MOBILE BANKING ADOPTION IN VIETNAM: AN EMPIRICAL STUDY

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Abstract. *Several banks in Vietnam are beginning to provide banking services via mobile phones, but few investigations have explored the factors that could assist bankers in creating mobile services that are appropriate and appealing to bank customers. The aim of this study is to explore the impact of a set of technical attributes on the adoption of mobile banking in a developing country like Vietnam. The study utilizes the Diffusion of Innovation theory as a framework to investigate the factors that could influence the adoption and usage of mobile banking. The study specifically examines the potential facilitators and barriers to mobile banking adoption, including the five attributes of innovations identified in previous studies: relative advantage, compatibility, complexity, trialability, and observability, as well as perceived risk. This research is the first attempt to apply the Diffusion of Innovation theory to the context of mobile banking in a developing country like Vietnam. This study addresses this gap by analyzing various factors that influence mobile banking adoption. The study draws on the Diffusion of Innovation theory and collected data from 420 mobile banking users. The results indicate that adoption is positively influenced by relative advantage, compatibility, and observability, while trialability and complexity have no significant effect. Perceived risk has a negative impact on adoption, which contradicts previous research findings. The study's conclusions will have practical implications for the banking industry in Vietnam.*

Keywords*: mobile banking, IT adoption, IT satisfaction, Vietnam.*
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Introduction. The banking industry has undergone significant transformation in recent years due to technological advancements in telecommunications and information technology. This has resulted in major changes in the delivery of financial services (Almustafa et al., 2023; Dang et al., 2020; Dang & Nguyen, 2021a, 2021b). The industry has become more turbulent and competitive on a global scale, prompting banks to adopt a new strategy that prioritizes customer satisfaction through better products and services while minimizing operational costs. To achieve this, banks have leveraged technological developments and introduced mobile banking services. Understanding the customer adoption process of these services is crucial for both bankers and customers.

Mobile banking is increasingly important in Vietnam due to several factors. Firstly, the country has experienced rapid economic growth over the past decade, leading to a rise in the number of middle-class citizens who are seeking convenient and efficient banking services. Mobile banking offers a convenient way for customers to conduct financial transactions without the need to visit physical bank branches, which can be time-consuming and inconvenient. Additionally, mobile banking offers greater accessibility to banking services for customers living in remote areas or those who may have difficulty visiting physical bank branches. Mobile banking in Vietnam is still very young, the development of mobile banking system is considered very important, contributing to the development of the banking system in general (Dang & Nguyen, 2022; Dang et al., 2022).

Secondly, the increasing penetration of smartphones in Vietnam has created a significant market for mobile banking services. The number of smartphone users in Vietnam is growing rapidly, with over 50% of the population now owning a smartphone. This provides a huge opportunity for banks to reach a large customer base and offer them the convenience of mobile banking services. With the COVID-19 pandemic leading to increased social distancing measures and reduced physical interactions, the importance of mobile banking has only increased further. In summary, mobile banking is essential in Vietnam due to its convenience, accessibility, and the growing penetration of smartphones in the country (Q. K. Nguyen, 2022d, 2022e; Q. K. Nguyen & Dang, 2022).

Aims. The aim of this study is to explore the impact of a set of technical attributes on the adoption of mobile banking in a developing country like Vietnam. The study utilizes the Diffusion of Innovation theory as a framework to investigate the factors that could influence the adoption and usage of mobile banking. The study specifically examines the potential facilitators and barriers to mobile banking adoption, including the five attributes of innovations identified in previous studies: relative advantage, compatibility, complexity, trialability, and observability, as well as perceived risk. This research is the first attempt to apply the Diffusion of Innovation theory to the context of mobile banking in a developing country like Vietnam.

Literature review. Previous research on the adoption of mobile banking has predominantly focused on it as a technological innovation. The Diffusion of Innovation theory is a widely accepted theory that aims to explain the factors that influence an individual's adoption of a new technology or innovation. The theory explores how new ideas and technology spread through cultures and the rate at which they are adopted. Rogers, who developed the theory, defines diffusion as the acceptance or penetration of a new idea, behavior, or physical innovation within a given social system over time. Rogers also identified several key attributes of an innovation that impact adoption behavior, including relative advantage, complexity, compatibility, trialability, and observability. Previous studies have examined these attributes in the adoption and diffusion of Internet-based technologies and have consistently found that relative advantage, ease of use, and compatibility are the most significant factors for the adoption of internet and mobile technologies (Koenig-Lewis et al., 2010). In the following sections, we provide a brief overview of Rogers' five attributes and their relationship with the adoption of innovation.

Based on the previous studies (More & Benbasat 1991; Gu et al. 2009; Chen 2008; Rogers 2003), we propose the hypotheses as follow:

H1. Relative advantage will have a positive effect on mobile banking adoption.

