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Modeling the Success of Application-Based Mobile Banking

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Abstract: The present study addresses the issue of mobile banking customer retention by developing and empirically testing a theoretical model that describes the way mobile banking success is achieved. The data collection process was conducted via a web-based questionnaire survey through which 402 usable responses from users of application-based mobile banking services were collected. The data collected were further analyzed via covariance-based structural equation modeling. Results indicate that application-based mobile banking success can be defined in terms of the favorable attitude toward and repeated use of mobile banking applications. Experienced advantage, user satisfaction, and post-use trust toward mobile banking applications are among the critical enablers of application-based mobile banking success. The findings of this research can enable academicians and practitioners, banks, and financial institutions, in particular, to devise the mechanism through which the success of application-based mobile banking services can be facilitated.

Keywords: mobile banking; loyalty; repeated use; satisfaction; trust; mobile commerce; banking performance

1. Introduction

Under the worldwide hyperactive competition across the banking industry, contemporary banks strive to offer new banking technologies to advance the infrastructure and capability of the banking system (Wonglimpiyarat 2014). Mobile banking, as the newest delivery channel established by large to retail and microfinance banks, has offered numerous advantages to both customers (users of mobile banking), as well as banks as the service provider (Mohammadi 2015). Mobile banking offers customers the privilege of performing many banking activities, such as account balance inquiry and bill payment, anytime and anywhere (Tam and Oliveira 2016). Moreover, mobile banking services provided by banks are usually safe, secure, and usually free of charge in most advanced countries (Shaikh and Karjaluoto 2015). The advantages of mobile banking are not limited to bank customers (Baabdullah et al. 2019). Banks can achieve salient operational efficiency by offering mobile banking services given the expenses associated with processing a transaction via mobile banking can be up to two times lower than via online (web) banking, ten times lower than via an ATM, and up 50 times lower than by a branch (Deloitte 2010). Indeed, a Fiserv study of major banks and credit unions has revealed that when financial institutions develop robust mobile channels that serve the needs of mobile banking customers, advantages, such as reduction of drop-in branch and ATM-based transactions, coupled with increased debit and credit card usage, provide them with superior financial gains (Fiserv 2016).

Thanks to the advancement of mobile technologies and widespread of digital banking services, customers can install multiple mobile banking applications in their smartphones/devices and switch, sometimes permanently, to different application-based mobile banking services, or even alternate banking channels (e.g., web banking). It means retaining application-based mobile banking users may not be an easy task, and it is crucial to banks to recognize what factors contribute to the success of their application-based mobile banking services (Baptista and Oliveira 2015; Gu et al. 2009; Mohammadi 2015; Wonglimpiyarat 2014). The diffusion of any technological innovation involves two distinct stages of initial adoption and post-adoption (Zhou 2011), and application-based mobile banking is no exception (Mohammadi 2015). The mobile banking initial adoption has received much attention from academia (Shaikh and Karjaluoto 2015). Prior literature has provided evidence that task-technology fit, perceived ease of use, initial trust, perceived usefulness, and effort expectancy are among key determinates of an individual's decision in adoption and further use a mobile banking service (Baptista and Oliveira 2015; Gu et al. 2009; Laukkanen 2016; Lin 2011; Oliveira et al. 2014; Zhou et al. 2010). It is after the initial adoption phase that an individual may use mobile banking services. Thus, the behavioral intention of customers toward the reuse of a particular mobile banking service can be only assessed at the post-adoption stage (Kuo et al. 2009).

Contrary to the mobile banking initial adoption stage, the understanding of the way existing application-based banking customers remain behaviorally loyal to a particular application is severely limited. Banks generally offer the application-based banking service free of any charge to potential customers. Thus, they are forced to absorb the entire development costs of this service. Since customers of application-based mobile banking can receive the required banking service through multiple alternative banking channels (e.g., internet banking or other digital banking services from competitors), customer retention in terms of behavioral loyalty toward the repeated use of the mobile banking application is vital to sustained profitability of banks (Baabdullah et al. 2019).

The present study strives to advance the application-based mobile banking literature and practice by modeling the mechanism through which customers of the application-based mobile banking service ultimately form behavioral loyalty to the reuse of the application, a research topic that has received little attention to date.

2. Review of Literature

The genesis of mobile banking dates back to the late 1990s when Paybox and Deutsche Bank first offered text-based banking via mobile phones (Shaikh and Karjaluoto 2015). However, banks confronted numerous mobile banking challenges until the first smartphones hit the market in 2007. With the widespread of tablets and smartphones, the financial institution developed and offered their mobile banking software, usually called the mobile banking application, to allow customers to conduct banking operations remotely (Ghobakhloo et al. 2013). Today, instead of using text-based banking or internet browsers to access the bank website via mobile devices, customers can easily use mobile banking applications to conduct a variety of banking operations (Tam and Oliveira 2016).

Previous studies on mobile banking can be divided into two main strands of research. The first strand of research addresses the issues related to the initial adoption of mobile banking (e.g., Akturan and Tezcan 2012; Alalwan et al. 2017; Chaouali et al. 2017; Mohammadi 2015; Montazemi and Qahri-Saremi 2015). As explained in Table 1, these studies mainly investigate consumer adoption behavior toward mobile banking and offer insights into the diffusion pattern of this type of technological innovation. In this well-studied strand of research, the underlying objective has generally been to discover personal attributes that influence potential adopters' intention toward mobile banking adoption (Shaikh and Karjaluoto 2015). Popular models employed to achieve this objective include the Technology Acceptance Model (TAM) (Davis et al. 1989), the Theory of Planned Behavior (TPB) (Ajzen 1991), Task-Technology Fit (TTF) (Goodhue and Thompson 1995), the Diffusion of Innovation (DOI) theory (Rogers 1983), the Theory of Reasoned Action (TRA) (Fishbein and Ajzen 1975), and the Unified Theory of Acceptance and Use of Technology (UTAUT) introduced by Venkatesh et al. (2003).

Table 1. Selected empirical studies on mobile banking adoption.

