Journal of Universal Computer Science, vol. 16, no. 13 (2010), 1801-1824
submitted: 28/2/10, accepted: 6/5/10, appeared: 1/7/10 © *J.UCS*

Toward an Understanding of the Mediating Role of "Trust" in Mobile Banking Service: An Empirical Test of Indonesia Case

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Abstract: Mobile banking has been considered to be one of the most value-added and important mobile services currently available. Considering the fact that the penetration of this technology is undefined well, particularly in developing country, this study clarified the role of trust as a mediating variable in mobile banking environment. An empirical study was undertaken in Indonesia and the data of 100 respondents were collected. The empirical results provided strong evidence for the explanatory power of our research model. Firstly, we found that the trust mediated the effects of information quality to perceived usefulness and end-user satisfaction. Second, the both relationships of system quality and perceived usefulness and system quality and end-user satisfaction were partially mediated by trust. Third, trust also showed a direct effect on both end-user satisfaction and perceived usefulness. Lastly, the result provided support of the positive relationship between perceived usefulness and end-user satisfaction. Implication for both practice and further research were also discussed.

Keywords: Mobile Banking, Indonesia, Trust, IS success factors
Categories: H.1.2, J.4

1 Introduction

The growth of wireless technology has increased the number of people using mobile devices and accelerated the development of mobile service conducted with these devices [Wang et al. 2006]. This new technology is changing every aspect of daily life and bringing new opportunities in many areas [Fjermestad et al. 2006]. Banks have also begun to provide mobile banking services, to enable customers to transact using mobile technologies such as phones, PDAs, and smart-phones [Barnes and Corbitt 2003; Hoehle and Huff 2009]. These mobile services facilitate customers to check the balance and transactions of their accounts, pay invoices and transfer funds between accounts, and confirm the direct payment via the phone's microbrowser [Mallat et al. 2004]. Because of the benefits offered by this channel, it has been considered to be one of the most value-added and important mobile services currently available [Lee et al. 2003].

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However, even though this application is readily set up, their international usage rates have remained fairly low [Suoranta and Mattila 2004] and the penetration of this technology is undefined well [Laukkanen and Pasanen 2008], particularly in developing countries [Donner and Tellez 2008]. Despite this fact has been realized by IS researchers, yet, few empirical studies have been conducted on this subject [Chung and Kwon 2009; Doner and Tellez 2008]. Among them, we addressed some gaps that need to be verified in the further research. Firstly, although some authors have indicated that the low penetration must be related to the trust issue, the entire role of "trust" itself is vague. For instance, [Chung and Kwon 2009] found that the perceptions of the system quality, information quality and information presentation of mobile banking moderated by trust influence customer satisfaction. However, while they assessed the difference between user with high level trust and low level trust and considered "trust" as a moderating variable, their test does not confirm the size effect of this moderator and they neglected the possibility of trust as mediating variable even though they argued that customers' trust is a significant factor that influences their attitude toward mobile banking, as well as their intentions to use. In addition, in this case, the view of trust should be addressed from both specific parties and technology perspective (IT artifacts). While it only possible under online business transaction such as mobile banking [Vance et al. 2008], there is little research go into it [Wang and Benbasat 2005].

Secondly, in this limitation, developing world has received less attention. [Donner and Tellez 2008] argued that the technology condition in developing world has risen a challenge for IS researchers. In order to understand the role of "trust", the study of developing countries is initially important since mobile banking in these countries may be more about "trust" as a key driver. Thirdly, the existing studies just limit their discussion on the technology acceptance variables by employing the traditional IS theories such as Technology Acceptance Model, Technology Planned Behavior, and Task Technology Fit and indicated the adoption behavior [e.g., Kim et al. 2007; Luarn and Lin 2005] or intention to use of mobile banking [e.g., Hoehle and Huff, 2009; Kim et al. 2009] as the dependent variables. There is limited study discussing the interrelationships between IS success factors and trust of this technology from users' perspective.

The objective of this study is to clarify the role of trust as a mediating variable in mobile banking environment of developing country by conducting empirical study in Indonesia. Why Indonesia? It because Indonesia banking industry has been considered as one of the most open markets for foreign investors in Asia Pacific [Business Wire 2009], while IS research development in this country is relatively slow [Jardine 2009]. Therefore, through this study, we addressed the following research question: "Does "Trust" factor mediate the interrelationships of IS success factors in Indonesia's mobile banking?"

This paper's goal is threefold: first, it investigated the role of trust in mediating the interrelationships of the success factors. Second, it fulfilled the gaps in the existing literatures by focusing on the interrelationships between IS success factors and trust of mobile banking. Lastly, this paper critically addressed the need of mobile banking research in developing country such as Indonesia. Thus, the result is expected to challenge both IS researchers and practitioners to look into the future development of mobile technology, particularly in developing countries.

This paper is organized as follows. The next section presents the theory background of this study as well as mobile banking development in Indonesia. The third section proposed research model and hypotheses development. The forth section describes the research methodology and data collection, followed by analysis of result in the fifth section. The final section provides a discussion of findings, concludes with limitations and implications for future research and practice.

2 Background

2.1 Mobile Banking in Indonesia

Indonesia is an archipelago of more than 17.000 islands [Indonesia 2009] with a total population of 225.6 million people in 2007 [World Bank 2010]. The profile of Indonesia can be seen in [table 1] below. Indonesia's telecommunication sector grew by 48 percent in 2007, with active mobile phone numbers reached 80 million [Donny and Mudiardjo 2009].