H2. Complexity will have a negative effect on mobile banking adoption.

H3. Compatibility will have a positive effect on mobile banking adoption.

H4. Observability will have a positive effect on mobile banking adoption.

H5. Trialability will have a positive effect on mobile banking adoption.

H6. Perceived risk will have a negative effect on mobile banking adoption.

The adoption of an innovation, according to Rogers (2003), refers to the decision to fully utilize it. This study aims to examine the factors that influence the adoption of mobile banking. While there are various studies that define adoption in terms of implementation, usage, utilization, or satisfaction, this study uses satisfaction as the measure of adoption. Satisfaction is often used as a dependent variable for measuring the success of information technology. The reason for choosing satisfaction as a surrogate measure for adoption is twofold. Firstly, "satisfaction" is a valid measure of success. It is difficult to refute the success of a system if users report liking it. Secondly, satisfaction is widely used as a measure of success and post-adoption measure of mobile services (DeLone et al. 1992; DeLone et al. 2003). Figure 1 illustrates the hypotheses of this study.

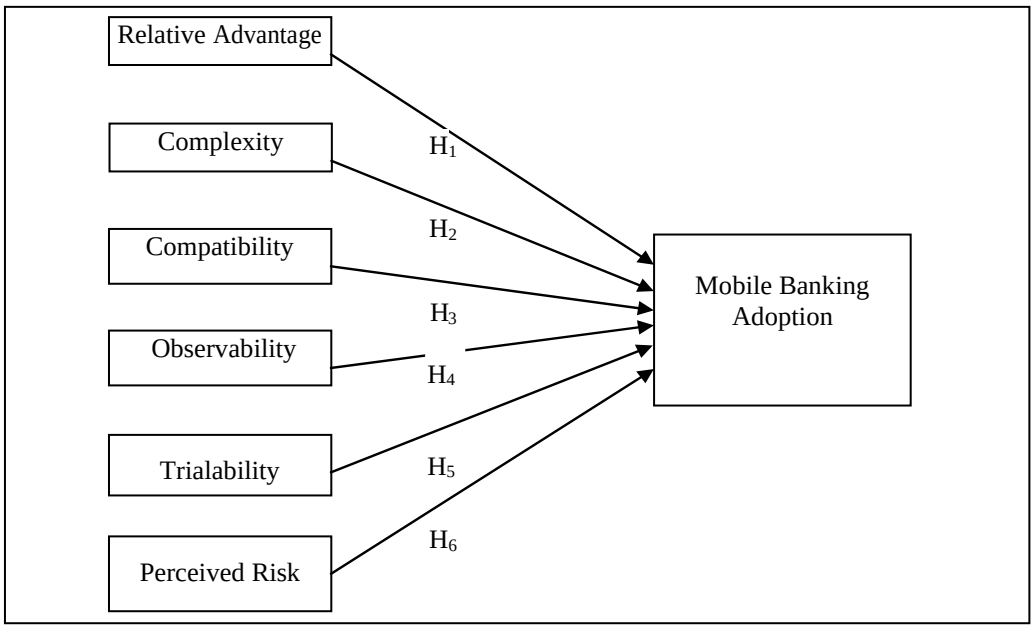

Figure 1. The Research Model

Methodology. The study created a survey instrument to examine factors that influence mobile banking adoption, based on a literature review and focus group discussion. The survey was designed as a self-administered questionnaire with two parts. The first part gathered data on demographic characteristics and mobile banking usage patterns of respondents. The second part collected information on constructs such as relative advantage, complexity, compatibility, observability, trialability, and perceived risk that affect mobile banking adoption. The items used to measure these constructs were adopted from prior research on internet and mobile banking. A pilot test was conducted with 20 randomly selected mobile banking users from various backgrounds to ensure the clarity and validity of the survey instrument. The feedback from the pilot test led to modifications in the wording of some questions. All items were measured on a five-point Likert scale ranging from strongly disagree to strongly agree.

The study aimed to investigate the adoption of mobile banking among adult individuals living in Vietnam, and due to the challenges of obtaining random samples, the researchers used a convenience sampling technique. Initially, the authors randomly selected university students from three major cities in Vietnam,

and questionnaires were distributed to 1500 participants. The collected questionnaires were then checked for completeness, and an editing process was carried out to eliminate illegible, inconsistent, and ambiguous responses. After data cleaning, the data was inputted into SPSS for analysis. Out of the 466 questionnaires, 420 were completed by mobile banking users, while 131 were potential mobile banking users, resulting in a 31% response rate. This rate is comparable to previous studies conducted in Vietnam. In this study we also apply OLS estimation method to investigate the impact of some factor affect mobile banking adoption. This method is used in many previous studies (Q. Nguyen & Dang, 2020; Q. K. Nguyen, 2020, 2021, 2022a, 2022b, 2022c).