Study	Survey Overview	Theoretical Basis	Findings
Gu et al. (2009)	A web-based survey of 910 users of Wooribank mobile banking service	Technology Acceptance Model (TAM) and the trust-based TAM	Trust, perceived ease of use, and perceived usefulness are three direct antecedents of behavioral intention. These variables, in turn, are determined by social influence, system quality, self-efficacy, and facilitating conditions, among others
Chung and Kwon (2009)	Survey of 397 users of mobile banking in Korea	DeLone & McLean IS success model	Information and system quality directly affect customer satisfaction, while information presentation fails to do so. Trust can potentially moderate these relationships
Zhou et al. (2010)	Survey of 250 users of mobile banking	Unified Theory of Acceptance and Use of Technology (UTAUT) and Task-Technology Fit (TTF)	Factors, such as facilitating conditions, task-technology fit, performance expectancy, and social influence, are among determinants of mobile banking adoption
Lin (2011)	Survey of 177 potential and 191 repeat customers of mobile banking	Diffusion of Innovation (DOI)	Factors, such as competence, relative advantage, and compatibility, are critical determinants of attitude. The attitude, in turn, leads to behavioral intention to mobile banking adoption or continued usage
Zhou (2011)	Survey of 210 users of mobile banking	DeLone & McLean IS success model, Theory of Reasoned Action (TRA) and trust background	Structural assurance, coupled with information quality, can develop initial trust. System quality and information quality predict perceived usefulness, which is, in turn, affected by the initial trust. Initial trust and perceived usefulness, collectively, determine mobile banking usage intention
Akturan and Tezcan (2012)	Survey of 435 non-users of mobile banking	TAM	Attitude toward mobile banking is predicted by traditional determinants, such as perceived social risk, perceived benefit, and perceived performance. Attitude, in turn, determines mobile banking adoption intention
Kang et al. (2012)	Survey of 370 Korean mobile-banking users	DOI, TAM, TRA, and Theory of Planned Behavior (TPB)	Sustained use of mobile banking among Korean users is determined by perceived usability, perceived value, and channel preference
Oliveira et al. (2014)	Survey of 194 potential users of mobile banking	TTF, UTAUT, and initial trust model	Behavioral intention is affected directly by initial trust, task-technology fit, and performance expectancy. Mobile banking, in turn, is affected by behavioral intentions, as well as facilitating conditions
Mohammadi (2015)	The online survey of 128 potential users of mobile banking	TAM, UTAUT, and DOI	In the mobile banking context, compatibility determines attitude. Resistance is negatively associated with ease of use and usefulness. The relationship between usefulness and attitude is moderated by personal innovativeness, as well as subjective norms
Montazemi and Qahri-Saremi (2015)	Review of 25,265 cases in the context of online banking adoption	Grounded Theory Literature Review method	Trust in the physical bank, trust in online banking, and perceived ease of use and usefulness significantly affect mobile banking adoption intentions. Besides perceived usefulness, trust in the physical bank and trust in online banking directly determine continued use intention toward online banking
Tam and Oliveira (2016)	The online survey of 233 individual users of mobile banking	DeLone & McLean IS success model and TTF model	Individual performance is determined by user satisfaction, as well as system use. Task-technology fit moderates the influence of system use on performance. Quality dimensions of mobile banking positively affect user satisfaction
	An online survey of Tunisian bank customers	The theory of trying	Three different types of attitudes (toward success, failure, and learning to use) determine attitude toward mobile banking, which, in turn, determines the mobile banking adoption indention directly

Table 1. *Cont.*

Study	Survey Overview	Theoretical Basis	Findings
Al-Otaibi et al. (2018)	The online survey of mobile banking application users in the United Kingdom, as well as the Kingdom of Saudi Arabia	User satisfaction background	Although system quality directly determines customer satisfaction in the United Kingdom, this relationship, however, has been insignificant among Saudi Arabian users. Customer satisfaction, in turn, is affected by the interface design, as well as information quality. Satisfaction with mobile banking was observed to be higher in the UK
Zhou (2018)	Survey of 309 users of mobile service users in China	IDT, TTF, UTAUT, and IS success model	Relative advantage, trust, and social influence, among other factors, determine mobile banking switching intention
Sharma (2019)	The electronic survey of Omani mobile banking users	TAM	The two variables of trust and autonomous motivation are critical predictors of mobile banking acceptance among Omani users

The second strand of research concerns the post-adoption states of mobile banking, which is in its infancy. Table 1 explains that only a handful of recent studies have attempted to understand the determinants of satisfaction with mobile banking (Al-Otaibi et al. 2018; Ghobakhloo et al. 2013), individual performance of mobile banking users (Tam and Oliveira 2016), and sustained usage of mobile banking (Kang et al. 2012).

3. Model and Hypotheses Development

Mobile commerce research is abundant, but the concept of mobile banking reuse behavior is severely understudied. For addressing this research gap, the present study drew of DeLone and McLean (2004) electronic commerce (EC) success model, commonly referred to as the D&M EC success model, and developed the proposed research model within Figure 1. The following facts support our decision for selecting the D&M EC success model as the preferred theoretical basis:

1. The literature considers the D&M EC success model as an all-inclusive post-adoption assessment framework, and a great deal of empirical research has already validated the associations proposed by this model, e.g., (Lee and Chung 2009; Petter and McLean 2009; Tam and Oliveira 2016; Zhou 2013);

2. Due to the popularity of this model, prior scholars have introduced and validated countless measurement items for assessing dimensions (variables) proposed by the D&M EC success model (Ghobakhloo et al. 2015; Petter et al. 2008; Urbach et al. 2010), and;

3. Review of the literature indicates that the D&M EC success model, and its predecessors, the original and updated D&M IS success model (DeLone and McLean 1992, 2003) are the dominating and most frequently used frameworks for the post-adoption assessment of EC/IS (Petter et al. 2013; Petter and McLean 2009; Urbach and Müller 2012). Examples of the application of the original or updated D&M IS success model include the assessment of employee portal success (Urbach et al. 2010), student information system usage (Rai et al. 2002), mobile banking user satisfaction (Chung and Kwon 2009), EC website success (Chen et al. 2013), enterprise resource planning implementation success (Ram et al. 2013), success of prescription-release IS (Ku et al. 2014), and individual performance of mobile banking users (Tam and Oliveira 2016).

The D&M success model and its variants offer a valuable framework for comprehending the IS/EC post-adoption phenomenon. However, the D&M success model is limited, in the sense that it mainly focuses on system characteristics. Thus, it has been a standard procedure within the literature to extend the D&M success model by integrating it with other well-known theories and models, as well as further enhance its robustness, e.g., (Ghobakhloo et al. 2014; Tam and Oliveira 2016; Zhou 2013). Consistently, we incorporated perceptual factors and beliefs, crucial to the study of the e-service usage behavior,