Indicator	2000	2005	2007
Population, total (in millions)	206.27	220.56	225.63
GNI per capita, PPP (current international $)	2,240	3,040	3,560
GDP (current US$) (billions)	165.02	285.87	431.93
GDP growth (annual %)	4.9	5.7	6.3
Mobile cellular subscriptions (per 100 people)	2	21	41
Internet users (per 100 people)	0.9	3.6	11.1
High-technology exports (% of manufactured exports)	16	16	11

Source: World Bank, 2010

Table 1: Data Profile of Indonesia (2000, 2005, 2007)

The third generation (3G) cellular phone services were entered Indonesia market in 2006. These services are being aggressively promoted in this country. There were five 3G providers and four millions 3G customers by the end of 2007, where the market is dominated by three gain providers (Telkomsel, Indosat, and Excelcomindo). Mobile services have grown livelier when these three operators upgraded their services to High Speed Downlink Packet Access (HSDPA) technology, which provides ten times faster cellular access compared to the older 3G technology [Donny and Mudiardjo 2009]. Along with this mobile technology, e-banking is becoming popular among Indonesian Internet users with online services offered by some of banking companies such as BCA Bank (www.klikbca.com), Mandiri Bank (www.bankmandiri.com), BNI 46 Bank (www.bni.co.id), and Lippo Bank (www.lippobank.co.id) [Donny and Mudiarjo 2009]. However, they noticed that, although there has been significant growth in cell-phone use in Indonesia, mobile banking and mobile payments remained slowly increased.

2.2 Conceptualizing Trust

The concept of trust has been widely adopted by IS research [e.g. Bhattacherjee 2002, Gefen et al. 2003, Jarvenpaa et al. 2000]. In traditional context, there are many definitions of trust. [Doney and Cannon 1997] defined trust as the perceived credibility and benevolence of a target of trust. [Gefen et al. 2003] indicated trust as the degree to which people believe a firm is dependable in protecting customers' personal information. In online environment, [McKnight et al. 2002], [Pavlou 2003] conceptualized trust as the belief that allows customers to willingly become vulnerable to web retailers after having taken the retailers' characteristics into consideration. Trust is important because it helps customers overcome perceptions of uncertainty and risk and engage in "trust-related behaviours" with vendors, such as sharing personal information or making purchases [McKnight et al. 2002]. Trust issue is initially important in that people are not able to guarantee that the information captured from various resources (e.g. their neighbours) is always trustworthy [Jung 2009].

Conceptually, there are many perceptions of trust. In this study, however, trust can be viewed from two perspectives: institutional-based trust [McKnight et al. 2002] and initial trust (personal-based trust) [McKnight et al. 1998]. Initial trust refers to trust in an unfamiliar trustee, a relationship in which the actors do not yet have credible, meaningful information about, or affective bonds with, each other [McKnight et al. 2002]. Trust has three characteristics: ability, benevolence, and integrity [Gefen et al. 2008]. Ability means that a trustor believes that a trustee has the power to do for him/her what he/she needs done. Benevolence is the extent to which a trustee is believed to want to do good to a trustor, aside from an egocentric profit motive. Integrity means that a trustor believes that a trustee makes good-faith agreements, tells the truth, acts ethically, and fulfils promises [McKnight and Chervany 2002]. Furthermore, institutional-based trust is a person's feeling or belief that the environment in which he or she transacts has appropriate safeguards and protections [Vance et al. 2008]. There are two dimensions of institutional-based trust: (1) structural assurance, the belief that structures are in place to promote success; and (2) situational normality, the belief that the environment is in proper order and success is likely because the situation is normal and favourable [McKnight et al. 2002].

Trust phenomenon involves, however, not only people but also IT artefacts – hardware and software that enables tasks (technology trust) [Vance et al. 2008]. [Lippert and Davis 2006, p.438] defined technology trust as "an individual's willingness to be vulnerable to an information technology based on expectations of technology predictability, reliability and utility and influenced by the individual's predilection to trust technology". Therefore, following previous studies, trust in mobile banking is defined here as *the belief that allows individual to willingly become vulnerable either to the bank or e-banking technology after having taken the bank's characteristic embedded in its technology artefact.* This definition captured both traditional view of trust in "a specific party" and trust in "the integrity of technology artefact" where its process is built the same way as trust in people [McKnight et al. 2002].

2.3 Information System Success

The main IS success concept have been proposed by prior researchers [e.g. DeLone and McLean 1992, 2003; Sabherwal et al. 2006; Seddon 1997]. [DeLone and McLean 1992] posit a model of IS success that includes six constructs: information quality, system quality, use, user satisfaction, individual impact, and organizational impact. In 1997, Seddon used theoretical approach to modify DeLone and McLean's original model. He questioned the "Use" construct presented in this model. He argued that this construct can be measured if the system use is mandatory, not voluntary [Seddon 1997]. Thus, he incorporated the additional construct of perceived usefulness in his modification model. Overall, Seddon's model includes three types of constructs: measures of information and system quality, system use as a behaviour, and general measures of net benefit from system use [Sabherwal et al. 2006].

