A Study of Mobile and Internet Banking Service: Applying for IS Success Model

Chulmo Koo*, Yulia Wati**, Namho Chung***

   Understanding success factors in electronic banking is important to helping banks succeed. In this study, we extend DeLone and McLean's IS success model to the electronic banking by adding trust as a success variable. We tested the extended model by comparing internet banking and mobile banking in Indonesia. Using a structural equation modelling approach. We found that system quality had positive impacts on perceived usefulness and end-user satisfaction for both internet banking and mobile banking. The development of e-banking (internet banking and mobile banking) in Indonesia is in its initial stage. Finally, although we tested for the common method bias to relieve concern, further research may use multiple methods when collecting the data. This study investigated the role of each dimension of IS success in the electronic banking environment. While the original IS success model emphasizes individual and organizational impacts, we have argued that trust is an important indicator of IS impact on an individual socially in the banking industry. The contribution of our study is two-fold. Conceptually, the study is the first to extend the IS success model to the e-banking context. We provide an extension of the updated IS success model by adding trust as an outcome variable in the research model.

Keywords : IS Usage, Internet Banking, Mobile Banking, IS Success Model, Indonesia

―――――――――――――――――

*   Assistant Professor of Convention Business Department College of Hotel and Tourism Management, Kyung Hee University
**   Sam M. Walton College of Business University of Arkansas Fayetteville, Arkansas, U.S.
*** Corresponding Author, Associate Professor, College of Hotel and Tourism Management, Kyung Hee University

Ⅰ. Introduction

Banking industries have increasingly relied on innovative electronic banking (e-banking) technologies to enhance business operations and competitive advantages [Meuter *et al.*, 2000; Sundarraj and Wu, 2005]. The development of e-banking has stimulated the banking and financial industry towards the development of close customer relationships by means of improved customer services and products [Liao *et al.*, 1999; Yiu *et al.*, 2007]. Smart banking is a further development of e-banking technology. It enables users to access an account balance, pay bills, and transfer funds through cell phones and other mobile devices, instead of visiting the physical bank office or using a computer for internet banking [Gu *et al.*, 2009; Tiwari and Buse, 2007].

Previous studies have shown considerable interest in e-banking, and there are many studies examining different forms of e-banking technologies in various countries. However, several gaps exist in the current research. First, although most studies are focused on e-banking adoption [Shih and Fang, 2006], there is a lack of research going beyond the initial adoption and focus on post-adoption issues. A second gap in the literature could be described as the need for study of the factors leading to adoption and use. Some researchers have analyzed factors such as quality [Floh and Treiblmaier, 2006], and trust [e.g., Floh and Treiblmaier, 2006; Gu *et al.*, 2009; Jayawardhena, 2004; Kassim and Abdula, 2006; Vatanasombut *et al.*, 2008; Yousafzai *et al.*, 2003], based on some well-established theories and models. Yet, limited research has provided a unified nomological view of the success factors of e-banking, which may provide new insights for practitioners to plan and implement e-banking in different situations. Third, a majority of these studies have investigated de-veloped countries which have very advanced Information Technology (IT) infrastructures [e.g., Gu *et al.*, 2009; Ho and Ko, 2008; Kim *et al.*, 2009; Lee, 2009; Liao and Cheung, 2008; Luarn and Lin, 2005; Yiu *et al.*, 2007]. However, limited empirical evidence from developing countries is available. Lastly, prior studies focus on one type of e-banking technology such as internet banking [e.g., Lee, 2009; Liao and Cheung, 2002; Ndubisi, 2007]. Few studies have reported the examination of more than one technology in the validation of the research model and hypotheses.

The primary objective of this study is to identify success factors for e-banking using a research model developed from DeLone and McLean's Information System success model [DeLone and McLean, 1992, 2003]. To our best knowledge, little study has examined the IS success model in an e-banking context. The second objective is to explore and test this model in Indonesia. The lack of interest in IT development in Indonesia [Jardine, 2009] led us to choose this country as our research context. The research question of this study is "Can we validate DeLone and McLean IS success factors using an e-banking context in the Indonesian environment?".

The contribution of our study is two-fold. Conceptually, the study is the first to extend the IS success model to the e-banking context. We provide an extension of the updated IS success model [DeLone and McLean, 2003] by adding trust as an outcome variable in the research model.

Ⅱ. Background

2.1 The DeLone and McLean Model for IS Success

The measurement of information systems' suc-

cess is crucial for understanding the value and efficacy of IS management and IS investment. Therefore, DeLone and McLean [1992] proposed an integrative model for conceptualizing and operationalizing IS success factors, through a synthesis of previous research which studied IS success [DeLone and McLean 2003]. The model is refered to as the DeLone and McLean IS Success Model.

Because IS success is a multi-dimensional concept, the measure of IS success has neither been totally clear or defined. The first version of the DeLone and McLean success model <Figure 1> assumes that system quality and information quality, individually and jointly, affect user sat-

isfaction and use, which then influence individuals and the organization [DeLone and McLean 1992]. System quality refers to the performance of IS in term of reliability, convenience, ease of use, functionality, and other system metrics. Information quality is described as characteristics of the output offered by the IS, such as accuracy, timeliness, and completeness. User satisfaction is related to the approval or likeability of an IS or its output and information. Use refers to the recipient's consumption of the output of an information system. Individual impact refers to the effect of information on the behavior of the recipient, while organizational impact refers to the effect of information on organizational perform-
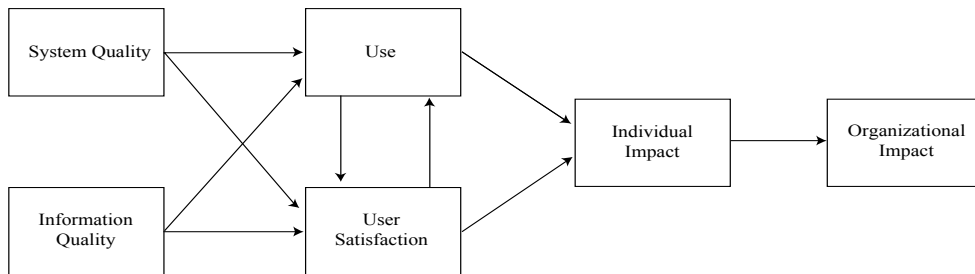
<Figure 1> DeLone and McLean's IS Success Model [1992]
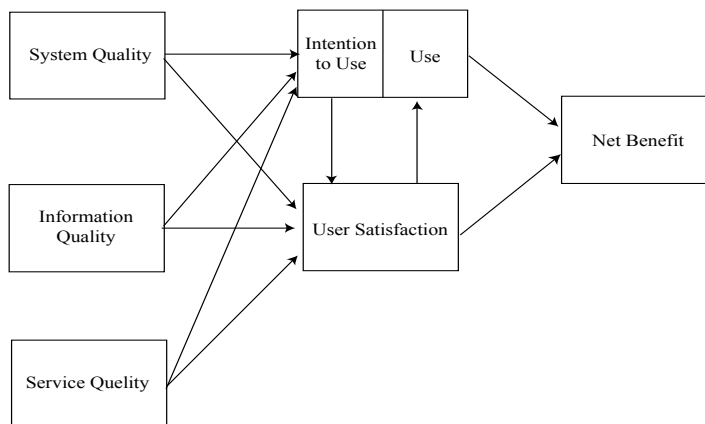
<Figure 2> DeLone and McLean's Update IS Success Model [2003]

ance [DeLone and McLean 1992, 2003].