offered in IS acceptance research (Petter et al. 2013) and customer trust research (McKnight et al. 2002), as well as the theory of brand loyalty (Oliver 1999) to the D&M EC success model.
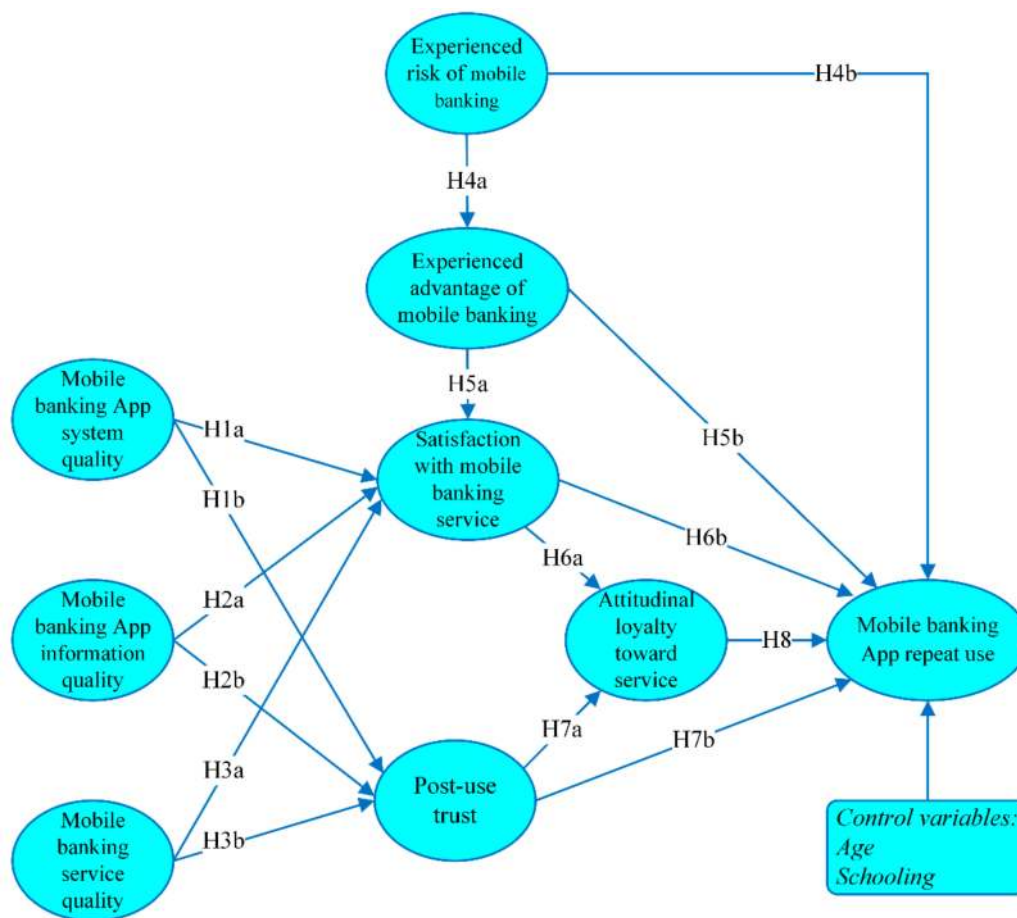

Figure 1. The research model of study.

3.1. Hypotheses

System quality refers to different technical characteristics of the digital application, such as accessing speed, ease of interaction, navigation, and visual appeal (Gu et al. 2009; Zhou 2013). The IS literature, viewed from the individual level of analysis, firmly acknowledges the impact that system quality has on user satisfaction (Petter et al. 2008). The mobile banking background also supports this particular relationship, as Lee and Chung (2009) and Tam and Oliveira (2016), for example, showed when mobile banking application is easy to operate, offers access to needed information, and operates accurately, users' satisfaction with the digital service tends to increase. Alternatively, experts believe that if mobile banking systems are challenging to operate and have a poorly designed interface, users may assume that service providers, banks in the case of this study, are incapable of offering quality services, an undesirable condition that negatively affects their trust (Zhou 2013). We consistently draw on the Hernandez-Ortega (2011) concept of post-use trust and speculate that an existing user of a particular banking service has already experienced the majority of the quality characteristics of that service. Therefore, when the user perceives and experiences the quality aspects of a mobile banking application, they will develop a higher degree of experienced-based trust.

Hypothesis 1a. *Mobile banking application system quality exerts a significant positive effect on satisfaction with mobile banking service.*

Hypothesis 1b. *Mobile banking application system quality exerts a significant positive effect on post-use trust.*

Information quality denotes the favorable characteristics of outputs of an IS, such as accuracy, understandability, and completeness of reports (Petter and McLean 2009). The literature explains that, at the individual unit of analysis, the relationship between information quality and user satisfaction is strongly supported (Akter et al. 2013; Urbach et al. 2010). Recent studies have provided strong evidence for this relationship in the mobile banking settings and revealed that poor information quality might force users to spend much effort on information scrutinizing leading to a lower level of satisfaction with mobile banking (Tam and Oliveira 2016; Zhou 2013). The literature also argues that users expect mobile banking to better facilitate different banking activities as compared to alternative banking channels, anytime from anywhere (Akturan and Tezcan 2012). If the information provided by the mobile banking system is irrelevant, imprecise, or out-of-date, users may doubt the reliability of reports and information from the mobile banking system, which might negatively impact their trust in the mobile banking and the service providers (Lee and Chung 2009; Zhou 2011; Zhou 2013).

Hypothesis 2a. *Mobile banking application information quality exerts a significant positive effect on satisfaction with mobile banking service.*

Hypothesis 2b. *Mobile banking application information quality exerts a significant positive effect on post-use trust.*

Many scholars attempted to link service quality to user satisfaction. Nevertheless, their results were mixed and inconclusive (Urbach and Müller 2012). This inconsistency can be attributed to scholars measuring service quality using multiple methods (Petter et al. 2008). Within the mobile banking context, service quality relates to the quality of support that a user receives from a mobile banking service provider in times of need, reflecting characteristics, such as reliability, technical competence, and responsiveness of the support center. Tam and Oliveira (2016) showed that it is common for users of mobile banking applications to face technical issues, such as usability problems, and when users receive professional, timely, detailed, and truthful support from their service provider, they form higher levels of satisfaction with the service. The review of the literature indicates that the relationship between service quality and post-use trust is deeply unexplored. Building on the service quality-trust relationship research in the EC/IS setting (e.g., Leclercq 2007; Liu et al. 2011), we speculate that providing quality support to users will indicate service providers' benevolence and technical competence. Conversely, if service providers offer unreliable and untrustworthy services, sluggish response, and weak support, users will not build trust in their services. Thus, we expect users receiving a higher level of service quality develop a higher degree of post-use trust in the mobile banking context.

Hypothesis 3a. *Mobile banking service quality exerts a significant positive effect on satisfaction with mobile banking service.*

Hypothesis 3b. *Mobile banking service quality exerts a significant positive effect on post-use trust.*

Perceived risk has been a critical factor for behavioral decision theories and has been frequently included in models and frameworks that explain consumer behavior in various marketing environments, including mobile banking (Kang et al. 2012; Wu and Wang 2005). Mobile transactions involve risk because a user's decision has consequences that cannot be predicted correctly, some of which could be unpleasant (Featherman and Pavlou 2003). Risk is particularly more salient to users of mobile banking due to the spatial separation from the bank, the security issues with the mobile device itself, and the security issues entangled with the internet networks, as well as the mobile banking application (Chen 2013). It is well agreed that environmental and behavioral uncertainties that are related to possible threats and losses can increase the risk perception of individuals. The perceived risk, in turn, influences users' cognitive recognition development regarding the usefulness and benefits of mobile banking services (Luo et al. 2010). Consistently, the experienced risk associated with a mobile banking

application/service within the post-adoption phase decreases the users' experienced value of the service (Kang et al. 2012). Scholars also believe that mobile banking application usage intention contains a certain amount of uncertainty. Thus, perceived risk should be considered as a crucial determinant of behavioral intention toward mobile banking application usage (Luo et al. 2010; Wu and Wang 2005). We expect this link to be even stronger in the post-adoption phase, where users who have experienced a mobile banking application/service as less risky in practice would be more likely to reuse it.