In 2003, DeLone and McLean also modified their model by adding service quality dimension to measure quality aspect of IS personnel. In their new model, they also distinguish system use from intention to use and integrated individual and organizational impact into one construct of net benefit. However, as [Seddon 1997] indicated, it was improper to integrate the measurement of technological aspects of system with human factor of IS service. Thus, in this study, mobile banking success was examined using four constructs: information quality, system quality, end user satisfaction, and perceived usefulness [Sabherwal et al. 2006; Seddon et al. 1997].

3 Research Model and Hypotheses

By integrating the concept of IS success and trust, we proposed our research model as illustrated in [figure 1]. Within this model, we assessed the role of trust in mediating the interrelationships of IS success factors. For the next paragraphs, we developed corresponding research hypotheses. According to [DeLone and McLean 2003], in order to measure the success of an individual system, information quality and system quality are the most important quality components. In this vein, mobile banking can be counted as information system, where system and information system quality are very important aspects of mobile banking [Aladwani and Palvia 2002; Kim et al. 2009].

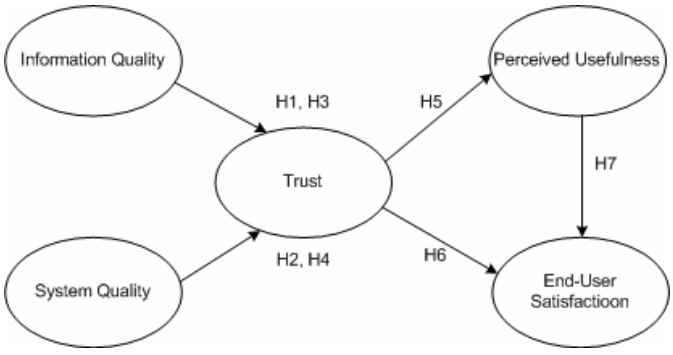

Figure 1: Research Model

Information quality is defined as the capability of information output to benefit users [Ding and Straub 2008]. [Nelson et al. 2005] developed a core set of information quality dimensions: accuracy, completeness, currency, and format. Completeness is the degree to which the system provides all necessary information; whereas accuracy represents the user's perception that the information is correct; format represents the user's perception of how well the information is presented; and currency represents the user's perception of the degree to which the information is up to date [Wixom and Todd 2005]. The measurement of IS system quality involves performance-related measures of hardware, software, and resource utilization [Kriebel and Raviv 1980]. System quality is the capability of an IT artefact to process and deliver information for the benefit users [Ding and Straub 2008]. [DeLone and McLean 1992] defined system quality as technical level effectiveness of an IS. [Nelson et al. 2005] identified five key measures of IS system: accessibility, reliability, flexibility, response time, and integration. Reliability refers to the dependability of system the dependability of system operation, flexibility refers to the way the system adapts to changing and demands of the user, integration refers to the way the system allows data to be integrated from various sources, accessibility refers to the ease with which information can be accessed or extracted from the system, and timeliness refers to the degree to which the system offers timely responses to requests for information or action [Wixom and Todd, 2005].

Across the literature, trust has been described as a factor that relates to behaviour directly and also through mediation [Cugelman et al. 2009]. Under relationship marketing theory, trust is identified as a key mediator that influences company actions on consumer behaviours [Morgan and Hunt, 1994). To say that trust "mediates" the effects of these variables on consumer decisions and behaviours is to argue that trust plays an important "middleman" function in market exchange [Johnson 2007]. The mediating role of trust has also been confirmed by other studies [e.g. Johnson 2007; Nicolaou and McKnight 2006]. [Nicolaou and McKnight 2006] argued that to build partner trust, the providers must do more than merely provide electronic linkages. They pointed out that information quality should be an important trust-building mechanism in online interactions [Fung and Lee 1999; Keen et al. 2000]. Likewise, [Vance et al. 2008] explored the conceptualization of trust placed in technology and found that system quality significantly influenced trust in technology. They observed that in online environment such as mobile commerce where available cues are limited; system quality attributes can strongly influence the formation of trusting beliefs, indirectly, affect the behaviours. System quality attributes are relevant to the concept of trust because it has been suggested that technical aspects of technology affect users' willingness to trust [Gefen et al. 2006].

According to [Mayer et al. 1995] and [Morgan and Hunt 1994] trust forms a central mental construct in the relationship. Trust is crucial, and people start to rely more on the usefulness of the interaction than trust on forming their behavioural intentions [Gefen et al. 2008]. They indicated that as an IT system, while perceived usefulness is one of the key determinants of its use, as a conduit to the vendor, trust is the key. User trust in the IT can be developed through the process of evaluating technology trust based on a combination of the technology predictability, reliability and utility construct and through an evaluation within a specific context [Lippert and Davis 2006]. Thus, perceived quality should relate positively to trusting beliefs, that

is, if customers perceive that the system is of high quality, they will assume that the information system has positive attributes and will form trusting intentions [McKnight et al. 2002], in turn, increase their perceived usefulness [Davis 1989]. In this context, we argued that trust mediates the effects of quality attributes on perceived usefulness of mobile banking as potential benefit of mobile banking can only be realized if customers feel comfortable transacting over the new medium with unfamiliar vendors [Gefen and Straub 2002]. Thus, we hypothesized:

H1: Trust mediates the effect of information quality on perceived usefulness of mobile banking

H2: Trust mediates the effect of system quality on perceived usefulness of mobile banking

