adoption, type of technology and users and the context (Chen *et al*., 2007). Consequently, a growing body of research has focused on integrating TPB and TAM to examine technology adoption owing to the complimentary and explanatory power of the two models together (Aboelmaged, 2010; Chau and Hu, 2002; Chen *et al*., 2007; Hung *et al*., 2006; Lu *et al*., 2009; Wu and Chen, 2005). Since the focus of this study is mobile banking adoption, the integration of TPB and TAM constructs for our research model should provide strong empirical support to mobile banking adoption research and account for the technological and social factors influencing the intention to use mobile banking system.

TPB and TAM were developed as an extension to Ajzen and Fishbein's (1980) theory of reasoned action (TRA). TRA is conceived as a general structure designed to explain almost all human behavior and is based on the importance of an individual's beliefs for the prediction of his/her behavior (Fishbein and Ajzen, 1975; Ajzen and Fishbein, 1980). According to TRA, behavioral intention to exhibit a particular behavior is formed based on the individual's attitude toward the behavior and on perceived subjective norm. The first determinant, attitude toward behavior, reflects a person's beliefs that the behavior leads to certain outcomes and the person's evaluation of those outcomes, favorable or unfavourable. The more positive the attitude, the stronger the behavioral intention and, ultimately, the higher the probability of a corresponding behavior should be. Attitude toward using a particular system is a major determinant of the intention to use that system, which in turn generates the actual usage behavior. The underlying premise is that individuals make decisions rationally and systematically on the basis of the information available to them (Ajzen, 1991).

Many existing studies in the context of e-business have shown that individual's attitude directly and significantly influences behavioral intention to use a particular e-business application (George, 2002; Gribbins *et al*., 2003; Moon and Kim, 2001). For example, George (2002) found a strong positive relationship between an individual's attitude toward purchasing online and the user's behavioral intention. Gribbins *et al*. (2003) studied the acceptance of wireless technologies by users. Also, Puschel *et al*. (2010) found that attitude significantly affects intention to adopt mobile banking.

They demonstrated support for the relationship between attitudes toward using mobile commerce/ banking and behavioral intention. Thus, the following hypothesis is proposed:

H1. Attitude will positively influence mobile banking adoption.

The second determinant in TPB is subjective norm which captures individual's perceptions of the extent to which his/her social environment (e.g. family, friends, co-workers, authority figure or media) influences such a behavior to be normal and desirable. The more strongly this pressure is experienced, the greater the behavioral intention and, indirectly, the probability that the behavior will be realized. Existing research have found a significant relation between subjective norm and intention in online settings. For example, Bhattacherjee (2000) found a positive impact of subjective norm on intention to use electronic brokerages service. Venkatesh and Davis (2000) established direct link between subjective norm and intention to use in a study pooling results across four longitudinal field studies. In addition, Liao *et al*. (2007) developed an integrated model to predict individual's use of online services based on the concepts of the expectation disconfirmation model and the TPB. The findings showed that subjective norm is a strong determinant of behavioral intention towards e-service. Empirical research also suggests that subjective norm positively affect e-payment as well as internet banking adoption (Gu *et al*., 2009; Kleijnen *et al*., 2004; Lin, *et al*., 2009; Chan and Lu, 2004; Puschel *et al*., 2010). Consequently, this research proposes the following hypothesis:

H2. Perceived subjective norm will positively influence mobile banking adoption.

Ajzen (1987, 1991) and Ajzen and Madden (1986) developed the TRA further into TPB by adding new determinant of behavioral intention, perceived behavioral control, which is based on Bandura's concept of self-efficacy. Perceived behavioral control assesses the degree to which people perceive that they actually have control over enacting the behavior of interest. It is suggested that individuals are more likely to engage in behaviors they feel to have control over and are prevented from carrying out behaviors over which they feel to have no control. As a result, a person who does believe himself capable of certain behavior will exhibit correspondingly a behavioral intention to exhibit a particular behavior.