Hypothesis 4a. *Experienced risk of mobile banking exerts a significant negative effect on the experienced advantage of mobile banking.*

Hypothesis 4b. *Experienced risk of mobile banking exerts a significant negative effect on mobile banking application repeated use.*

Within the IS acceptance literature, perceived usefulness, commonly known as net benefits or relative advantage, is regarded as a critical determinant of usage behavior (Davis et al. 1989; DeLone and McLean 1992; Venkatesh et al. 2003). Similar to trust, perceived usefulness varies for initial and post-adoption stages. Perceived usefulness in the initial adoption stage refers to the expected advantage of a system as assumed by potential users who have not experienced the system yet. Perceived usefulness in the post-adoption stage, however, refers to experienced advantages of a system by existing users of the system (Bhattacherjee 2001). D&M IS success taxonomy proposes that usefulness (net benefits) can directly determine post-adoption usage behavior. In effect, numerous IS scholars provided empirical support for the direct association of perceived usefulness and post-adoption usage behavior (e.g., Khalifa and Liu 2007; Saeed and Abdinnour-Helm 2008; Thong et al. 2006; Wang 2008). In the mobile banking context, scholars observed that in the initial adoption stage, perceived usefulness is an essential determinant of users' adoption intentions (e.g., Luarn and Lin 2005). More recent studies also supported this link at the post-adoption stage. Gu et al. (2009) showed that, in the post-adoption phase, perceived usefulness influences intention to reuse mobile banking. Consistently, Kang et al. (2012) reported that once current users of a mobile banking service perceive it as valuable and beneficial, they would develop continued usage behavior. These facts, collectively, lead us to propose that:

Hypothesis 5a. *Experienced advantage of mobile banking exerts a significant positive effect on user satisfaction with mobile banking service.*

Hypothesis 5b. *Experienced advantage of mobile banking exerts a significant positive effect on mobile banking application repeated use.*

The positive effect of user satisfaction (with a particular service) on the attitudinal and behavioral loyalty has been acknowledged consistently within the marketing literature (Anderson and Srinivasan 2003; Kashif et al. 2015; Hallowell 1996; Yang and Peterson 2004). EC literature, for example, explains that dissatisfaction toward a product or service may cause customers to develop disloyalty traits, which in turn results in customers searching for replacements, attempting to decrease dependence on the service provider, and resisting the retention efforts (Anderson and Srinivasan 2003). Bhattacherjee (2001) extended the application of expectation confirmation theory (Oliver 1980) to the IS discipline and revealed that the satisfaction of IS users' expectations would be associated with the development of system reuse intentions among users. Extending to the mobile phone service setting, Lee et al. (2001) further confirmed that when users of a system are satisfied with it, their repeated use behavior (behavioral loyalty) rate is significantly higher than unsatisfied users. Khalifa and Liu (2007), in an online-shopping context similarly found that users' intentions for online repurchase are a product of a rational assessment of users' satisfaction with online banking. Besides, the empirical study by Seo et al. (2008) on customer retention behavior in the

mobile telecommunications service context supported the direct relationship between satisfaction and loyalty. Consistently, Hong and Cho (2011) empirically supported this relationship within the business to customer EC environment. In the mobile commerce setting, Lin and Wang (2006) offered similar results and showed that users' satisfaction directly determines customer loyalty. Consistently, we draw on the previous IS and marketing research, as well as the existing evidence within the mobile banking literature (e.g., Lin 2011; Mohammadi 2015), and speculate that satisfied mobile banking users will first develop dispositional commitment toward the bank that provides a particular application-based mobile banking service and further perform the repeated use of the application.

Hypothesis 6a. *Satisfaction with mobile banking service exerts a significant positive effect on attitudinal loyalty toward service.*

Hypothesis 6b. *Satisfaction with mobile banking service exerts a significant positive effect on mobile banking application repeated use.*

The positive association of user trust and loyalty has been acknowledged widely within the marketing literature (Chaudhuri and Holbrook 2001; Sirdeshmukh et al. 2002). EC literature explains that since e-vendors or e-service providers can always, potentially, execute discouraging opportunistic behaviors, such as price-fixing or violating customer privacy, trust plays a significant role in the process of users developing attitudinal and behavioral loyalty. Consistently, Lin and Wang (2006) drew on the McKnight et al. (2002) concept of trust and defined mobile commerce trusting belief as a user perception of a particular mobile service provider attributes. Lin and Wang (2006) further showed that trusting beliefs of mobile commerce users directly predict their altitudinal and behavioral loyalty. Hong and Cho (2011) additionally showed that in the business to customer EC context, attitudinal loyalty and behavioral loyalty are determined by trust. Within the mobile banking context, there is strong evidence that when users perceive the mobile banking application or service as trustworthy, they tend to be more loyal to it attitudinally (Lin 2011) and behaviorally (Gu et al. 2009). Drawing on the findings of prior studies presented above, we propose that mobile banking service users those who trust a particular application-based mobile banking service initially form a higher level of dispositional commitment to the bank and the mobile banking service it offers and will have a higher intention toward repeated use of the mobile banking application.

Hypothesis 7a. *Post-use trust exerts a significant positive effect on attitudinal loyalty toward service.*

Hypothesis 7b. *Post-use trust exerts a significant positive effect on mobile banking application repeated use.*

Marketing scholars offer two diverse schools of thought when it comes to studying the brand loyalty phenomenon (Bandyopadhyay and Fraccastoro 2007). A significant strand of marketing literature views brand loyalty from the behavioral point of view whereas another strand of marketing literature draws on Dick and Basu (1994) perspective and assumes that customer loyalty should involve both the user's attitude, as well as the user's repeated purchase behavior (Chaudhuri and Holbrook 2001). Consistently, Oliver (1999) followed Dick and Basu (1994) perspective and introduced the loyalty continuum of cognitive loyalty → affective loyalty → conative loyalty → action loyalty. Similarly, Bandyopadhyay and Fraccastoro (2007) confirmed the Dick and Basu (1994) perspective of loyalty and found that behavioral loyalty is positively affected by attitudinal loyalty. More recently, Hong and Cho (2011), in their study of business to customer EC usage behavior, acknowledged that attitudinal loyalty and purchase intentions are distinguishable but related constructs. Hong and Cho (2011) empirically showed that loyalty is among the more significant determinants of repurchase intention within the e-marketplace business environment. Building on Dick and Basu (1994) perspective and related literature (Watson et al. 2015), we distinguish between attitudinal loyalty and behavioral loyalty toward the mobile banking service and propose that users who are satisfied with a specific

application-based mobile banking service, initially, grow positive beliefs toward it. Users' attitudinal readiness is evolved further into the readiness for reusing the mobile banking application.

Hypothesis 8. *Attitudinal loyalty toward service exerts a significant positive effect on mobile banking application repeated use.*

3.2. Control Variables

IS/EC acceptance literature mostly believes that demographic characteristics, such as users' age and schooling, may determine usage intention (Oliveira et al. 2014; Yu 2012). To remove the potential effects of age and schooling from the research model, we consider them as control variables in the present study.