Trust is a crucial factor in customer satisfaction and the IS quality aspects are necessary in building trust for mobile banking environment [Lee and Chung 2009]. From psychological state, trust is clearly different from, but antecedent to, behaviour, and it relates to belief [Bhattacherjee 2002]. As a belief, it refers to trustor's perceptions of trustee attributes that may influence trustee's behaviour [Bhattacherjee 2002]. According cognitive-based trust literature, it posits that trusting beliefs may form quickly (before the parties have meaningful information) because of some aspects such as reputation, disposition, institutional roles, and so forth [McKnight et al. 1998]. Furthermore, according to the expectancy-theory (TRA) [Ajzen and Fishbein 1980], external variables influence beliefs about the outcomes associated with performing a behaviour, which in turn shape attitudes toward performing behaviour [Wixom and Todd 2005]. That is, attitude influences intention to perform the behaviour itself. Satisfaction in a given situation is a person's feelings or attitudes toward a variety of factors affecting that situation. In this framework, user satisfaction is typically viewed as the attitude that a user has toward an information system, that is, it represents an object-based attitude [Wixom and Todd 2005], and has been measured by various constructs such as information and system quality [DeLone and McLean 1992]. Therefore, we posit that trust belief (perception of specific mobile banking attributes) [McKnight et al. 2002] mediates relationships of quality factors (information and system quality) and end user satisfaction.

H3: Trust mediates the effect of information quality on end-user satisfaction of mobile banking

H4: Trust mediates the effect of system quality on end-user satisfaction of mobile banking

Perceived usefulness refers to the extent to which a user believes that he or she will benefit from using the mobile phone (mobile banking) [van Biljon and Kotze 2008]. Individuals evaluate the consequences of their behaviour in terms of perceived usefulness and base their choice of behaviour on the desirability of the usefulness [Kim et al. 2007]. [Gefen et al. 2003] suggested that trust may increase certain aspects of the perceived usefulness. Thus, understanding how users trust in the technology influences their use of the system [Lippert and Davis 2006]. Trust is a crucial antecedent in online setting because of the greater ease with which vendors

can behave in an opportunistic matter [Reichheld and Schefter 2000]. The usefulness of a technology depends on both the effectiveness of its relevant technological properties. [Goodhue and Thompson 1995] suggested that a system will be perceived as more useful and job performance is likely to be enhanced if system characteristics match the requirements of the task and delivered significant value to the users. [Chircu et al. 2000] argued that trust relates to perceived usefulness. When users develop their trust, they will perceive mobile banking to be useful and they are willing to use it [Gu et al., 2009]. Accordingly, [Gefen 1997] and [Gefen and Straub 2002] also integrated trust and perceived usefulness in e-services context. Trust is one of the determinants of perceived usefulness because part of the guarantee that customers will gain their expected usefulness from the technology [Pavlou 2003]. Following these literatures, we indicated that trust positively influences perceived usefulness that enables customers to become vulnerable to the mobile banking to ensure that they received the expected interaction.

H5: Trust has a direct effect on perceived usefulness of mobile banking

End user satisfaction has been used widely to assess IS success and effectiveness [DeLone and McLean 2003; Zviran and Erlich 2003]. [DeLone and McLean 1992, 2003; Doll and Torkzadeh 1988; McKinney et al. 2002, and Seddon 1997] indicated that end-user satisfaction is an important area of IS research because it is considered as a significant factor in measuring IS success. [Zviran and Erlich 2003] posit that one factor that conspicuously absent from most IS satisfaction studies is the security factor to establish users' integrity [Tan and Lo, 1990]. This security factor is closely related to trust [Vance et al. 2008]. The use of technology-enabled services implies confidence and trust that the services delivery system will perform satisfactorily, accurately and reliably, and deliver the services required [Walker and Johnson 2006]. [Teo et al. 2009] indicated that satisfaction is sometimes regarded as the antecedent of trust. [Balasubramanian et al. 2003] found that perceived trustworthiness of an online broker is directly related to online investor's satisfaction. [Yoon 2002] posited that satisfaction is an outcome of trust and pointed out that trust correlates positively with end user satisfaction. Trust also creates positive attitudes and perceived behavioural control toward transactions with, reducing uncertainty and providing expectations for a satisfactory transaction [Pavlou, 2003]. Similarly, prior literatures also indicated that trust has a positive effect on end-user satisfaction [Chung and Kwon 2009]. Hence, we hypothesized:

H6: Trust has a direct effect on end-user satisfaction of mobile banking

User satisfaction is formed through the evaluation of product-service attributes, including content (accuracy and relevance), presentation (format and mode) [Melone 1990]. Under IS research, it defined as the IS end user's overall affective and cognitive evaluation of the pleasurable level of consumption-related fulfilment experienced with IS [Au et al. 2008]. In other words, the main reason that people exploit m-service systems is that they find the systems useful to their transaction [Wang et al. 2006]. User satisfaction has also been associated with terms of perceived

usefulness [Bhattacherjee 2002; Ives et al. 1983; Melone 1990]. Therefore, we proposed the following hypothesis:

H7: Perceived usefulness has a direct effect on end-user satisfaction

4 Research Model and Hypotheses

4.1 Data Collection

A field study using surveys for data collection was used to test the research model. The instrument was pilot-tested with twenty research assistants to check the validity and reliability of the questionnaire. Additional advice from MIS professors was also considered and appropriate changes were made. For the main study, we collected data from faculties, staffs, and students from computer science department at a large private university in Indonesia during January-February 2009. The questionnaire was prepared in English. For research purpose and reducing the ambiguity of the questionnaire, we translated it into Indonesia and back into English.