The multidimensional and interdependent nature of IS success factors require careful examination of the definition and measurement of each aspect of the independent variables in the model. Responding to many arguments about the first model, DeLone and McLean [2003] proposed an update model <Figure 2>.

2.2 The Applicability of the IS Success Model for an e-banking Context

Banking is an information intensive business [Shih and Fang, 2006]. From the customer's perspective, banking channels should provide superior value to customers [Stamoulis et al., 2002]. From the Information Technology perspective, quality characteristics of electronic banking should have a definite impact on the business value of the bank [Stamoulis et al., 2002]. Moreover, e-banking channels are the essential interface between the bank and its customers [Stamoulis et al., 2002]. Using these online channels, customers transact with the bank's computer network electronically [Jayawardhena, 2004]. Thus, examining the quality of the online system, the quality of the information provided by the system, the customer's use of the system, as well as the impact of using the system on the customer's trust, are all necessary for the success of the e-banking practice. By using the IS success model as our theoretical framework and integrating trust in the model, this study may provide an integrated understanding of e-banking success.

In the DeLone and McLean IS success model, both independent variables (system quality, information quality, and service quality) and inter-

mediating variables (use and end-user satisfaction) can be a good starting point when considering the core constructs for measuring e-banking success. Regarding the independent variables, a meta-analysis found that the majority of the hypotheses implied by the updated DeLone and McLean models were supported [Petter and McLean, 2009]. However, the hypotheses associated with service quality were not supported. Therefore, we do not include service quality in our model. In the e-banking context, the success of this industry depends on customers' perception of trust toward the electronic system [Benemati and Serva, 2004]. The key success in electronic banking is the establishment of trusted transaction processes where the sellers create an environment in which a prospective consumer can be relaxed and confident about any prospective transaction [Graboski, 2001]. Therefore, trust reduces customers' transaction specific uncertainly associated with the possibility that a bank might behave opportunistically [Yousafzai et al., 2003]. As in e-banking environment, the consumers interact with the system instead of human agents; we conceptualized trust in this study as a trust toward electronic banking system from institutional perspective.

Ⅲ. Research Model and Hypotheses

Based on DeLone and McLean's IS Success Model [1992, 2003], we develop our research model to extend the IS success model to the e-banking context (shown in <Figures 3>) in order to address those gaps found in our literature review. In the following, we develop corresponding research hypotheses.

1. Internet Banking
2. Mobile Banking
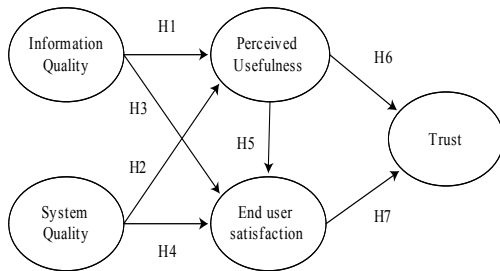
<Figure 3> e-banking Success Model

System quality refers to the performance of IS in terms of reliability, convenience, ease of use, functionality, and other system metrics. Information quality refers to characteristics of the output offered by the IS, such as accuracy, timeliness, and completeness [DeLone and McLean, 2003]. Seddon [1997] defined perceived usefulness as the degree to which the stakeholder believes that using a particular system has enhanced his or her job performance, or his or her group's or organization's performance. The perception of system quality is used as an antecedent for perceived usefulness, and provides a subjective measurement of usability for the information system [e.g., DeLone and McLean, 1992; Lin and Lu, 2000]. In the end-user computing environment, users assume more responsibility for their own applications in order to enter information or prepare output reports [Jun and Chai, 2001].

With the advance of technology in the banking environment, and a wider range of choices in selecting financial products or services than ever before, the quality aspect of banking products has become a driving force in determining customers' perception. Online system quality attributes such as content, accuracy, ease of use, and timeliness have been reported as important is-

sues when users perform online banking transactions [Jun and Chai, 2001]. In addition, Liao and Cheung [2001] noted that system capabilities had a positive impact on the perceived usefulness of a website. Lin and Lu [2000] also argued that the quality of the information system, as measured by information quality, response time and system accessibility, was able to elicit usage on the website. These relationships were also presented and supported by Seddon [1997] in an extension of the IS success model. Thus, we hypothesize:

> H1: Information quality has a positive impact on perceived usefulness.
> H2: System quality has a positive impact on perceived usefulness.

Customer satisfaction is one of the major consequences of quality [Fassnacht and Kose, 2007]. According to Jun and Cai [2001], the attributes of online system quality and product quality have been the main sources of user satisfaction. If the system does not perform well, customers are not able to conduct reliable financial transactions or access useful information. This may lead to a negative impact on their perception of the system [Rod et al., 2009]. Customers' satisfaction will increase if they can interact with the bank through a convenient online system, with a minimum level of transaction errors. In sum, the more positive customers' perception toward e-banking quality, the better their overall satisfaction level with the bank [Rod et al., 2009].

Similarly, Spreng et al. [1996] proposed that when customers compare their perceptions of the product or service performance with their desires and expectations, feelings of satisfaction increase.

This process involves feeling satisfaction about the information (information satisfaction) [Lee *et al.*, 2009]. Following the DeLone and McLean [1992, 2003] model, satisfaction is determined by both information and system quality [Livari, 2005].

> H3: *Information quality has a positive impact on end-user satisfaction.*
> H4: *System quality has a positive impact on end-user satisfaction.*

Use and user satisfaction are closely interrelated [Wang and Liao, 2008]. DeLone and McLean [2003] noted that positive experience with use will lead to greater user satisfaction. This argument suggests that use precedes user satisfaction. Usefulness shows that a user's perception about the potential benefits of using a technology leads to a positive effect towards the technology [Davis, 1989; Davis *et al.*, 1992]. In the case of users interacting with organizational systems, the empirical evidence supports the relationship between usefulness and user satisfaction in information systems research [Lai *et al.*, 2009; Seddon, 1997]. Similarly, a previous study by Bhattacherjee [2001] found that perceived usefulness predicts satisfaction in the post-adoption context. Usability has been shown to be a key factor in virtual environments, as well as a driver of users' satisfaction [Flavian *et al.*, 2006]. Hence, we hypothesize:

> H5: *Perceived usefulness has a positive impact on end-user satisfaction.*

Trust is one of the most effective tools for reducing uncertainly and risk. Krauter and Faullant [2008] noted that characteristics of e-banking web-sites and the underlying technology infrastructure are salient factors that affect trust. Gefen *et al.* [2003] integrated customer trust in the context of online shopping and found a significant relationship between perceived usefulness and trust. Kaufaris and Sosa [2003] indicated that perceived website usefulness is a significant antecedent of initial trust. The study of e-commerce by Suh and Han [2002] indicated that perceived usefulness has a direct impact on trust. Further, Kim *et al.* [2009] confirmed that the value of mobility improves customers' sense of perceived usefulness in the mobile banking context, and results in a higher trust level.