4. Research Methodology

4.1. Instrument Development

This study followed the standard procedure for the development of the measurement instrument (questionnaire), which included adapting validated and reliable measurement items available within IS, EC, and marketing literature whenever possible, as well as following well-known measurement instrument development guides and instructions (DeLone and McLean 1992, 2003, 2004; Ghobakhloo et al. 2019; Straub 1989; Sethi and King 1991) for creating new items or significantly modifying existing items. Table 2 lists the measurement items used in this study. After creating the original version of the questionnaire, we formed a focused group that included five IS, EC, or marketing scholars who were experts in the context of IS and EC success. The focus group reviewed the original questionnaire and added four measurement items that initial questionnaire development stage ignored, removed one item exposed to misinterpretation, and modified seven measurement items that lacked sufficient clarity. In the next step, and after the improvements that focus group applied to the questionnaire, we piloted the final version of the questionnaire among 55 users of mobile banking applications. After addressing the minor issues inside the questionnaire identified during the pilot study, and excluding users who contributed to the pilot study form the pool of potential participants, the study executed the final data collection process. The questionnaire uses a seven-point Likert scale, ranging from 1 *extremely disagree* to 7 *extremely agree*, to measure the main variables of the model excluding the variable '*mobile banking application repeated use*'.

Table 2. Measurement instrument properties.

Variable	Items	Coding	Source
Mobile banking application system quality	*The main mobile banking application that I am currently using* . . . always provides me with needed information in a timely fashion. always operates reliably. enables me to access the needed information easily. has always been easy to interact with. has enabled me to conduct needed banking activities.	*SYSQ* SYSQ1 SYSQ2 SYSQ3 SYSQ4 SYSQ5	Chung and Kwon (2009), Ghobakhloo et al. (2013), Kang et al. (2012)
Mobile banking application information quality	*The main mobile banking application that I am currently using has provided me with* . . . all the information I need. up-to-date information. well-formatted information. accurate and reliable information. error-free and detailed information.	*INFQ* INFQ1 INFQ2 INFQ3 INFQ4 INFQ5	Chung and Kwon (2009), Lee and Chung (2009)
Mobile banking service quality	*With regard to the main mobile banking service and application that I am currently using, my service provider has* . . . been willing to solve my problems with mobile banking. paid adequate attention when I experience problems with mobile banking. always been ready to help me with my requests. been knowledgeable enough to answer my questions and inquiries.	*SERVQ* SERVQ1 SERVQ2 SERVQ3 SERVQ4	Wang (2008), Zhou (2013)

Table 2. *Cont.*

Variable	Items	Coding	Source
Experienced advantage of mobile banking	*The main mobile banking service and application that I am currently using …* has enabled me to accomplish more banking activities. has enabled me to perform banking activities more efficiently. has provided me with greater control over the financial transaction. has enabled me to perform banking activities more quickly.	*EXPA* EXPA1 EXPA2 EXPA3 EXPA4	Kang et al. (2012), Tam and Oliveira (2016)
Satisfaction with mobile banking service	*With regard to the main mobile banking service and application that I am currently using, I am satisfied with …* the information I get from the mobile banking service. the mobile banking service and the functionality of its mobile banking application. the overall performance of the mobile banking service.	*SATIS* SATIS1 SATIS2 SATIS3	Chung and Kwon (2009), Ghobakhloo et al. (2013), Tam and Oliveira (2016)
Post-use trust	*Based on my experience with the main mobile banking application that I am currently using, …* I believe I can trust it in protecting my personal information. I believe I can trust in it. I believe it is reliable. I believe it provides good service.	*PUT* PUT1 PUT2 PUT3 PUT4	Lee and Chung (2009), Luo et al. (2010), Zhou (2013)
Experienced risk of mobile banking	*With regard to the main mobile banking application that I am currently using, …* there have been several problems with my financial transactions. I have experienced monetary loss because of my mobile banking. I have experienced mobile banking application or account being hacked. there has been a considerable amount of risk involved with banking activities.	*RISK* RISK1 RISK2 RISK3	Akturan and Tezcan (2012), Kang et al. (2012)
Attitudinal loyalty toward service	*With regard to the main mobile banking service and its banking application that I am currently using, …* my preference for using mobile banking services would not willingly change. it would be difficult to change my beliefs about the mobile banking service. changing from mobile banking to alternate banking services (other banking channels, such as web banking) requires major rethinking.	*ATTL* ATTL1 ATTL2 ATTL3	Hong and Cho (2011), Mohammadi (2015)
Mobile banking application repeated use	*Please indicate the frequency of usage of the main mobile banking application for conducting the following banking activities: (8-point scale. 0, never used; 1, once a week; … ; 7, more than 20 times a week.* Viewing balance and account activity Inter/Intra account transfers 3rd party payments Debit card management ATM locators Accessing customer support Mobile bill payment	*MBRU* MBRU1 MBRU2 MBRU3 MBRU4 MBRU5 MBRU6 MBRU7	Kang et al. (2012), Wang (2008)

4.2. Research Design

The current research conducted a questionnaire-based survey for data collection from potential respondents. The electronic data collection process was executed via a popular online survey website from September 2018 to December 2018. This study is concerned with the post-adoption of application-based mobile banking. Therefore, at the beginning of the survey, we defined mobile banking as the use of mobile applications provided by banks installed on smartphones and tablets, which use mobile networks or wireless internet for communication with banking systems. We consistently asked respondents whether they currently use a mobile banking service for their banking activities. If a potential respondent did not actively use mobile banking, that person was excluded from the survey. To improve the generalizability of our study and to avoid potential bias, the research group benefited from the most popular social networking sites, including Facebook, LinkedIn, ResearchGate, and Reddit, to advertise our research and randomly contact potential respondents worldwide. In this survey, multiple responses were not allowed, and we benefited from the two dummy questions of -Do not respond to this item- to detect potential insincere responses and respondents who randomly mark questions without actually reading the contents. In general, a total of 2147 potential participants were contacted via email or private messages within the social networking sites. After accounting for non-adopters of mobile banking, insincere responses, and incomplete responses, 402 usable responses were received, which can be interpreted as the response rate of 18.72%. We did not apply any restrictions on the nationality of potential participants, and respondents came from different countries, including the Netherlands, Spain, Brazil, Iran, Portugal, the UK, Malaysia, the USA, Sweden, and Turkey. The profile of the sample is listed in Table 3.

Table 3. Demographic characteristics of the sample.

Variable	Type	Frequency	Percentage
Gender	Male	205	50.995%
	Female	197	49.005%
Age	Less than 22	63	15.672%
	22–26	102	25.373%
	26–35	109	27.114%
	35–45	86	21.393%
	More than 45	42	10.448%
Schooling	Lower than BSc	111	27.612%
	BSc	203	50.498%
	MSc or higher	88	21.891%
Mobile device	Smartphone	277	68.905%
	Tablet	125	31.095%

Overall, the study applied various measures to warrant the reliability of the data collected. Following the guidelines available within the literature, e.g., (Burton-Jones 2009; Kock 2015; Podsakoff et al. 2003), the study applied a non-response bias test, pilot test, Common Method Variance (CMV) analysis, item randomization, and systematic coding schemes among many other measures. We compared the early responses against the late responses to identify the potential non-response bias. Following the standard procedure within the literature, e.g., (Ghobakhloo et al. 2014), questionnaires were sorted based on the date of completion, from the oldest to the newest. A series of *t*-tests comparing the first quarter of responses (early responses) against the last quarter of responses (late responses) demonstrated that none of the essential variables statistically differs among the two groups. We also examined the potential existence of CMV because the study can mistakenly draw on the self-reported data collected and wrongly conclude on some specific effects while ignoring the fact that the research method itself might be the cause of effects (Malhotra et al. 2006). Consistently, the study benefited from the Exploratory Factor Analysis (EFA) to perform Harman's single-factor test (Podsakoff et al. 2003). EFA results showed that multiple factors could be extracted from the un-rotated factor solutions, and there is no single factor accounting for the majority of covariance (the highs amount of covariance accounted by a single variable was 12.22 percent). Since EFA did not show any trace of CMV, the study proceeded with the structural path analysis.