The respondents were asked to evaluate mobile banking service offered by Bank Central Asia, the largest private bank in Indonesia. We also posted our questionnaire on a website and invited the respondents to visit the web. In order to avoid the multiple responses, we checked the IP address of respondents. The questionnaires were administered to 300 respondents, and resulted in 257 responses in return. Questionnaires from respondents who had not previously mobile banking experience were discarded. In total, 100 responses were usable for the further analysis. The sample was particularly appropriate because it included individuals who were typically already experienced in using mobile banking, thus, have relatively well-knowledge about mobile service.

Sixty one percent of the respondents were male, and thirty nine percent were female. Almost all respondent were in their twenties or thirties. About half of the respondents used the m-banking for 1-3 times in one week, while twenty six percent used this banking channel for 4-6 times a week. Detailed descriptive statistics relating to the respondent's characteristic are shown in [table 2].

4.2 Measures

The questionnaire items were adopted and modified from various studies. The multi-dimensional measures of information quality and system quality were adopted from [Wixom and Todd 2005]. Trust was adopted from [Gefen et al. 2003] and perceived usefulness was adapted from [Chau and Lai 2003]. Lastly, for end-user satisfaction, we adapted the construct from [Lin and Hsieh 2007]. All scales were measured by using seven-point scale, ranging from "strongly agree" to "strongly disagree". All measurement items are listed in Appendix A.

Measure	Item	Freq	%
Gender	Male	61	61
	Female	39	39
Age	18-24	84	84
	25-31	15	15
	>31	1	1
Education	Graduate or similar	11	11
	University or similar	71	71
	High school	18	18
	Others	-	-
Usage time of m-banking (in 1 week)	1-3	54	54
	4-6	26	26
	7-9	7	7
	>9	13	13
Reason to be considered when using mobile banking	Lack of Trust	17	19
	Privacy Concern	13	14
	Security Concern	26	29
	Other Alternatives	19	21
	Difficult to use	15	17

Table 2: Demographic Respondent

5 Analysis and Result

The PLS (Partial Least Square) was used to validate the research model for several reasons. Firstly, we indicated the multi-dimensional of quality constructs as formative indicators [Edward 2001] that is not supported by covariance-based SEM [Chin 1998a,b]. A formative model is more appropriate in this case because the dimensions of quality constructs are not expected to be highly interrelated [Chin 1998]. Unlike reflective indicators, whereby the latent variable causes the observed variables, formative indicators can be viewed as causing rather than being caused by the latent variable measured by the indicators [Diamantopoulos 1999; Au et al. 2008]. Second, the variance-based PLS approach does not impose sample size restrictions or require multivariate normality distribution for the underlying data [Bhattacherjee and Prekumar 2004]. Given our small sample size of 100, we employed PLS in this study. PLSGraph version 03.00 was used for the analysis and the bootstrap resampling technique was carried out to determine the significance of the paths within the structural model.

5.1 Validity and Reliability

For formative construct validation, we follow an approach suggested by [Gable et al. 2005]. First, we test for the multi-collinearity among the measures. Thus, we first determined the Variance Inflation Factor (VIF) for the all measurement items of the

formative construct. All measures were below the common VIF threshold of 10, indicating all items were subjected to further analysis [Gable et al. 2005].

Next, we tested the measurement model for convergent and discriminant validity. Composite scores of the first-order factors were computed and represented the observed indicators of the two first-order factors [Hair et al. 1998]. Convergent validity can be evaluated by examining individual item reliability (threshold value > 0.5) [Fornell and Larcker 1981]. We also performed Confirmatory Factor Analysis in PLS, where the pattern of loadings of the measurement items on the latent constructs is specified explicitly in the model [see table 3].

Items	IQ	SQ	TR	PU	SF
CP	**0.74**	0.66	0.51	0.49	0.52
FT	**0.96**	0.74	0.69	0.53	0.67
CR	**0.90**	0.75	0.64	0.53	0.57
RL	0.77	**0.81**	0.61	0.49	0.55
FX	0.77	**0.81**	0.59	0.56	0.64
AS	0.57	**0.83**	0.63	0.67	0.67
TL	0.60	**0.87**	0.62	0.69	0.64
TR1	0.61	0.70	**0.87**	0.62	0.68
TR2	0.74	0.72	**0.95**	0.78	0.77
TR3	0.59	0.64	**0.88**	0.72	0.77
PU1	0.52	0.65	0.74	**0.94**	0.68
PU2	0.54	0.64	0.71	**0.94**	0.70
PU3	0.62	0.62	0.74	**0.91**	0.68
PU4	0.58	0.71	0.74	**0.94**	0.67
SF1	0.69	0.73	0.79	0.70	**0.94**
SF2	0.63	0.68	0.77	0.65	**0.96**
SF3	0.64	0.70	0.82	0.69	**0.94**

Legends: IQ: Information Quality; SQ: System Quality; TR: Trust; PU: Perceived Usefulness; SF: End-user Satisfaction

Table 3: Confirmatory Factor Analysis Result

For formative items (i.e., items themselves causing a latent construct) only the weights rather than the loadings need to be considered in assessing the measurement model [Au et al. 2008; Chin 1998b]. The results indicated that the score loadings for all the constructs with reflective measures were exceed 0.70 and statistically significant [Hair et al. 1998]. For formative measures, one dimension of system quality (Integration) and one dimension of information quality (Accuracy) were insignificant, thus we excluded these dimension from the analysis. We re-do the analysis and the final result showed that the weights for the formative measures were

also statistically significant, indicating satisfactory item reliability for both the reflective and formative measures [see table 4].