It has been argued that usage of a computer system favours more complete learning and a greater capacity to infer how the system will act [Flavian *et al.*, 2006]. Thus, usability may increase the customers' trust level. Greater usability results in better comprehension of the contents and tasks that the customer must realize to achieve an objective. This reduces the error possibility and increases trust [Flavian *et al.*, 2006]. Hence, we hyphotesize:

> H6: *Perceived usefulness has a positive impact on trust.*

A customer makes many technology decisions almost solely on the basis of trust [Benemati and Serva, 2007; Urban *et al.*, 2000]. In the online environment, Kaufaris and Sosa [2004] argued that perceived benefit (such as satisfaction) may contribute to the development of trust. Electronic banking brings great benefits to customer, including time and cost savings, no limitation on time and place, and provision of more services. All of these benefits enhance the perceptions of

the banking customer, and may lead to improved performance [Suh and Han, 2002]. This performance is characterized by increased satisfaction, and in the long term, increased trust. Similarly, the study by Rexha *et al.* [2003] found that the cumulative effects of user satisfaction had a positive impact on trust directed towards the bank. When a customer enters the online environment, their trust level should be greater when satisfaction regarding products or services given to the customer is greater. As a result, increasing customer trust is a consequence of improving customer satisfaction levels.

H7: End-user satisfaction has a positive impact on trust.

Ⅳ. Research Methodology

4.1 Indonesia and Its e-banking Development

In order to test the research model, we conducted an empirical study in Indonesia. Indonesia is the fourth most populous country in the world, with approximately 225.6 million people [US Department of State, 2008]. Economic and socio-cultural disparities, including considerable poverty, are often observed and reported in Indonesia's

vast geographical territory [Wahid *et al.*, 2004]. The economy of Indonesia is largely market-based, but the government plays a significant role. A brief demographic and economic snapshot of Indonesia can be seen in <Table 1> below.

The internet was first introduced in Indonesia in 1994 through an academic institution. Since then, the internet in Indonesia has grown at a very fast pace [Boerhanuddin, 2002]. While the huge population is a potential market for internet and e-commerce business, penetration in this country is small and unpredictable. Only about 14% of Indonesians have internet access currently [Boerhanuddin, 2002].

The research indicated that only 42% of those Indonesians with internet access have ever made purchases through the internet [Business Monitor, 2009]. A summary of Indonesian IT conditions can be seen in <Table 2> below.

Indonesia currently has 128 commercial banks, of which 11 are majority foreign-owned, and 17 are foreign joint-ventures. The top 15 banks control about 70% of assets in the sector [US department of state, 2008]. Significant growth in electronic banking transactions has been reported by Bank Central Asia [2006], the biggest private bank in Indonesia. According to the annual report of Bank Central Asia [2006] <Table 3>, ATM's transaction value, internet banking, and

<Table 1> Common Information of Indonesia

Data	Year	Latest Data
Gross Domestic Product (Current US$) Billions	2006	432.8
GNI per capita, Atlas method (current US$)	2007	1650
Life expectancy at birth, total (years)	2006	68
Population, total (millions)	2007	225.6
Population growth (annual %)	2007	1.2

Source: World Bank, 2009.

<Table 2> Statistics of Indonesian Information Technology

Information Technology	Year	Latest Data
Fixed line and mobile phone subscribers (per 100 people)	2007	44
Households with televisions (%)	2005	65
Internet user (per 100 people)	2007	6
Mobile phone subscribers (per 100%)	2007	36
Information and communication technology expenditure (% of GDP)	2007	4

Source: World Bank, 2009.

<Table 3> Increased Usage of Electronic Banking Channel

	Number of Transaction (Million)			Transaction Value (Rp trillion)		
	ATM	IB	MB	ATM	IB	MB
Sep-04	324.2	10.7	6.7	243.6	36.6	4.5
Sep-05	372.9	26.5	11.7	329.9	112.9	8.7
Sep-06	461.1	37.1	19	409.6	219.5	16.3

Source: Bank Central Asia, 2006.

mobile banking increased by 24.2%, 94.4%, and 87.4% respectively.

Indonesia has devoted only a small percentage of its Gross Domestic Product to ICT implementation, and has a low score for the Network Readiness Index (NRI) and E-Readiness Index (ERI) [Business Monitor International, 2009]. The banking sector is expected to be the largest buyer of IT products and services in Indonesia [Business Monitor International, 2009]. This phenomenon represents the importance of information technology in the banking industry [Shih and Fang, 2006], yet there is currently no empirical research examining this issue in Indonesia.

4.2 Data Collection

Our research used survey methodology in the empirical study. We collected data from bank cus-tomers in Indonesia during January-February 2009. Questionnaires (see the following section about measures) were distributed to students from the computer science department of one private university in Indonesia. University professional staff also received the survey, as well as professional workers outside the university. For student respondents, the questionnaires were distributed during class sessions with the instructor or lecturer's assistance. Individuals were informed that participation in this survey was anonymous and voluntary. Two hundred questionnaires were distributed and one hundred questionnaires were returned. In addition, we posted the questionnaire on a website and invited the respondents to visit the website to fill out the survey. In order to avoid multiple responses, we checked the IP address of respondents. One hundred individuals were invited and forty-one finished the survey. In total,

there were one hundred and forty-one completed surveys collected from the conventional survey and the web survey.

The questions were prepared in English. To reduce the ambiguity of the instruments, the questionnaire was translated into Indonesian and back into English. The questionnaire consisted of three sections: respondent demographics, internet banking questions, and mobile banking questions.

In the introduction to the survey, participants were asked to respond and evaluate the e-banking of Bank Central Asia (BCA). A pilot test was first conducted to assess the validity and reliability of the questionnaire. For this pre-test, approximately twenty questionnaires were distributed to teaching assistants. Additional advice from a consulting MIS professor was also considered. Our sample totaled 141 effective responses (48%). Among the respondents, the number of respondents who had experience with either internet banking or mobile banking were 41 (29.1%) and 29 (20.6%) respectively; another 71 respondents (50.4%) had experience in using both internet banking and mobile banking. Thus, for data analysis of internet banking, we had 112 cases in the sample, and 100 cases in the sample for mobile banking.