5. Analysis and Results

The study uses Covariance-based Structural Equation Modeling (CB-SEM) for data analysis and the assessment of hypothesized relationships. This decision is supported by the fact that the purpose of this study is theory building and confirmation (Hair et al. 2006, 2013). Consistently, the study follows the two-step approach introduced by Anderson and Gerbing (1988) for the assessment of the structural model. As such, the first step involves the assessment of measurement models for ensuring the reliability and validity of the measurement items, and the second step includes the assessment of the structural path model. The study utilizes IBM AMOS for performing SEM analysis.

5.1. Measurement Model

Consistent with the standard methodology for the application of CB-SEM (Hair et al. 2006, 2013; Jarvis et al. 2003; Petter et al. 2007), the study assessed the internal consistency reliability, convergent validity, discriminant validity, and the overall goodness of fit of the measurement model. Confirmatory factor analysis results presented in Table 4 indicate that the factor loading of each of the measurement items is above the acceptable level of 0.5 (Hair et al. 2006). This table also explains that Cronbach's alpha and composite reliability values for each of the latent variables are well above the commonly accepted threshold of 0.7 (Hair Jr. et al. 2013). These results, collectively, indicated the internal consistency reliability of the data. Since the Average Variance Extracted (AVE) values in Table 4

are all above the minimum level of 0.5, data in the present study also satisfies convergent validity (Fornell and Larcker 1981).

Table 4. Results of assessment of measurement models.

Variable	Item	Factor Loading	Cronbach's Alpha	Composite Reliability	Average Variance Extracted
Mobile banking application system quality			*0.899*	*0.909*	*0.668*
	SYSQ1	0.736			
	SYSQ2	0.872			
	SYSQ3	0.860			
	SYSQ4	0.794			
	SYSQ5	0.817			
Mobile banking application information quality			*0.906*	*0.920*	*0.697*
	INFQ1	0.759			
	INFQ2	0.788			
	INFQ3	0.901			
	INFQ4	0.846			
	INFQ5	0.873			
Mobile banking service quality	*SERVQ*		*0.851*	*0.860*	*0.606*
	SERVQ1	0.830			
	SERVQ2	0.751			
	SERVQ3	0.803			
	SERVQ4	0.726			
Experienced advantage of mobile banking	*EXPA*		*0.834*	*0.855*	*0.597*
	EXPA1	0.785			
	EXPA2	0.716			
	EXPA3	0.774			
	EXPA4	0.813			
Satisfaction with mobile banking service	*SATIS*		*0.828*	*0.835*	*0.628*
	SATIS1	0.822			
	SATIS2	0.793			
	SATIS3	0.761			
Post-use trust	*PUT*		*0.842*	*0.854*	*0.594*
	PUT1	0.759			
	PUT2	0.838			
	PUT3	0.720			
	PUT4	0.762			
Experienced risk of mobile banking	*RISK*		*0.769*	*0.799*	*0.570*
	RISK1	0.760			
	RISK2	0.792			
	RISK3	0.711			
Attitudinal loyalty toward service	*ATTL*		*0.850*	*0.866*	*0.684*
	ATTL1	0.851			
	ATTL2	0.786			
	ATTL3	0.842			
Mobile banking application repeated use	*MBRU*	Not available since the composite score was calculated for items MBRU1 to MBRU7 in the Structural Equation Modeling (SEM) analysis.			

For assessing discriminant validity, we drew on Chin (1998) and Hair Jr. et al. (2013) instructions and constructed a correlation matrix (Table 5) for latent variables of the study that places the square root of AVE of variables within the corresponding positions on the diagonal. Table 5 explains that for each of the latent variables, the square root of AVE is larger than the correlations that the latent variable has with remaining latent variables in the measurement model. Therefore, the data satisfies the discriminant validity requirements. Given the highest correlation value in Table 5 was 0.708, the data also did not show any indication of common method bias (Sai Hong and Ghobakhloo 2013). Finally, yet importantly, and as compared to the guides available within the literature, e.g., (Ghobakhloo et al. 2014; Hair et al. 2006), the measurement model provided overall satisfying goodness of fit during CB-SEM

analysis (Comparative Fit Index (CFI) = 0.962, Incremental Fit Index (IFI) = 0.952, Relative Fit Index (RFI) = 0.901, Goodness-of-Fit Index (GFI) = 0.909, Normed Fit Index (NFI) = 0.910, Standardized Root Mean Square Residuals (SRMR) = 0.034, CMIN/DF = 1.166, and Root Mean Square Error of Approximation (RMSEA) = 0.029).

Table 5. Correlation matrix.

	SYSQ	**INFQ**	**SERVQ**	**EXPA**	**SATIS**	**PUT**	**RISK**	**ATTL**	**MBRU**
SYSQ	*0.817*								
INFQ	0.599	*0.835*							
SERVQ	0.503	0.626	*0.778*						
EXPA	0.584	0.532	0.546	*0.773*					
SATIS	0.708	0.623	0.185	0.575	*0.792*				
PUT	0.623	0.414	0.453	0.614	0.548	*0.770*			
RISK	−0.204	−0.066	−0.488	−0.491	−0.507	−0.406	*0.755*		
ATTL	0.605	0.536	0.487	0.451	0.484	0.591	−0.370	*0.827*	
IRMB	0.657	0.558	0.470	0.618	0.365	0.638	−0.309	0.657	*NA*