Construct	Type of Indicator	Item	Item mean	Standard Deviation	Standardized Factor Loading (weights for formative measures)	t-value (p<.001)
Information Quality	Formative	CP	4.89	1.06	0.18	2.60
		FT	4.89	1.08	0.51	2.66
		CR	4.96	1.12	0.40	2.36
System Quality	Formative	RL	4.82	1.14	0.41	2.27
		FX	4.92	0.97	0.27	2.22
		AS	4.92	1.02	0.25	2.78
		TL	4.84	1.14	0.25	2.10
Trust	Reflective	TR1	4.95	1.20	0.89	28.30
		TR2	5.03	1.13	0.95	84.06
		TR3	4.93	1.18	0.88	25.91
Perceived usefulness	Reflective	PU1	5.18	1.19	0.94	70.87
		PU2	5.16	1.14	0.94	59.62
		PU3	5.23	1.16	0.93	49.64
		PU4	5.16	1.22	0.94	64.86
End user satisfaction	Reflective	SF1	5.00	1.12	0.94	57.21
		SF2	4.97	1.18	0.96	107.26
		SF3	4.86	1.31	0.94	80.59

Table 4: Measurement Model

Additionally, we also evaluated composite reliability (threshold value >0.7), and average variance extracted (AVE) to measure whether the variance the construct captures exceeds the variance due to measurement error (threshold value >0.7) [Fornell and Larcker 1981] [see table 5].

In order to test the discriminant validity, firstly we examined the extent to which each measured construct has higher loadings on the indicators in its own block than indicators in other blocks [Chin 1998b; Nicolaou and McKnight 2006]. Furthermore, we compare the square root of AVEs to the correlation scores, that is, the AVE of two measured constructs should be greater than the correlation between the two constructs [Fornell and Larcker 1981] [see table 4].

We investigated the possibility of common method bias by employing Harman's one factor test [Podsakoff et al. 2003]. The percentage of variance explained by one general factor was 41.2%, indicating no single factor accounted for the majority of variance. Moreover, we employed a single method factor test in PLS [Liang et al. 2007]. The results indicated that score loadings from the latent method factor were insignificant and indicators' substantive variances were much greater than their

method variance. Thus, we conclude that common method bias was not a serious issue in the current study.

Construct	CR	AVE	Factor Correlation*				
			IQ	SQ	TR	PU	SF
IQ	*NA*	*NA*	**089**				
SQ	*NA*	*NA*	0.78	**0.85**			
TR	0.94	0.83	0.69	0.72	**0.91**		
PU	0.97	0.88	0.59	0.70	0.78	**0.94**	
SF	0.96	0.90	0.67	0.74	0.78	0.73	**0.95**

*Legends: IQ: Information Quality; SQ: System Quality; TR: Trust; PU: Perceived Usefulness; SF: End-user Satisfaction; CR: Composite Reliability; AVE: Average of Variance Explained; NA: Not applicable: since formative measures need not co-vary, the internal consistency of formative items is not applicable [Chin 199]; * Diagonal elements represent square root of AVE for that construct.*

Table 5: Scale Properties and Correlation Scores

5.2 Structural Model and Hypotheses Testing

The next step of our data analysis was testing our proposed hypotheses in the structural model [Figure 2]. For mediating tests, we followed the approach recommended by [Johnson 2007] [see table 6]. Trust fully mediated the effects of information quality to perceived usefulness and end-user satisfaction. Information quality was significantly influenced trust, but not perceived usefulness (validating H1).

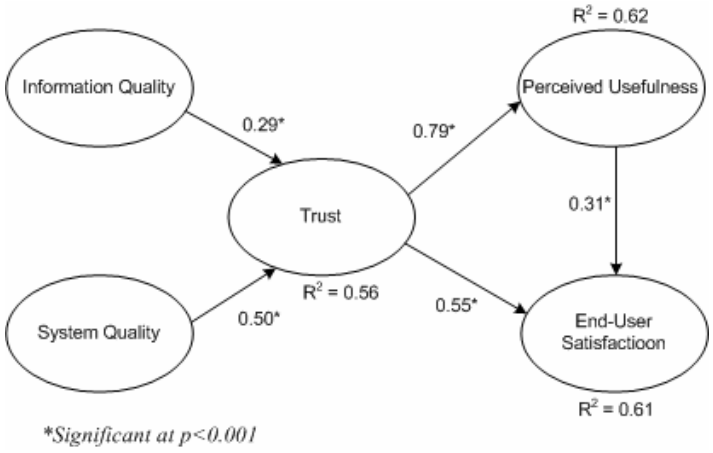

Figure 2: Hypotheses Result

Also, the effect of information quality on end-user satisfaction became insignificant in the presence of trust, supporting H3. Trust partially mediated the effects of system quality on both perceived usefulness and end-user satisfaction, indicated by the

coefficient decreased from 0.65 to 0.37 and from 0.54 to 0.23 respectively, in the presence of trust. Therefore, H2 and H4 were supported. The path coefficients of both trust to perceived usefulness and trust to end-user satisfaction were statistically significant. Thus, H5 and H6 were supported by the data.