4.3 Measures

To ensure the validity of the scale used, item selected for the constructs were adopted from prior studies. Questions about information quality and system quality were adopted from DeLone and McLean [1992, 2003], and Wixom and Todd [2005], with minor revisions to meet our study context. Specifically, information quality was measured by dimensions of complete-ness, accuracy, format, currency, and reliability. System quality was measured by flexibility, integration, accessibility, and timeliness (DeLone and McLean 2003; Wixom and Todd 2005). To measure the end-user satisfaction construct, we used three items that asked users about their satisfaction with using e-banking. The perceived usefulness item scale was adopted from Chau and Lai [2003]. Trust was measured using the scale from Gefen and Straub [2003], with minor revisions aligned to our research need. To maintain overall consistency, all variables were measured using seven-point Likert scales, with anchors ranging from 'strongly disagree' to 'strongly agree.' The items used in this study are listed in <Appendix A>.

4.4 Sample Characteristics

<Table 5> shows the descriptive statistics for demographics of the participants. Of a total 141 responses, 83 (58.9%) were male, and 58 (41.1%) were female. Almost all respondents were from eighteen to twenty-four years old (82.3%). More than half of the respondents were university students (87.2%), while 12.8% of respondents were university graduates. In order to enhance our analysis, we included several questions on our questionnaire asking about respondents' concerns when using e-banking (internet banking and mobile banking). The results suggest that security (26.5%), privacy (25.6%), and lack of trust (21.4%) were the main concerns. Furthermore, around 26 respondents (28.9%) of mobile banking users suggested that security concerns should be considered thoroughly, followed by the availability of other alternatives (21.1%), and lack of trust (18.9%).

<Table 4> Demographic Respondents

Measure	Items	Indonesia	
		Freq	%
Number of User	Internet Banking and Mobile Banking	71	50.4%
	Internet Banking only	41	29.1%
	Mobile Banking only	29	20.6%
Gender	Male	83	58.9%
	Female	58	41.1%
Age	18~24	116	82.3%
	25~31	22	15.6%
	32~38	1	0.7%
	39~44	1	0.7%
	> 44	1	0.7%
Education	Graduate or similar	18	12.8%
	University or similar	123	87.2%
	High school	0	0.0%
	Others	0	0.0%
Usage time of e-banking (in 1 week)	1~3	74	52.5%
	4~6	39	27.7%
	7~9	8	5.7%
	> 9	20	14.2%
Reason to be considered when using	**IB**		
	Lack of Trust	25	21.4%
	Privacy Concern	30	25.6%
	Security Concern	31	26.5%
	Other Alternatives	19	16.2%
	Difficult to use	12	10.3%
	MB		
	Lack of Trust	17	18.9%
	Privacy Concern	13	14.4%
	Security Concern	26	28.9%
	Other Alternatives	19	21.1%
	Difficult to use	15	16.7%

Ⅴ. Analyses and Results

LISREL 8.8 was used to validate the measures and test the research hypotheses. Following a typical structural equation modeling (SEM) approach, we first examined the measurement model, and then tested the structural model.

5.1 Reliability and Validity of Measurement Items

Confirmatory factor analysis (CFA) was applied to assess the measurement model and establish the convergent and discriminant validity of the constructs. Each item was modeled as a reflective indicator of its latent construct. Model estimation was done using a maximum likelihood model with covariance matrix as input.

All factor loadings were greater than the recommended 0.5 cut-off, and were statistically significant [Nunnally and Bernstein, 1994] (see <Table 5>). For the measurement model to have a sufficiently good model fit, we adopted the commonly accepted criteria [Chau and Hu, 2001]. The second order constructs (for information and system quality) were treated as first order factors, measured by the composite scores of first order factors.

The internal validity of the measurement model was examined by calculating the composite reliability (CR) and average variance extracted (AVE) [Fornell and Larcker, 1981]. All the composite reliability scores were well above the recommended value 0.7 [Nunnaly and Bernstein, 1994] (see <Table 6>). The AVE represents the amount of variance captured by the construct's measure relative to measurement error and the correlations among the latent variable. In this study, the AVE value of each measure extracted more than or equal to 50% of variance, reflecting an adequate internal validity [Fornell and Larcker, 1981].

<Table 5> Fit Indices for Measurement of Internet Banking and Mobile Banking

Model	X^2	Df	X^2/df	GFI	AGFI	RMSEA	NFI
Recommended value			< = 3	> 0.90	> 0.80	< 0.08	> 0.90
Internet Banking							
2nd order Information Quality	42.98	29	1.48	0.93	0.86	0.06	0.94
2nd order System Quality	8.84	16	0.50	0.98	0.96	0.00	0.99
Full CFA Model	193.46	136	1.42	0.94	0.84	0.06	0.95
Mobile Banking							
2nd order Information Quality	35.70	27	1.32	0.93	0.86	0.05	0.96
2nd order System Quality	25.16	15	1.67	0.94	0.86	0.06	0.96
Full CFA Model	206.92	128	1.61	0.90	0.81	0.06	0.92

<Table 6> CFA Results of e-banking

Variable	Items	Internet Banking			Mobile Banking		
		Loading	CR	AVE	Loading	CR	AVE
Information Quality	CP	0.73	0.87	0.58	0.68	0.91	0.68
	AC	0.78			0.84		
	FT	0.81			0.89		
	CR	0.73			0.90		
	RL	0.72			0.81		
System Quality	FX	0.82	0.90	0.69	0.85	0.88	0.65
	IT	0.81			0.72		
	AS	0.82			0.83		
	TL	0.86			0.82		
End-user Satisfaction	US1	0.93	0.84	0.64	0.95	0.93	0.82
	US2	0.73			0.90		
	US3	0.73			0.85		
Perceived usefulness	PU1	0.86	0.92	0.73	0.89	0.95	0.81
	PU2	0.87			0.89		
	PU3	0.85			0.91		
	PU4	0.83			0.92		
Trust	TR1	0.84	0.90	0.76	0.77	0.89	+0.73
	TR2	0.91			0.93		
	TR3	0.86			0.86		

Finally, the discriminant validity of the scale was assessed using the guideline recommended by Fornell and Larcker [1981], where the square root of the AVE from the construct should be greater than the correlation shared between the construct and other constructs in the model.

<Table 7> and <Table 8> below provide the correlation among the constructs with the square root of the AVE on the diagonal. All the diagonal values exceed the inter-construct correlations; hence, the test of discriminant validity was acceptable. Therefore we conclude that the scales should have sufficient construct validity.

<Table 7> Correlation Matrix and AVE of Internet Banking

Construct	Construct				
	IQ	SQ	EUS	PU	TR
IQ	**0.76**				
SQ	0.75	**0.83**			
EUS	0.62	0.63	**0.80**		
PU	0.62	0.65	0.53	**0.85**	
TR	0.70	0.63	0.69	0.56	**0.87**

Note) Diagonal elements are the square root of the average variance extracted (AVE). Off-diagonal elements are the correlations among constructs.