The italic items on the diagonal represent the square roots of the Average Variance Extracted (AVE). NA, not available.
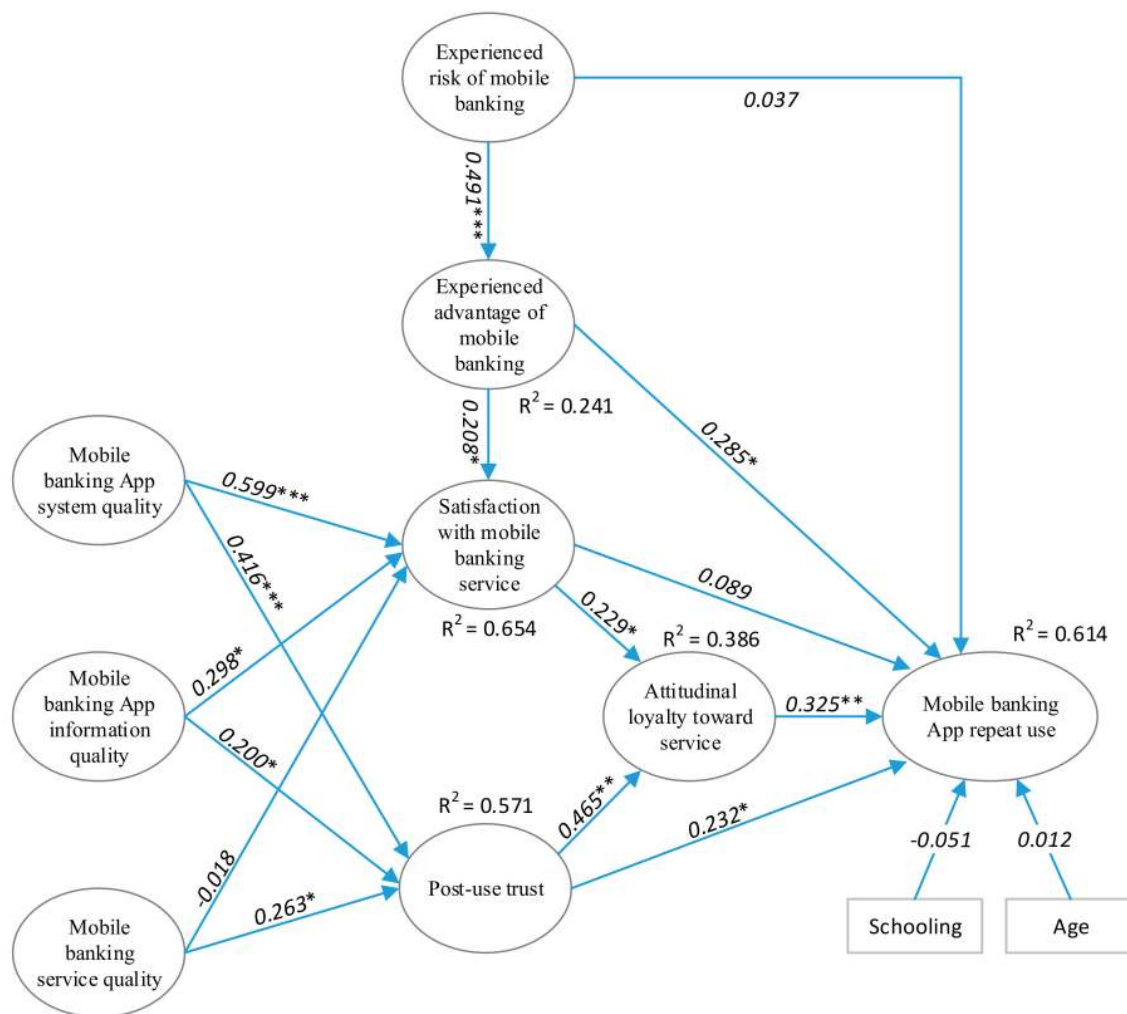
5.2. Structural Model

The assessment of the structural path model in this study consisted of calculating and assessing the (1) significance and relevance of hypothesized relationships (path coefficients and *p* values), (2) coefficient of determination (R^2), (3) effect size (f^2), and (4) predictive relevance (Q^2) (Ghobakhloo et al. 2014; Ghobakhloo and Azar 2018; Hair Jr. et al. 2013). The results of the assessment of the proposed structural model have been provided in Figure 2 and Table 6, which indicate the acceptance of all hypotheses, excluding H3a, H4b, and H6b. Findings suggest that experienced risk, experienced advantage, post-use trust, satisfaction with mobile banking, attitudinal loyalty, and the two control variables of age and schooling, collectively, accounted for 61.4% of the variance in intention to reuse (repeated use of) mobile banking. Sixty-five four-tenths percent of the variance in satisfaction with mobile banking, 38.6% of the variance in attitudinal loyalty, 57.1% of the variance in post-use trust, and 24.1% of the variance in the experienced advantage variable were explained by the precursor factors studied. The results further showed that neither of the control variables had a significant effect on the intention to reuse mobile banking.

Table 6. Results of the assessment of hypothesized relationships.

Hypotheses	Relationship	β	*p* Value	f^2	Support
H1a	Mobile banking application system quality → Satisfaction with mobile banking service	0.599	0.000	0.203	Yes
H1b	Mobile banking application system quality → Post-use trust	0.416	0.003	0.177	Yes
H2a	Mobile banking application information quality → Satisfaction with mobile banking service	0.298	0.015	0. 147	Yes
H2b	Mobile banking application information quality → Post-use trust	0.200	0.028	0.092	Yes
H3a	Mobile banking service quality → Satisfaction with mobile banking service	−0.018	0.893	0.003	No
H3b	Mobile banking service quality → Post-use trust	0.263	0.019	0.086	Yes
H4a	Experienced risk of mobile banking → Experienced advantage of mobile banking	−0.491	0.000	0.251	Yes
H4b	Experienced risk of mobile banking → Mobile banking application repeated use	−0.037	0.847	0.008	No
H5a	Experienced advantage of mobile banking → Satisfaction with mobile banking service	0.208	0.041	0.106	Yes
H5b	Experienced advantage of mobile banking → Mobile banking application repeated use	0.285	0.010	0.069	Yes

Table 6. *Cont.*

Hypotheses	Relationship	β	*p* Value	*f*²	Support
H6a	Satisfaction with mobile banking service → Attitudinal loyalty toward service	0.229	0.014	0.075	Yes
H6b	Satisfaction with mobile banking service→ Mobile banking application repeated use	0.089	0.108	0.011	No
H7a	Post-use trust → Attitudinal loyalty toward service	0.465	0.002	0.290	Yes
H7b	Post-use trust → Mobile banking application repeated use	0.232	0.013	0.148	Yes
H8	Attitudinal loyalty toward service → Mobile banking application repeated use	0.325	0.004	0.239	Yes
-	Age → Mobile banking application repeated use	0.012	0.948	0.002	No
-	Schooling → Mobile banking application repeated use	−0.051	0.926	0.005	No

* *p < 0.05*; ** *p < 0.01*; ***p < 0.001*

RMSEA = 0.029, CMIN/DF = 1.166, RMR = 0.024, SRMR = 0.034, CFI = 0.962, IFI = 0.952, TLI = 0.950, GFI = 0.909, NFI = 0.910, and RFI = 0.901.

Figure 2. Structural path model of mobile banking repeated use.

Since assessing the prediction accuracy of exogenous variables can offer valuable insight into the overall robustness of the structural model (Götz et al. 2010), the study performed the non-parametric Stone-Geisser test (Geisser 1975; Stone 1974). Overall, exogenous variables offered satisfying predictive relevance, given that all Q^2 values were positive, ranging from 0.119 to 0.438.