Most empirical applications of the TPB try to explain or predict newly introduced behavior (Armitage and Connor, 2001). Similarly, previous research in online technology adoption suggested perceived behavioral control as a good predictor of usage intention (Choi and Geistfeld, 2004; George, 2002; Klein and Ford, 2003). A user who does believe him/herself capable of using an e-business application will exhibit correspondingly a behavioral intention to use that application. Shim *et al*. (2001) predicted perceived behavioral control would positively impact behavioral intention of users to search online. Moreover, George (2002) suggested that perceived behavioral control has a direct effect on the user's attitude toward using the internet for online purchase. In addition, Puschel *et al*. (2010) found that behavioral control signifi-cantly affects intention to adopt mobile banking. Based on the foregoing argument, this study examines the following hypothesis:

H3. Perceived behavioral control will positively influence mobile banking adoption.

The second theoretical grounding for this research is derived from the TAM, which is initially developed by Davis (1989) and Davis *et al*. (1989) as an extension of Ajzen and Fishbein's TRA to explain and predict particularly IT usage behavior across a wide range of technologies and user populations. TAM has received much attention from researchers and practitioners as a parsimonious yet powerful model for explaining and predicting usage intention and acceptance behavior (Yi and Hwang, 2003). In contrast to TRA and TPB models, TAM focuses exclusively on the analysis of IT (Chau, 1996; Venkatesh, 2000; Mathieson *et al*., 2001; Childers *et al*., 2001; Featherman and Pavlov, 2003). However, the topics of TAM research have been varied, including the employment of personal computers in the workplace (Hamner and Qazi, 2009; Moore and Benbasat, 1991; Igbaria *et al*., 1996), internet use (Lederer *et al*., 2000); e-commerce (Pavlou, 2003); ERP acceptance (Amoako-Gyampah and Salam, 2004); telemedicine (Hu *et al*., 1999); internet banking (McKechnie *et al*., 2006). According to TAM, perceived usefulness can lead to behavioral intention. Davis (1989, p. 320) defined perceived usefulness as the degree to

which "a person believes that using the system will enhance his or her performance". This proposition is justified from the perspective that people's intentions to use the technology will be greater in spite of their attitude toward the technology alone, if they expect a technology to increase their performance on the job. Many existing studies have shown that perceived usefulness directly and significantly influences behavioral intention to use a particular online system (Chen and Ching, 2002; Chen *et al*., 2002; Heijden *et al*., 2003; Guriting and Ndubisi, 2006; Khalifa and Shen, 2008; Liao *et al*., 2007; Lin and Chang, 2011; Lin and Wang, 2005; Lai and Yang, 2009; Luarn and Lin, 2005; Nysveen *et al*., 2005; Wei *et al*., 2009). In the context of mobile business service, researchers found that perceived usefulness is a vital factor determining the adoption of mobile service since users consider its benefits (Kleijnen *et al*., 2004; Luarn and Lin, 2005; Wang et.al, 2006). Consequently, the following hypothesis is suggested:

H4. Perceived usefulness will positively influence mobile banking adoption.

In turn, attitude in TAM is influenced by a priori two key elements determining technological behavior: perceived ease of use and perceived usefulness (Davis, 1989; Igbaria *et al*., 1996). Mathieson *et al*. (2001) argued that TAM's ability to explain attitude toward using an information system is better than the other multi-attribute models' such as TRA and TPB. Venkatesh and Davis (2000, p. 186) note that "TAM consistently explains a substantial proportion of the variance [typically about 40 percent] in usage intentions and behavior and that TAM compares favourably with alternative models such as the Theory of Reasoned Action and the Theory of Planned Behaviour". According to TAM, perceived usefulness affects person's attitude toward using the system. Lai and Yang (2009) argued that employees in a performance-oriented e-business context are generally reinforced for good performance and benefits. This implies that realizing usefulness of e-business applications such as mobile banking in improving performance or efficiency will positively impact attitude toward that application. The effect of perceived usefulness on attitude has been validated in many studies including (Chen *et al*., 2002; Cheung and Liao, 2003; Curran and Meuter, 2005; Gribbins *et al*., 2003; Heijden *et al*., 2003; Kleijnen *et al*., 2004; Nysveen *et al*., 2005; Porter and Donthu, 2006; Robinson *et al*., 2005). Therefore, the following hypothesis is advised:

H5. Perceived usefulness will positively influence individual's attitude toward mobile banking adoption.