<Table 8> Correlation Matrix and AVE of Mobile Banking

Construct	Construct				
	IQ	SQ	EUS	PU	TR
IQ	**0.83**				
SQ	0.76	**0.81**			
EUS	0.68	0.71	**0.90**		
PU	0.57	0.71	0.73	**0.90**	
TR	0.71	0.68	0.76	0.71	**0.86**

One potential methodological issue in interpreting survey results is common method bias [Podsakoff *et al.*, 2003]. We investigated the common method bias by employing Harman's one factor test [Podsakoff *et al.*, 2003]. Evidence for common method bias exists when a general construct accounts for the majority of the covariance among the constructs. In this analysis, each prin-

cipal construct explained roughly equal variance (range from 18.8-12.4% for internet banking and 24.0-13.1% for mobile banking), indicating no substantial common method bias. Also, the correlation matrix showed that none of the correlation coefficients were above the 0.9 level [Liang *et al.*, 2007]. Therefore, we conclude that common method bias was not present in the current study.
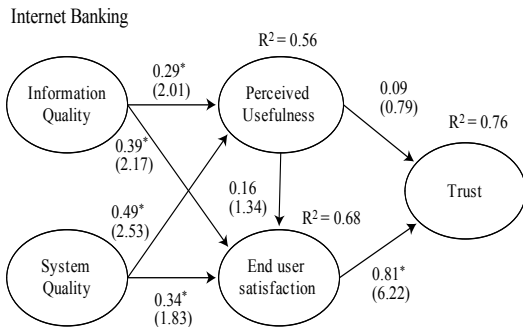
5.2 Structural Model and Hypotheses Testing

After achieving satisfactory fit in the measurement model, we tested research hypotheses in the structural model. The model fit indices provided evidence of a good fit both for internet banking and mobile banking (See <Table 9>. <Figure 4> and <Figure 5> illustrate path coefficients and their significance levels. The coefficients of determination (R^2) for each endogenous construct were also shown.

In the context of internet banking, both information quality and system quality exhibited strong positive effects on perceived usefulness. Therefore, H1 and H2 were supported. Moreover, the paths from both information quality and system quality to end-user satisfaction were positively significant. Thus, H3 and H4 were also supported. These implied that increased information and the system quality of internet banking would be associated with increased perceived usefulness and end-user satisfaction. However, perceived usefulness had no significant impacts on end-user satisfaction and trust, indicating that H5 and H6 were not supported. As expected, end-user satisfaction had a significant positive effect on trust, supporting H7. R^2 values show that information quality and system quality account for 56% of the variance
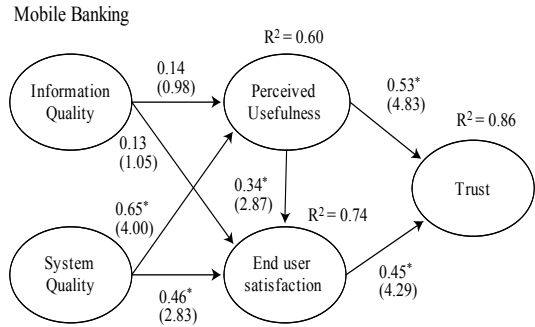
<Table 9> Structural Model Indices

Model	X^2	Df	X^2/df	GFI	AGFI	RMSEA	NFI
Recommended value		-	< = 3	> 0.90	> 0.80	< 0.08	> 0.90
Internet Banking	202.16*	139	1.45	0.92	0.84	0.064	0.91
Mobile Banking	218.06*	126	1.73	0.91	0.81	0.068	0.90

*p < 0.001.

<Figure 4> Hypotheses Testing Results: The Case of Internet Banking

*p < 0.001.

<Figure 5> Hypotheses Testing Results: The Case of Mobile Banking

of perceived usefulness, and 68% of variance of end-user satisfaction. Finally, 76% of the variance of trust was explained by end-user satisfaction.

In the context of mobile banking, information quality had no significant impact on perceived usefulness and end-user satisfaction. Thus, H1 and H3 were not supported. On the contrary, system quality had significant and positive influence on the perceived usefulness and end-user satisfaction

of mobile banking, supporting H2 and H4. The path from perceived usefulness to end-user satisfaction was significant and positive, indicating H5 was supported. Moreover, the path coefficients from perceived usefulness and end-user satisfaction to trust were positively significant. Therefore, H6 and H7 were supported. System quality explained 60% of the variance of perceived usefulness, while 74% of variance of end-user sat-

<Table 10> Summary of Hypotheses Result

Hypotheses	Internet Banking	Mobile Banking
Information quality → perceived usefulness (H1)	Supported	Not supported
System quality → perceived usefulness (H2)	Supported	Supported
Information quality → end-user satisfaction (H3)	Supported	Not supported
System Quality → end-user satisfaction (H4)	Supported	Supported
Perceived usefulness → end-user satisfaction (H5)	Not Supported	Supported
Perceived usefulness → trust (H6)	Not Supported	Supported
End-user satisfaction → trust (H7)	Supported	Supported

<Table 11> The Direct, Indirect, and Total Effects among Constructs of Internet Banking

Construct	Direct			Indirect			Total Effect		
	PU	SF	TR	PU	SF	TR	PU	SF	TR
IQ	0.29	0.39				0.32	0.29	0.39	0.32
SQ	0.49	0.34				0.28	0.49	0.34	0.28
PU									
SF			0.81						0.81

<Table 12> The Direct, Indirect, and Total Effects among Constructs of Mobile Banking

Construct	Direct			Indirect			Total Effect		
	PU	SF	TR	PU	SF	TR	PU	SF	TR
IQ									
SQ	0.65	0.46			0.22	0.66	0.65	0.68	0.66
PU		0.34	0.53			0.15		0.34	0.68
SF			0.45						0.45

isfaction were explained by system quality and perceived usefulness. In addition, perceived usefulness and end-user satisfaction accounted for 86% of the variance of trust. The summary of hypotheses results can be seen in table 10below.

Direct and indirect effects among constructs were also calculated and reported in <Table 11> <Table 12>

Ⅵ. Discussions

This study has applied DeLone and McLean's Information System Success Model in the e-banking context. Through an empirical study conducted in Indonesia, we tested an extension of the IS success model by using data about two different e-banking products, i.e., internet banking and mobile banking. The empirical results provided considerable support for our proposed model. Three of the seven proposed hypotheses were found to be consistently significant in both internet banking and mobile banking. For both technologies, system quality was significantly associated with perceived usefulness and end-user satisfaction. These two findings are consistent with the abundant literature based on the IS success model [Jun and Chai, 2001; Wu and Wang, 2006], suggesting e-banking technology users emphasize the system quality of the technologies. Reliability, convenience, ease of use, and the range of functionality of the e-banking technology are critical factors in an individual's evaluation of the utility of the e-banking technology and the satisfaction from using the technology. The quality of system operation is very important during the implementation process of e-banking. We have also found that end-user satisfaction was significantly associated with trust in e-banking technologies and the bank. The finding is also consistent with previous studies [e.g., Benemati and Serva, 2007]. If users repeatedly feel satisfied with the e-banking product, they have a reason

to trust the bank and the technology provided by the bank.