Lastly, as shown in the figure, the result indicated that perceived usefulness has significant impact on end-user satisfaction, accepting H7. The R^2 for trust, perceived usefulness, and end-user satisfaction were 57%, 66%, and 70% respectively, indicating that the model provides strong explanation of variance in trust, perceived usefulness, and end-user satisfaction.

Dependent Variable	**Step 1: Ind Med**	**Step 2: Med Dep**	**Step 3: Ind Dep**	**Step 4: Ind Dep (In the presence of trust)**	**Conclusion**
Perceived Usefulness					
Information Quality	0.54*		0.07	-0.14	Fully Mediated
System Quality	0.31*		0.65*	0.37*	Partially Mediated
Trust		0.79*		0.60*	
R^2	0.56	0.61	0.50	0.66	
End-User Satisfaction					
Information Quality	0.54*		0.26**	0.11	Fully Mediated
System Quality	0.31*		0.54*	0.23*	Partially Mediated
Trust		0.79*		0.39*	
R^2	0.56	0.65	0.66	0.70	

$*p<0.001$, $**p<0.05$

Legends: Ind: Independent; Dep: Dependent; Med: Mediation

Table 6: Test of Mediating Effects of Trust

5.3 Discussion

The empirical results provided strong evidence for the explanatory power of our research model. Firstly, we found that the trust mediated the effects of information quality to perceived usefulness and end-user satisfaction. Thus, H1 and H3 were accepted. These results successfully confirmed the importance of trust in mobile

banking environment. We should note, however, that the trust role in online environment proposed by previous studies [e.g. Gefen et al. 2003; Pavlou 2002; Pavlou et al. 2007] is relatively different from mobile environment. While information can be presented clearly on the PC-screen, this e-commerce advantage has been recognized as one of the drawbacks of mobile service. Thus, upon the limitations of mobile banking such as small screen and its tiny keyboard [Lee and Chung 2009], customers still consider use this mobile device for information access in "anytime and anywhere" situation. That is, however, should be supported by the presence of trust. Moreover, mediated by trust, high quality information helps reduce the levels of perceived uncertainly and risk because such information should provide what is needed to conduct the transaction in the controlled manner and should therefore alleviate the uncertainly and associated risks [Kim et al. 2008]. Therefore, we argued that credible information is gained only after the users have both engaged in trust-relationship and assessed the "trustworthiness" of the system [McKnight et al. 2002], in turn, increase their perceived usefulness and end-user satisfaction.

Second, as we proposed and expected, the both relationships of system quality and perceived usefulness and system quality and end-user satisfaction were partially mediated by trust, supporting H2 and H4. It is clear that reliability, flexibility, accessibility, and timeliness are the key indicators of customers' belief that mobile banking may improve their transaction performance, and lead to customer satisfaction. Consistent with prior trust literatures, this study also confirmed that the use of technology-enabled services implies confidence and trust that the system will perform satisfactorily, accurately and reliably, and deliver the services required [Walker and Johnson 2006]. Furthermore, we argued that for users in developing world, the existence of mobile banking is likely more about accessibility and affordability [Donner and Tellez 2008] through the trust mediation.

Third, the direct effects of trust in both perceived usefulness (H5) and end-user satisfaction (H6) demonstrated by this study support the relevance of the previous trust literatures. These results confirmed that a high level of trust is positively associated with the performance perceptions of system [Teo et al. 2009]. Customers' trust on mobile banking transactions have some unique dimensions, such as the extensive use of mobile device for transaction, the distance and impersonal nature of mobile environment, and the implicit uncertainly of using an open technological infrastructure for transactions [Yousafzai et al., 2003], that is, under this circumstance, trust is necessary to establish usefulness and satisfaction toward the mobile service. Lastly, the result provided support of the positive relationship between perceived usefulness and end-user satisfaction, accepting H7. This finding corroborates research findings by [Au et al. 2008; Seddon 1997; Wang et al. 2006], indicating that usefulness are initially relevant to increase end-user satisfaction toward mobile banking.

6 Conclusions

Generally, our empirical study has successfully investigated the role of trust in mediating the interrelationships of the success factors (information quality, system quality, perceived usefulness, and end-user satisfaction). By selecting Indonesia as

our research intention, we have shown interesting findings as critical contributions for both IS researchers and practitioners.

6.1 Limitation

We call for further studies to assess the generalizability of our findings. First, our study was carried out in Indonesia, under relatively moderate technology development, thus further studies should be conducted in various countries. Second, we did not have a large sample size for this empirical study for the penetration of mobile banking in this country is relatively low [Donny and Mudiardjo 2009]. We just had a hundred valid respondents of three hundred registered respondents. A rigid and more structural survey is needed for future research. Third, we only measured four success factors (two quality factors and two dependent variables). Future research may consider other success factors. Forth, although we have tested for the possibility of common method bias [Podsakoff et al. 2003] further research may use multiple methods when collecting the data. Lastly, as we collected data in education institutions, further research is needed to verify the model by using different sample characteristics.