Complexity of one particular system will become the inhibitor that discourages the adoption of an innovation (Rogers, 1995). Davis (1989, p. 320) defined perceived ease of use as the degree to which "a person believes that using the system will be free of mental effort". According to TAM, perceived ease of use affects a person's attitude toward using the system. The existing studies suggest that ease of use is a major attribute of e-business applications such as internet commerce (Chen *et al*., 2002; Heijden *et al*., 2003), online banking (Guriting and Ndubisi, 2006), and mobile commerce (Lin and Wang, 2005; Luarn and Lin, 2005). Users would be concerned with the effort required to use that application and the complexity of the process involved. Such perceived ease of browsing, identifying information and performing transactions should enable favorable and compelling individual experience (Chen *et al*., 2002; Curran and Meuter, 2005; Kleijnen *et al*., 2004; Nysveen *et al*., 2005; Porter and Donthu, 2006; Robinson *et al*., 2005; Heijden *et al*., 2003). Thus, this study examines the following hypothesis:

H6. Perceived ease of use will positively influence individual's attitude toward mobile banking adoption.

TAM suggests that ease of use is thought to influence the perceived usefulness of the technology. The easier it is to use a technology, the greater the expected benefits from the technology with regard to performance enhancement. This relationship has also been validated in online technology context (Gefen and Straub, 2003; Gefen *et al*., 2003; McCloskey, 2006; McKechnie *et al*., 2006; Moon and Kim, 2001; Morosan and Jeong, 2008). Based on these arguments, we propose the following hypothesis:

H7. Perceived ease of use will positively influence perceived usefulness of mobile banking.

5. Research Method and Design

Data Collection

Since this paper aimed to examine the effects of TAM and TPB variables on the intention of mobile banking adoption, a self-administered questionnaire was used to target a convenient sample from undergraduate and postgraduate students of UAE universities in Dubai. With regard to mobile banking adoption, student sample is appropriate since several studies have confirmed that a typical internet banking user is a relatively young educated user (Cruz *et al*., 2010). Out of total 300 distributed questionnaires 188 were retuned giving a response rate of 63 per cent. After reviewing 69 responses were found to be incomplete, thus excluded from the study. This left a total number of 119 responses for final analysis (usable response rate 40 per cent). To help reduce the potential of common method bias temporal separation along with Harmon's one-factor test were provided while collecting the data for main study (Podsakoff *et al*., 2003). Since a single factor did not emerge and one-factor did not account for most of the variance, this suggested that the results were not due to common-method bias.

Sample Demographics

Table 1 lists the demographic characteristics of the sample. The gender distribution of the study subjects was 78.2 per cent males and 21.8 per cent females, respectively. Respondents above 30 years formed the largest age group (40.3 per cent). A good majority of respondents (70.6 per cent) had more than ten years of internet experience. Also, majority of respondents (76.5 percent) used at least one of mobile banking services which made a good sample as respondents are generally known to be familiar with mobile banking technology (Cho and Jung, 2005).

Measures

A two-part questionnaire was designed. The first part involves nominal scale items used to collect basic information about respondents' demographics including gender, age, internet experience and usage of mobile banking. The second part includes five-point Likert scales, ranging from (1) "strongly disagree" to (5) "strongly agree", used to operationalize the constructs included in the investigated research model; intention to use, attitude, usefulness, ease of use, subjective norm, and behavioral control. The questionnaire items were mostly adopted from relevant prior research, with necessary validation and wording changes tailored to mobile banking as shown in Table 2.

Table 1

Demographic details of respondents

	N	%		N	%
Age			***Internet Experience***		
< 20	9	7.6	< 5	12	10.1
21-25	27	22.7	6 -10	23	19.3
26-30	35	29.4	> 10	84	70.6
> 30	48	40.3	Total	119	100
Total	119	100			
Gender			***Using mobile banking***		
Male	93	78.2	User	91	76.5
Female	26	21.8	Not a User	28	23.5
Total	119	100	Total	119	100

Validity and Reliability of the Instrument

Validity of the measures should be established before testing the theory (Bagozzi *et al*., 1991).

Content validity assesses representation and comprehensiveness of scale items by examining the process by which scale items are generated. Content validity in this study should be relatively acceptable since the questionnaire was developed based on extensive review of relevant literature as shown in Table 2. Furthermore, Cooper and Schindler (2003) suggest another way to determine content validity through panel of persons to judge how well the instrument meets the standards. Thus, the researchers conducted independent interviews with two management professors to evaluate whether research covers relevant constructs. They suggested that the procedure and Arabic translation of the measures were generally appropriate, with some modifications in the translated version of the questionnaire. In addition, pre-testing the instrument through interviews enabled researchers to assess whether the instrument was capturing the desired phenomena and to verify that important factors had not been omitted (Wu and Wang, 2006).