However, the rest of the hypotheses received mixed support from the data about internet banking and mobile banking. First, information quality had positive and significant impacts on perceived usefulness and end-user satisfaction in the context of internet banking, but not in the context of mobile banking. The results suggested that the users may access banking information from alternative channels, rather than relying on mobile banking. Mobile banking may be more heavily used for conducting banking transactions than for getting banking information. Mobile banking is purposely designed as a way to connect mobile and wireless devices for transactions. Therefore, the end user may focus on the most efficient way of connecting to their account and processing transactions; both are related to system quality rather than information quality. End users can switch to internet banking channels if they need detail financial information when internet banking is available [Calisir and Gummussoy, 2008]. In this case, internet banking provides better information for users. Another reason for switching to internet banking is the limitation of media devices when used for mobile banking. Mobile phones have a relatively small window. Screen space is very limited compared to a computer workstation. This small screen also presents fewer surrogate cues to the user for human interaction than would be available with a full-scale PC, making it inconvenient for reading information [Vance et al., 2008].

Second, perceived usefulness had significant impacts on end-user satisfaction and trust in the mobile banking setting, compared to the internet banking setting. In order to explain the incon-

sistencies, we have to consider the study context and the stage of adoption. The above relationships may differ depending on the adoption stage. Users may not report that perceived usefulness influences their satisfaction and trust after they have enough experience using internet banking. However, they express concern about this when using mobile banking. Mobile banking is a new e-banking product in countries like Indonesia. In order to enhance users' satisfaction toward, and trust in, the technology, the users have to first recognize the utility and value of the technology [Kaufaris and Sosa, 2003; Kim et al., 2009]. On the other hand, when users have accumulated sufficient levels of experience with internet banking, they may consider internet banking a routine banking service. Perceived usefulness doesn't play an important role in the internet banking context because users have become familiar with this e-banking product. As a result, they do not feel this usefulness will influence their satisfaction. Thus, the usefulness perception may be more important for mobile banking than for internet banking.

VII. Conclusions

Our study extends and assesses the relevancy of the IS success model in an e-banking environment. We selected Indonesia as our study area since this developing country may represent an opportunity to study the growing adoption of electronic banking. By comparing two different kinds of technologies-internet banking and mobile banking-our study showed that the users of different e-banking devices tend to have different focuses on the key success dimensions in the IS success model.

7.1 Limitations and Implications

Because of the following limitations in the current study, findings of this study should be interpreted with caution, and further verification is suggested. The development of e-banking (internet banking and mobile banking) in Indonesia is in its initial stage. Finally, although we tested for the common method bias [Podsakoff *et al.*, 2003] to relieve concern, further research may use multiple methods when collecting the data.

This study investigated the role of each dimension of IS success in the electronic banking environment. First, unlike previous studies which did not connect the quality dimensions of e-banking to existing nomological frameworks, we have fully integrated quality dimensions based on the IS success model. Second, we have integrated trust as an example of net benefit in the IS success model. While the original IS success model emphasizes individual and organizational impacts [DeLone and McLean, 2003], we have argued that trust is an important indicator of IS impact on an individual in the banking industry. Future research may investigate other well-established concepts, such as commitment and loyalty, to explicitly measure net benefits in the IS success model. For practitioners, this study provides several implications, particularly for investigating the success factors of electronic banking across countries. System quality, information quality, end-user satisfaction, perceived usefulness, and trust, need to be considered when evaluating e-banking success and establishing strategies to improve e-banking performance.

This study has shown that information quality is essential in internet banking, while system quality plays the most important role in affecting perceived usefulness and user satisfaction in mobile banking. Therefore, managers should be aware of these relationships when they make decisions on how to invest in different e-banking technologies, in order to improve their e-banking products.

⟨References⟩

[1] Bhattacherjee, A., "An Empirical Analysis of The Antecedents of Electronic Commerce Service Continuance," *Decision Support System*, Vol. 32, , No. 2, 2001, pp. 201-214.

[2] Calisir, Fethi; Cigdem Altin Gumussoy, "Internet Banking Versus Other Banking Channel: Young Customer's View," *International Journal of Information Management*, Vol. 28, 2008, pp. 215-221.

[3] Chau, Patrick Y.K., Vincent S.K. Lai., "An Emperical Investigation of the Determinants of User Acceptance of Internet Banking," *Journal of Organization and Computing and Electronic Commerce*, Vol. 13, No. 2, 2003, pp. 123-145.

[4] Davis, F.D., Bagozzi, R.P., Warshaw, P.R., "Extrinsic and Intrinsic Motivation to Use Computers in the Workplace," *Journal of Applied Social Psychology*, Vol. 22, No. 4, 1992, pp. 1111-1132.

[5] Davis, Fred D., "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly*, September 1989, pp. 319-340.

[6] DeLone, W.H. and McLean, E.R., "Information Systems Success: The Quest for the Dependent Variable," *Information Systems Research*, Vol. 3, No. 1, 1992, pp. 60-95.

[7] DeLone, W.H. and McLean, E.R., "The DeLone and McLean Model of Information Systems Success: A Ten Year Update," *Journal of Management Information Systems*, Vol. 19, No. 4, 2003, pp. 9-30.

[8] DeLone, W.H. and McLean, E.R., "Measuring E-Commerce Success: Applying the DeLone and McLean Information Systems Success Model," *International Journal of Electronic Commerce*, Vol. 9, No. 1, 2004, pp. 31-47.

[9] Durkin, Mark, Dierdre Jennings, Gwyneth Mulholland, Stephen Worthington, "Key Influencers and Inhibitors on Adoption of the Internet for Banking," *Journal of Retailing and customer services*, Vol. 15, 2008, pp. 348-357.

[10] Eriksson, Kent, Daniel Nilsson, "Determinants of the Continued Use of Self Service Technology: The Case of Internet Banking," *Technovation*, Vol. 27, 2007, pp. 159-167.

[11] Fassnacht, Martin, Ibrahim Kose, "Consequences of Web-Based Service Quality: Uncovering A Multi-Faceted Chain of Effects," *Journal of Interactive Marketing*, Vol. 21, No. 3, 2007, pp. 35-54.

[12] Flavian, Carlos, Miguel Guinaliu, Raquel Gurrea, "The Role Played by Perceived Usability, Satisfaction, and Customer Trust on Website Loyalty," *Information and Management*, Vol. 43, 2006, pp. 1-14.