6. Discussion

We believe that our study is among the first empirical research that attempts to explain the process through which the intention to reuse mobile banking applications is formed among users of particular mobile banking services. To achieve this objective, we first drew on the D&M EC success model and further extended it by incorporating key cognitive variables identified in the technology acceptance and marketing literature. As expected, the results of path modeling validate the direct association of system quality and information quality with user satisfaction, which provides support for many other comparable studies (e.g., Lee and Chung 2009; Tam and Oliveira 2016; Wang 2008). It means when users experience that the mobile banking service and its application operate reliably, are easy to interact with, and offer needed information accurately, promptly, and well-formatted, they will be more satisfied with that particular mobile banking service. Our results, however, revealed that user satisfaction is not significantly predicted by service quality. Although the updated D&M IS success model (DeLone and McLean 2003) highlighted the potential association of service quality and user satisfaction, however, many scholars struggled to support this association (Hsu et al. 2014; Urbach et al. 2010). This particular finding contradicts Tam and Oliveira (2016), who reported a positive association between service quality and user satisfaction. This inconsistency can be attributed to either the differences the two studies have regarding demographics of participants, where Tam and Oliveira (2016) surveyed Portuguese college students or the suppression effect of experienced advantage in our regression model. We also observed that system, information, and service quality dimensions exert a significant positive effect on post-use trust, which is comparable with previous works of Lee and Chung (2009), Zhou (2011), and Zhou (2013), highlighting the pivotal role that technical property of a service has on the development of user trust.

As we expected, the assessment of the structural model confirmed the negative association of experienced risk and experienced advantage, which empirically supports Kang et al. (2012), who first speculated that in the post-adoption stage, the perceived risk could reduce perceived usefulness of mobile banking service. Despite experienced risk being significantly negatively correlated with repeated use of mobile banking application, we found no statistically significant association between these two variables in the structural model. This contradictory outcome, which challenges the association of perceived risk and behavioral intention, e.g., (Luo et al. 2010; Wu and Wang 2005) can be perhaps attributed to suppression effect of other direct determinants of mobile banking application repeated use in our model. In D&M IS success taxonomy, experienced advantage is regarded as the direct determinant for user satisfaction and intention to reuse (DeLone and McLean 2003; Petter et al. 2008), and our results empirically supported these associations in the mobile banking context. The results tell a different story about satisfaction. Although we observed that satisfaction positively determines attitudinal loyalty, it does not have a significant effect on the mobile banking application repeated use, which contradicts the common school of thought regarding the association of satisfaction and intention to reuse (behavioral loyalty) in the marketing literature (Anderson and Srinivasan 2003; Bhattacherjee 2001; Khalifa and Liu 2007).

Results also highlighted the importance of post-use trust and demonstrated that when users perceive that a mobile banking service and its application are reliable, protect their personal information, and benefit them, they will have a higher intention to grow dispositional commitment to the bank providing that service. Consistently, they further become behaviorally loyal to the service, in the form of repeated use of mobile banking application. This finding that highlights the critical role of post-use trust in mobile banking brand loyalty setting is in line with several comparable research in EC and marketing literature (Gu et al. 2009; Lin and Wang 2006; Lin 2011). Finally, yet importantly, we observed that attitudinal loyalty is an essential determinant of mobile banking application repeated use. We found that the definition of loyalty towards mobile banking service should include both a favorable attitude and repeated use of the service, which supports and extends the previous works of Dick and Basu (1994), Bandyopadhyay and Fraccastoro (2007), and Bandyopadhyay and Martell (2007).

That is to say, when users of a particular application-based mobile banking service hold strong positive beliefs toward it, they are more likely to perform repeated use of the service.

6.1. Contribution to Research and Practice

The academic contribution of this research is twofold. First, this work contributes to the mobile banking literature by explaining how mobile banking users develop attitudinal and behavioral loyalty to a particular service, which can be considered as a pioneering step toward the study of mobile banking user retention. In doing so, we followed Hennig-Thurau and Klee (1997) perspective that customer retention instrument should assess the loyalty to both service and service provider, and we requested respondents to think about their primary mobile banking service provider and its mobile banking application while answering to the survey questions. Second, and from the theoretical perspective, we not only supported the majority of associations suggested by the D&M EC/IS success taxonomy in the emerging field of mobile banking, but we also successfully extended the D&M EC success model by incorporating key cognitive factors from expectation confirmation theory and trust background while predicting attitudinal and behavioral loyalty.

This research may offer significant practical implications for managers and decision-makers. In the banking business, customers can obtain banking services through multiple alternative channels. Thus, they have little incentive to invest in receiving application-based mobile banking services. This fact explains why banks usually offer their mobile banking services free of any charge. In such circumstances, banks usually absorb the majority of the cost associated with the development of application-based mobile banking service in the hope of a long-term stream of profits from loyal customers. Our findings offer helpful insight into the process through which banks can better devise their retention strategies and operate more successfully in mobile-financial service markets. We, therefore, recommend that to achieve continuous use of mobile banking services, banks need to focus on the technical quality aspects, e.g., (system, information, and service quality) in order to enhance user post-use trust and satisfaction with the application-based mobile banking service. It means the mobile banking application should be easy to work with, have a well-designed interface, operate reliably, and enable a wide variety of banking activities anytime from anywhere. Banking reports and information offered by the mobile banking service and its application should be accessible promptly, well-formatted, detailed, reliable, and understandable. The descriptive assessment of responses showed that the majority of mobile banking users who participated in this study experienced the sheer risk of mobile banking. Findings showed that although the experienced risk does not have a significant direct effect on the mobile banking application repeated use, it does, however, cause users to consider application-based mobile banking to be significantly less advantageous. This issue, in turn, reduces user satisfaction and lowers the probability of a user developing attitudinal and behavioral loyalty toward the service. Our results, therefore, imply that offering secure and less risky application-based mobile banking services should be the primary focus of banks. This finding is perhaps the most important managerial lesson to learn because, although users might tolerate a lower quality mobile banking service, a less secure service leads users to consider the service disadvantageous. Finally, yet importantly, banks are advised to consider both attitude and behavior while defining loyalty toward a particular mobile banking service and base their action plans on the factors that contribute to the development of both attitudinal and behavioral loyalty.

6.2. Limitations and Future Research Directions

The major limitation of this research is the amount of unexplained variance in the endogenous latent variables, particularly attitudinal loyalty. An exciting opportunity for future research would be to further extend our research model through drawing on other usage behavior theories and models to better account for possible predictors of attitudinal loyalty and behavioral loyalty. To improve the generalizability of our findings, we did not apply any limitation to the type of mobile banking users who could potentially participate in this study. We assumed that intention to reuse and repeated use

behavior would be the ultimate goal of mobile banking service providers, but it was not feasible to numerically link reuse intention of service users to the bank performance. Another avenue for future research could be to explore the potential associations among user intention to reuse, reuse behaviors, and bank-side mobile banking performance by conducting case studies and time series analysis. Since the present study mainly concerns the experienced risk of mobile banking from particular service providers, our research model did not include the potential negative impacts of experienced risk of internet banking nor other mobile applications on the repeated use intention of individual users. We consistently invite future research to study the potential impact of various types of experienced risks of digital banking on the reuse intention of application-based mobile banking. Finally, yet importantly, our sample was limited to only 402 respondents across various nationalities, the issue that can limit the generalizability of our findings. Any extension of our model applied to distinct regional banking settings can significantly broaden the generalizability of our research model.

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