Table 2

Measurement items

Items	Source
Attitude ATT1: Using mobile banking will save me time ATT2: Using mobile banking will be secure ATT3: Using mobile banking will save me money ATT4: Using mobile banking will be good for me	Wu and Chen (2005), Cheng *et al*. (2006) and Lai and Li (2005)
Perceived ease of use PEOU1: Learning to use mobile banking is easy PEOU2: It is easy to use mobile banking PEOU3: Overall, using mobile banking is easy	Cheng *et al*. (2006) and Curran and Meuter (2005)
Perceived usefulness PU1: mobile banking improves my work and life efficiency PU2: mobile banking allows me to easily acquire the information I need PU3: Overall, mobile banking is useful	Cheng *et al*. (2006) and Curran and Meuter (2005)
Behavioral control BC1: I am able to use mobile banking without help BC2: Using mobile banking would be entirely within my control BC3: I have the resources, knowledge, and ability to use mobile banking	Ho and Ko (2008) and Wu and Chen (2005)
Subjective norm SN1. My close friends think that I can use mobile banking SN2. My close friends think that I should use mobile banking SN3. My close friends think that I must use mobile banking	Wu and Chen (2005)
Mobile banking adoption INT1: I will adopt mobile banking as soon as possible INT2: I intend to use mobile banking in the future INT3: I will regularly use mobile banking in the future	Ho and Ko (2008) and Hsu and Chiu (2004)

Accordingly, the instrument was pre-tested on a convenience sample of nine MBA students to estimate the time required to fill the survey and to identify confusing wording. Some items were reworded and some instructions were re-written for clarity. Construct validity was assessed by both convergent and discriminant validity using confirmatory factor analytic techniques.

Convergent validity is the degree to which multiple attempts to measure the same concept are in agreement, while discriminant validity is the degree to which measures of different concepts are distinct. Factor analysis not only establishes the construct validity but also uncovers the underlying dimensions. The value for Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.808 justifying the applicability of factor analysis on the sample. Along with this the large value of Bartlett's test of sphericity suggesting factor analysis applicability as the null hypothesis that the variables with each dimension are uncorrelated in the population is rejected. Results of confirmatory factor analysis in Table 3 present values of standardized Cronbach alphas, eigenvalues, variances, and cumulative variances explained by each construct. Results indicated that a priori assumptions were substantiated with a six-factor solution. In general convergent and discriminant validity are considered to be satisfactory when measurement items load high on their respective constructs and low on other constructs. All the items had a loading of 0.541 or greater on their respective constructs and relatively low loadings (0.30 or lower) on other constructs.

Table 3

Results of principle component analysis and reliability

	1	**2**	**3**	**4**	**5**	**6**
PEOU 1	.790					
PEOU 2	.854					
PEOU 3	.796					
PU1		.618				
PU2		.621				
PU3		.665				
ATT1			.674			
ATT2			.708			
ATT3			.623			
ATT4			.541			
INT1				.741		
INT2				.629		
INT3				.721		
BC1					.865	
BC2					.660	
BC3					.517	
SN1						.714
SN2						.670
SN3						.768
Eigenvalue	6.36	2.92	1.61	1.27	1.19	1.07
Variance explained	30.18	10.08	8.46	6.65	5.76	3.27
Cronbach's alpha	0.79	0.82	0.81	0.76	0.93	0.78

Notes: a Total Variance Extracted 64.42%; Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy = 0.808; Bartlett's Test < 0.001; Extraction Method: Principal Component Analysis; Rotation Method: Varimax with Kaiser Normalization

Hair *et al*. (1998) suggest that item loading greater than 0.30 are considered significant, greater than 0.40 are more important and greater than 0.50 are considered very significant. To ensure internal consistency among the items included in each of the scales, Cronbach's coefficient alpha is estimated. The resulting alpha values for research factors were ranged from 0.76 to 0.93, which indicates adequate internal consistency associated with all measures according to Nunnally and Bernstein's (1994) guidelines. Based on the examination of the research scales and constructs, we conclude that each variable represents a reliable and valid construct.