[13] Floh, Arne, Horst Treiblmaier, "What Keeps the e-Banking Customer Loyal? A Multigroup Analysis of The Moderating Role of Customer Characteristics on e-Loyalty in The Financial Service Industry," *Journal of electronic commerce research*, Vol. 7, No. 2, 2006, pp. 97-110.

[14] Fornell, C. and Larcker, D.F., "Evaluating Structural Equation Models with Unobservable Variables and Measurement Error," *Journal of Marketing Research*, Vol. 18, February 1981, pp. 19-50.

[15] Gefen, D., Karahanna, E., and Straub, D.W., "Trust and TAM in Online Shopping: An Integrated Model," *MIS Quarterly*, Vol. 27, No. 1, 2003, pp. 51-90.

[16] Gu, J.C., Lee, S.C., and Suh, Y.H., "Determinants of Behavioral Intention to Mobile Banking," *Expert Systems with Applications*, 2009, doi:10.1016/j.eswa.2009.03.024.

[17] Ho, S.H. and Ko, Y.Y., "Effects of Self Service Technology on Customer Value and Customer Readiness: The Case of Internet Banking," *Internet Research*, Vol. 18, No. 4, 2008, pp. 427-446.

[18] Jardine, David, "Indonesia: Call for More Research Papers," University World News, 2009, Available at http://www.universityworldnews.com/article.php?story=20090212191105894.

[19] Jayawardhena, Chanaka, "Measurement of Service Quality in Internet Banking: The Development of an Instrument," *Journal of Marketing Management*, Vol. 20, 2004, pp. 185-207.

[20] Jun, M. and Cai, S.H., "The Key Determinants of Internet Banking Service Quality: A Content Analysis," *International Journal of Bank Marketing*, Vol. 19, No. 7, 2001, pp. 276-291.

[21] Kassim, Norizan Mohd, Abdel kader Mohammed Ahmed Abdulla, "The Influence of Attraction on Internet Banking: An Extension to Trust Relationship Commitment Model," *International Journal of Bank Marketing*, Vol. 24, No. 6, 2006, pp. 424-442.

[22] Kaufaris, Marios, William Hampton-Sosa,

"The Development of Initial Trust in an Online Company by New Customers," *Information and Management*, Vol. 41, 2004, pp. 377-397.

[23] Kim, G.M., Shin, B.S., and Lee, H.G., "Understanding Dynamic between Initial Trust and Usage Intentions of Mobile Banking," *Information System Journal*, Vol. 19, 2009, pp. 283-311.

[24] Krauter, Sonja Grabner, Rita Faullant, "Customer Acceptance of Internet Banking: The Influence of Internet Trust," *International Journal of Bank Marketing*, Vol. 26, No. 7, 2008, pp. 483-507.

[25] Lai, J.Y. and Yang, C.C., "Effects of Employees' Perceived Dependability on Success of Enterprise Applications in e-Business," *Industrial Marketing Management*, Vol. 38, 2009, pp. 263-274.

[26] Lee, M.C., "Factors Influencing the Adoption of Internet Banking: An Integration of TAM and TPB with Perceived Risk and Perceived Benefit," *Electron. Comm. Res. Appl.,* 2009, doi:10.1016/j.elerap.2008.11.006.

[27] Liang, H., Saraf, N., Hu, Q., and Xue, Y., "Assimilation of Enterprise Systems: The Effect of Institutional Pressures and The Mediating Role of Top Management," *MIS Quarterly*, Vol. 31, No. 1, 2007, pp. 59-87.

[28] Liao, Z. and Cheung, M.T., "Internet-Based e-Shopping and Consumer Attitudes: An Empirical Study," *Information and Management*, Vol. 38, 2001, pp. 299-306.

[29] Liao, Shaoyi, Yuan Pu Shao, Huaiqing Wang, and Ada Chen, "The Adoption of Virtual Banking: An Empirical Study," *International Journal of Information Management*, Vol. 19, 1999, pp. 63-74.

[30] Liao, Ziqi, Michael Tow Cheung, "Internet Based e-Banking and Customer Attitudes: An Empirical Study," *Information and Management*, Vol. 39, 2002, pp. 283-295.

[31] Liao, Ziqi, Michael Tow Cheung, "Measuring Customer Satisfaction in Internet Banking: A Core Framework," *Communications of the ACM*, Vol. 51, No. 4, 2008. pp. 47-51.

[32] Lin, C.-C. and Lu, H., "Towards an Understanding of the Behavioral Intention to Use a Website," *International Journal of Information Management*, Vol. 20, 2000, pp. 197-208.

[33] Livari, Juhani, "An Emperical Test of the DeLone-McLean Model of Information System Success," *The Database for Advances in Information Systems*, Vol. 36, No. 2, 2005, pp. 8-27.

[34] Luarn, P. and Lin, H., "Toward an Understanding of The Behavioral Intention to Use Mobile Banking," *Computers in Human Behavior*, Vol. 21, No. 6, 2005, pp. 73-91.

[35] Meuter, L., Matthew L.M., Ostrom, A.L., Roundtree, R.I., and Bitner, M.J., "Self Service Technology: Understanding Customer Satisfaction With Technology-Based Service Encounters," *Journal of Marketing*, Vol. 64, 2000, pp. 50-64.

[36] Ndubisi, Nelson Oly, "Customers' Perceptions and Intention to Adopt Internet Banking: The Moderating Effect of Computer Self Efficacy," *AI and Soc.*, Vol. 21, 2007, pp. 315-327.

[37] Nunnally, J.C. and Bernstein, I.H., "Psychometric Theory," Third ed. McGraw-Hill Book Company, New York, 1994.

[38] Petter, S. and McLean, E.R., "A Meta-Analytic Assessment of the DeLone and McLean IS Success Model: An Examination of IS Success at the Individual Level," 2009, Inf. Manage., doi:10.1016/j.im.2008.12.006.

[39] Podsakoff, P.M., MacKenzie, S.B., Lee, J.-Y., and Podsakoff, N.P., "Common Method Biases

in Behavioral Research: A Critical Review of The Literature and Recommended Remedies," *Journal of Applied Psychology*, Vol. 88, No. 5, 2003, pp. 879-903.

[40] Rexha, N., Kingshott, R.P.J., and Aw, A.S.S., "The Impact of The Relational Plan on Adoption of Electronic Banking," *Journal of Services Marketing*, Vol. 17, No. 1, 2003, pp. 53-67.

[41] Rod, Michel, Nicholas J. Ashill, Jinyi Shao, Janet Carruthers, "An examination of the Relationship Between Service Quality Dimensions, Overall Internet Banking Service Quality and Customer Satisfaction: A New Zealand Study," *Marketing Intelligence and Planning*, Vol. 27, No. 1, 2009, pp. 103-126.