6.2 Implication for Further Research

Our empirical results provided some implications for future research. First, this study found that trust mediates the interrelationships of success dimensions. This model provides a holistic view of trust-success connection process of mobile banking. We indicated that trust is relevant in the situations where one must enter into risks but has incomplete control over the outcomes [Kim et al. 2008]. Unlike the online banking environment, mobile banking service demands on small-screen device as the information media. Once the customers interact with mobile banking, information and system quality may become the key indicators of perceived usefulness and end user satisfaction through trust mediation. With regard to the limitation of information presentation of mobile device, trust is essential in order for the customers to associate the benefits of mobile banking. Since we limited our research model on the main outcomes of IS (perceived usefulness and end-user satisfaction), further research is needed to verify the roles of mediating trust by extending the model to measure net benefits as suggested by IS success literatures.

Second, while many researchers have not systematically explored how trust may operate in mobile banking environment [Vance et al. 2008], through this study, we have developed a new understanding of such trust-success relationships of mobile banking in different context. Even though we measured trust as a unidimensional construct, our trust definition covers the social and technical aspect of trust. However, as some authors [e.g. Gefen et al. 2003] indicated that trust is a multi-dimensional construct, we called for a further research to measure trust from this point view.

Third, our study has empirically test mobile banking in Indonesia. While most of previous studies in electronic banking were conducted in advanced countries, we claimed that the researchers should consider developing countries (i.e. Indonesia), particularly if they exclusively focus their research on the role of trust, for trust is a prerequisite of financial transaction under uncertainly situation [Donner and Tellez 2008]. Further research may investigate the relevance of this model by employing other developing countries.

Lastly, via the measurement of interrelationships of success factors, we also confirmed that the validity of these relationships depends on the system and research environment as well. For instance, the results indicated that information quality and system quality bring significant contributions on both usefulness and satisfaction with the presence of trust. It is also interesting to examine the importance of other quality attributes (e.g. service quality) mediated by trust in determining usefulness and end-user satisfaction as compared to system/information quality factors. Thus, further study is needed to extend our current model by combining other quality dimensions (e.g. service quality) to verify our findings.

6.3 Implication for Practices

From a practical stand point, the results highlight several trust-success enhanced factors that may guide the successful completion of mobile banking, particularly in developing country. Firstly, we posit that the success of this industry depends on customer's perception of trust in the banks and technology characteristics. Customers may estimate whether a vendor is trustworthy or not based on their evaluation of the quality attributes [Kim et al. 2004; McKnight et al. 2002]. The result pointed out that information presentation is the main disadvantage of mobile banking. The user may gain the usefulness of this information if they find the existence of trust in the transaction-relationship. Therefore, to cope with the limitation, the banking and financial managers should provide the information-based trust to their users. Because of the limitation of mobile technology, the manager may also give more intention on the user interface design to establish a loyal customer base [van Biljon and Kotze 2008].

Secondly, the quality of mobile banking and customers' trust levels affect the degree of satisfaction with mobile banking. It seems that system quality plays a dominant role in mobile banking. Recognizing the fact that the adoption of this mobile service is still insignificant [Mallat 2004], our study suggested that it relates to the trust-quality issue. Supporting [Florick and Chen 2004], we argued that the complexity of its transaction, lack of user-friendly mobile portals, and slow connectivity might be the crucial problems during its usage intention, especially in developing countries (i.e., Indonesia), where mobile-connectivity is still under-developed. This finding suggested that in order to increase the success rate of this technology in developing countries (i.e., Indonesia) the providers should ensure the quality factors work properly.

Lastly, as trust can be assessed through each interaction with the IT where the transaction will either increase or decrease the individual's trust in the system, we suggest the banking managers in Indonesia to find out the ways to establish such a solid trust with their customers. Some practical ways such as strengthening their IT infrastructures, encouraging the intensity of banking transaction on mobile banking should be considered as alternatives of their efforts.

Acknowledgements

This study was supported by research fund from Chosun University, 2008.

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Appendix A. Measurement Items

Variables		Items
Information Quality	Completeness	• MB provides me with a complete set of information • MB provides me with all the information I need
	Accuracy	• *MB produces correct banking information (dropped)* • *There are few errors in the information I obtain from MB (dropped)*
	Format	• The banking information provided by MB is well formatted • The banking information provided by MB is clearly presented on the screen
	Currency	• MB produces the most current information • The information from MB is always up to date
Systems Quality	Reliability	• MB performs reliably and securely • The operation of MB dependable
	Flexibility	• MB can be adopted to meet a variety of needs • MB can flexibly adjust to new demands or conditions

	Integration	• *MB effectively integrates data from several accounts (dropped)* • *MB effectively combines data to meet user's need (dropped)*
	Accessibility	• MB allows information to be readily accessible to me • MB makes information easily to access
	Timeliness	• MB provides information in timely fashion • MB returns answers to my request quickly
End-user Satisfaction		• Overall, I'm satisfied with the self-service of MB • The whole self-service technology through MB offered by the bank exceed my expectation • The whole self-service technology through MB offered by the bank are close to my ideal expectation
Perceived usefulness		• I can accomplish my banking tasks more quickly using MB • I can accomplish my banking tasks more easily using MB • MB enhances my effectiveness in utilizing banking service • MB enhances my efficiency in utilizing banking service
Trust		• I can trust MB • I trust the information presented by MB • I feel this MB would provide me with good service

MB: Mobile Banking