6. Research Findings

Table 4 presents the correlations between constructs. The correlations are ranged from 0.21 to 0.58; with no pair of measures exceeding the value of 0.60. This suggests no sever multicollinearity problems among research variables (Hair *et al*., 1998). The table also indicates a preliminary support for the significant relationships between mobile banking adoption and other research variables. Table 5 shows the results of regression analysis and hypothesis testing. The results indicates a significant positive influence of two variables pertaining to attitude toward mobile banking ($\beta = 0.35$, $p < 0.001$) and subjective norm ($\beta = 0.27$, $p < 0.01$) on mobile banking adoption. These results donate support for hypotheses H_1 and H_2. Surprisingly, the effects of behavioral control ($\beta = 0.12$, n.a.) and usefulness ($\beta = 0.07$, n.a.) on mobile banking adoption are not significant. Thus, hypotheses H_3 and H_4 are not supported.

Furthermore, the regression results indicate a significant impact of perceived usefulness on attitude toward mobile banking ($\beta = 0.58$, $p< 0.001$) which donate a support for hypothesis H_5. However, the effect of perceived ease of use on attitude toward mobile banking is not supported ($\beta = 0.014$, n.a.). Thus, hypothesis H_6 is rejected. Finally, the results support hypothesis H_7 which is donated to a positive and significant effect of perceived ease of use on perceived usefulness ($\beta = 0.59$, $p < 0.001$).

7. Discussion

The intent of this paper is to extend our understanding regarding the adoption of mobile banking using TAM and TPB models. Analyzing survey data from 119 respondents yielded important findings. The results partially support research hypotheses. However, the overall explanatory power of our research model was relatively low with an ΔR^2 of 36 per cent for mobile banking adoption. This is relatively low percentage when compared with previous studies in technology adoption. Several insightful results could be summarized from our research framework.

Table 4

Results of correlations

			Correlations*					
	Mean	**SD**	**1**	**2**	**3**	**4**	**5**	**6**
1- Mobile banking adoption	3.88	0.737	1	0.525	0.433	0.304	0.478	0.322
2- Attitude	3.64	0.593	0.525	1	0.589	0.210	0.402	0.354
3- Perceived usefulness	3.71	0.683	0.433	0.589	1	0.349	0.424	0.580
4- Behavioral control	3.66	0.567	0.304	0.210	0.349	1	0.334	0.334
5- Subjective norm	3.56	0.715	0.478	0.402	0.424	0.334	1	0.321
6- Perceived ease of use	3.72	0.694	0.322	0.354	0.585	0.334	0.321	1

* All correlations are significant at $p < 0.05$ (2-tailed)

Table 5

Results of regression analysis

Criterion (DV)	Predictor (IV)	Hypothesis	ΔR^2	Statistic Test			Results
				t	Sig.	*Beta*	
Mobile banking adoption	Attitude	H_1	0.36	3.754**	0.000	0.351	Supported
	Subjective norm	H_2		3.137*	0.002	0.268	Supported
	Behavioral control	H_3		1.427	0.156	0.115	Rejected
	Perceived usefulness	H_4		0.743	0.459	0.072	Rejected
Attitude	Perceived usefulness	H_5	0.34	6.279**	0.000	0.581	Supported
	Perceived ease of use	H_6		0.151	0.880	0.014	Rejected
Perceived usefulness	Perceived ease of use	H_7	0.34	7.802**	0.000	0.585	Supported

*$p<0.01$; **$p < 0.001$

Both attitude and subjective norm are positively and significantly impact mobile banking adoption. Nevertheless, the hypothesized relationships that behavioral control and usefulness positively and significantly influence mobile banking are not confirmed. Comparing path coefficients of antecedents of mobile banking adoption, attitude emerges as the most powerful predictor ($\beta = 0.35$, $p < 0.001$) of mobile banking adoption relative to the other factors. This singles out the importance of developing and managing user's attitude to ensure successful implementation of mobile banking services. Even though this finding is inconsistent with previous research (Chau and Hu, 2002; Davis *et al*., 1989; Heijden, 2003), it is similar to those of Chapman (2000), Davis (1993) and Wu and Chen (2005). Furthermore, this study confirms Davis *et al*.'s (1989) implication that attitude is a determinant of behavior intention in post -implementation stage since majority of respondents are using at least one of mobile banking services which positively influences user awareness of mobile banking.