[42] Seddon, P.B., "A Respecification and Extension of the DeLone and McLean Model of IS Success," *Information Systems Research*, Vol. 8, No. 3, 1997, pp. 240-253.

[43] Shih, Ya-Yueh and Kwoting Fang, "Effects of Network Quality Attributes on Customer Adoption Intentions of Internet Banking," *Total Quality Management*, Vol. 17, No. 1, 2006, pp. 61-77.

[44] Spreng, R.A., MacKenzie, S.B., and Olshavsky, R.W., "A Reexamination of the Determinants of Customer Satisfaction," *Journal of Marketing*, Vol. 60, No. 3, 1996, pp. 15-32.

[45] Stamoulis, Dimitrios, Panagiotis Kanellis, and Drakoulis Martakos, "An Approach and Model for Assessing the Business Value of e-Banking Distribution Channels: Evaluation as Communication," *International Journal of Information Management*, Vol. 22, 2002, pp. 247-261.

[46] Suh, B. and Han, I., "Effect of Trust on Customer Acceptance of Internet Banking," *Electronic Commerce Research and Applications*, Vol. 1, 2002, pp. 247-263.

[47] The Indonesia Information Technology Report 2009, Business Monitor International.

[48] Tiwari, Rajnish, and Stephan Buse, "The Mobile Commerce Prospects: A Strategic Analysis of Opportunities in the Banking Sector," Hamburg University Press, 2007, Available at http://hup.sub.uni-hamburg.de/produc ts-page/publikationen/56/.

[49] Urban, G.L., Sultan, F., and Qualls, W.J., "Placing Trust at the Center of Your Internet Strategy," *Sloan Management Review*, Vol. 42, No. 1, 2000, p. 39.

[50] US Department of State, September 2008, Indonesia Profile, Available at http://www.s tate.gov/r/pa/ei/bgn/2748.htm.

[51] Vance, Antony, Christophe Elie-Dit-Cosaque, and Detmar W. Straub, "Examining Trust in Information Technology Artifacts: The effect of System Quality and Culture," *Journal of Management Information System*, Vol. 24, No. 4, 2008, pp. 73-100.

[52] Vatanasombut, Banphot, Magid Igbaria, Antonis, S. Stylianou, Waymond Rodgers. "Information systems continuance intention of web based applications customers: The case of online banking," *Information and Management*, Vol. 45, 2008, pp. 419-428.

[53] Wahid, Fathul, Bjorn Furuholt, Stein Kristiansen, "Global Diffusion of the Internet III: Information Diffusion Agents and the Spread of Internet Cafés in Indonesia," *Communications of the Association for Information Systems*, Vol. 13, 2004, pp. 589-614.

[54] Wang, Y.S. and Liao, Y.W., "Assessing eGovernment system success: A validation of the DeLone and McLean Model of Information

System Success," *Government Information Quarterly*, Vol. 25, 2008, pp. 717-733.

[55] Wixom, H., Barbara, Peter A. Todd., "A Theoretical Integration of User Satisfaction and Technology Acceptance," *Information System Research*, Vol. 16, No. 1, 2005, pp. 85-102.

[56] Wu, J.H. and Wang, Y.M., "Measuring KMS Success: A Respecification of the DeLone and McLean's Model," *Information and Management*, Vol. 43, 2006, pp. 728-739.

[57] Yiu, Chi Sing, Kevin Grant, and David Edgar, "Factors Affecting the Adoption of Internet Banking in Hong Kong-Implication for the Banking Sector," *International Journal of Information Management*, Vol. 27, 2007, pp. 336-351.

[58] Yousafzai, Shumaila Y., John G. Pallister, Gordon R. Foxall, "A Proposed Model of e-Trust for Electronic Banking," *Technovation* Vol. 23, 2003, pp. 847-860.

⟨Appendix A⟩ Variables and Items of Research

Variables		Items
Information Quality	Completeness	• IB/MB provides me with a complete set of information • IB/MB provides me with all the information I need
	Accuracy	• IB/MB produces correct banking information • There are few errors in the information I obtain from IB/MB
	Format	• The banking information provided by IB/MB is well formatted • The banking information provided by IB/MB is clearly presented on the screen
	Currency	• IB/MB produces the most current information • The information from IB/MB is always up to date
	Reliability	• IB/MB performs reliably and securely • The operation of IB/MB dependable
Systems Quality	Flexibility	• IB/MB can be adopted to meet a variety of needs • IB/MB can flexibly adjust to new demands or conditions
	Integration	• IB/MB effectively integrates data from several accounts • IB/MB effectively combines data to meet user's need
	Accessibility	• IB/MB allows information to be readily accessible to me • IB/MB makes information easily to access
	Timeliness	• IB/MB provides information in timely fashion • IB/MB returns answers to my request quickly
End-user Satisfaction		• Overall, I'm satisfied with the self-service of IB/MB • The whole self-service technology through IB/MB offered by the bank exceed my expectation • The whole self-service technology through IB/MB offered by the bank are close to my ideal expectation
Perceived usefulness		• I can accomplish my banking tasks more quickly using IB/MB • I can accomplish my banking tasks more easily using IB/MB • IB/MB enhances my effectiveness in utilizing banking service • IB/MB enhances my efficiency in utilizing banking service
Trust		• I can trust IB/MB • I trust the information presented by IB/MB • I feel this IB/MB would provide me with good service

IB: Internet Banking; MB: Mobile Banking.

◆ About the Authors ◆

Chulmo Koo

Chulmo Koo is an assistant professor in Kyung Hee University, Korea. He received a Ph. D. in Management Information Systems from Sogang University, Korea. His research area is on Electronic Commerce Strategy and Performance, Green IT Management, Technostress, and Social Network Technologies Usage. His papers have been appeared in the International Journal of Electronic Commerce, International Journal of Information Management, Journal of Internet Commerce, Industrial Management and Data Systems, and Information Systems Frontiers. Currently he does actively research on Tourism and Hospitality and IT

Yulia Wati

Yulia Wati is a PhD student at College of Walton Business, University of Arkansas, USA. She received her bachelor's degree in management from Bina Nusantara University, Indonesia and MS in Chosun University, South Korea. Her research interests include Green Information Technology, Human Behavior and Information Technology, Information Technology Strategy, and Social Aspects of Information System.

Namho Chung

Namho Chung is a faculty member in the College of Hotel and Tourism Management at Kyung Hee University in Seoul, Korea. He received his Ph.D degree in MIS from Sungkyunkwan University. His research focuses on online consumer behavior, human computer interface, and knowledge management in the hospitality and tourism industry. His research work has been published in journals that include Information and Management, Computers in Human Behavior, Behaviour and Information Technology, Electronic Commerce Research and Applications, Tourism Management, International Journal of Tourism Research, Journal of Business Research, and Interacting with Computers.