Similarly, perceived subjective norm appeared to be the second most important determinant of Mobile banking adoption ($\beta = 0.27$, $p < 0.01$). The result is similar to the finding reported by Bhattacherjee (2000) and Karahanna *et al*. (1999), but differs from those of Taylor and Todd (1995) and Chau and Hu (2002). It also contradicts the implication that subjective norm could significantly determine intention to use in a mandatory-usage context, but its impact would become less significant while users are in a voluntary-usage context (Davis *et al*., 1989; Mathieson, 1991; Venkatesh and Davis, 2000) since mobile banking adoption still follows the voluntary form.

With regard to the role of perceived usefulness, the results indicated no significant impact of perceived usefulness on mobile banking adoption, though it significantly impact attitudes toward mobile banking adoption. This contradicts results of previous research such Taylor and Todd

(1995), which indicated that perceived usefulness has both indirect, via attitude, and direct influences on behavioral intentions toward system use. Also, the research results contradict findings of Chan and Lu (2004), Davis (1993), Davis *et al*. (1989), Pikkarainen (2004) and Taylor and Todd (1995), which indicated that perceived usefulness has a significant direct influence on intention toward system use. This finding reflects the pragmatic-free dimension in mobile banking adoption decision which based on subjective and social acceptance rather than being useful and beneficial.

In addition, behavioral control reflects people's perception of ease or difficulty in performing the behavior of interest (Ajzen, 1991). User's behavioral control in this study appeared to have

insignificant effect on the mobile banking adoption. Although this finding challenges Taylor and Todd's (1995) and Mathieson's (1991) recognition of perceived behavioral control as an important determinant of behavioral intention, it confirms Ajzen and Madden's (1986) claim that perceived behavioral control is less likely to be related to intention.

Finally, perceived ease of use has unexpectedly emerged in this study as an insignificant predictor of attitude (β = 0.014, n.a.), however it predicts perceived usefulness (β = 0.59, $p < 0.001$). This finding is inconsistent with the results by Kim *et al*. (2008), Lee (2009), Moon and Kim (2001), Wu and Chen (2005) and Yu *et al*. (2005) which showed ease of use had direct effect on perceived usefulness and attitude toward use. Yet, this finding confirms prior research that considers perceived ease of use as a basic requirement for system design and should not have an influence on attitude in the later stages of adoption (Agarwal and Prasad, 1998; Chau and Hu, 2002; Davis *et al*., 1989; Karahanna *et al*., 1999). A plausible explanation for this finding could be due to respondents' familiarity with mobile phones that may increase their expectancies of service usefulness rather than influencing their attitudes toward the service. This extends the implication that ease of use becomes a significant predictor of both attitude and usefulness when users are not familiar with the system (Agarwal and Prasad, 1999; Liaw, 2002).

8. Conclusions and Future Research

This study aimed to extend our understanding regarding the adoption of mobile banking through integrating TAM and TPB models. Analyzing survey data from 119 respondents yielded important findings that partially support research hypotheses. This study has been operationalized thoroughly according to the generally accepted research guidelines. However, it is important to bear in mind some of its limitations when interpreting its findings.

First, the results show that the proposed model has low explanatory power. This could be especially valuable for researchers to include more variables beyond TAM and TPB when predicting mobile banking adoption. In addition, some possible moderating effects are not presented in the research model. Therefore, future studies should extend the TAM and TPB models by adding important factors toward actual use such as organizational-related factors (e.g. bank type and customer service) or user-specific constructs (e.g. innovativeness and expressiveness) to increase the model's predictive power in the mobile banking context.

Second, as with any research, care should be taken when generalizing the results of this study. Selection bias could be a problem because only students were used in the data collection process. Therefore, future studies may ensure data collection from different users' background and experience. This will remedy the bias and help researchers to better understand mobile banking adoption.

Third, findings of this research are based on snapshot survey data that reduce the ability to reflect the changes in the research constructs, particularly when mobile banking services and experiences increase. Thus, future research may consider qualitative approaches including grounding theory or case study research to gain in-depth understanding of factors that influence mobile banking adoption. Besides, using a longitudinal study in future research will provide more comparative insights into mobile banking adoption at different time periods. Finally, future research may consider the adoption of mobile banking by both governmental and private banks and draws differences in adoption rate, mode and type of services.

In summary, the study proposes a model that helps to conceptualize mobile banking adoption through the integration of TAM and TPB models. The findings of this study have important implications for researchers and bank managers in today's dynamic environment.

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