Results. *Factor Analysis*. After conducting a review of the literature, the researchers identified the items to measure the six independent variables, including relative advantage, compatibility, observability, complexity, trialability, and perceived risk. To verify their unidimensionality, a factor analysis was performed on these items, and they were grouped into meaningful clusters. The factor analysis specified six factors, and principal component analysis with orthogonal varimax rotation was used. The researchers used the Bartlett Test of Sphericity and Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy to validate the use of factor analysis. The KMO value indicated that factor analysis can be conducted, and the Bartlett's Test of Sphericity was significant ($P<0.05$). A cutoff value of 0.50 was considered practically significant for factor loadings. However, the authors retained two items with lower loadings because they loaded on their own constructs. The remaining items were grouped into six factors, which explained 72.23% of the total variance. The results of the factor analysis are summarized in Table 2.

Table 1. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.823
Bartlett's Test of Sphericity	Approx. Chi-Square	4621
	Degrees of Freedom	231
	Significance	0.000

Factor 1 contains five items measuring the Relative Advantage with a variance of 18.87%. Factor 2 has five items measuring Compatibility with variance of 14.49%. Factor 3 has four items measuring Observability with variance of 11.07%. Factor 4 has three items measuring Complexity with variance of 10.99%. Factor 5 has three items measuring Perceived Risk with variance of 10.80%. Finally, two items of Trialability loaded on the sixth factor with variance of 8.64%.

Cronbach's coefficient of reliability. The study's constructs were evaluated for reliability by conducting an analysis of internal consistency using Cronbach's Alpha. The coefficients ranged from 0.918 for the Satisfaction factor to 0.775 for the Observability factor, which are all greater than the value of 0.6. This indicates that all of the items in the factorial groups of this study are sufficiently reliable measures. Table 3 presents the descriptive statistics and Cronbach's Alpha reliability coefficients.

Table 2. Exploratory factor analysis

Constructs	Factor Loadings					
	1	**2**	**3**	**4**	**5**	**6**
Relative Advantage						
MB is a convenient way to manage finance	**.859**	.105	.185	.135	.067	.065
MB allows to manage finance efficiently	**.840**	.135	.115	.085	.013	.058
MB allows me to manage my finance effectively	**.818**	.211	.235	-.055	.085	.181
MB gives greater control over finances	**.781**	.250	.111	-.028	.068	.061
MB is useful for managing financial resources	**.748**	.139	.333	.138	.143	.149
Compatibility						
MB fits well with the way I like to manage my finances	.532	**.529**	.142	.075	-.111	.240
I like to try new technology	.131	**.757**	.105	-.085	.009	.077
I like to adopt new innovation	.142	**.871**	.065	-.107	.118	.087
MB is compatible with my lifestyle	.296	**.656**	.261	-.002	-.010	.272
Using MB fits into my working style	.321	**.643**	.270	.020	-.109	.306
Observability						
MB can be accessed anytime & anywhere when in Viet Nam	.151	.117	**.855**	-.014	.007	.257
MB have no queue	.302	.106	**.719**	.095	.057	.033
MB can be accessed when abroad	.347	.219	**.682**	.145	.117	-.074
I can see the effect of a transaction immediately	.231	.332	**.482**	-.133	.171	.299
Complexity						
MB requires a lot of mental effort	.083	-.027	.076	**.842**	.278	-.039
MB requires technical skills	.119	-.106	-.005	**.832**	.157	.195
MB can be frustrating	.066	-.037	.062	**.828**	.229	.012
Perceived Risk						
Information about my transactions may be tampered by others	.037	-.073	.140	.252	**.847**	.098
I fear that the PIN codes get lost & end up in wrong hands	.029	.011	.071	.152	**.828**	.159
Information about my transactions may be known to others	.192	.112	-.065	.317	**.823**	-.002
Trialability						
I want to try for at least one month	.207	.175	.182	.148	.118	**.834**
I want to use MB on a trial basis to see what it can do for me	.135	.420	.078	.017	.199	**.822**
Eigen value	**4.15**	**3.19**	**2.44**	**2.42**	**2.38**	**1.90**
Variance explained (%)	**18.87**	**14.49**	**11.07**	**10.99**	**10.80**	**8.64**
Cumulative variance explained (%)	**18.87**	**33.36**	**44.42**	**55.42**	**66.22**	**72.23**

Regression analysis. Table 4 reports the result of the multiple regression model. The dependent variable is satisfaction of mobile banking use as a surrogate measure for mobile banking adoption. The *F* statistic for the regression model is 40.222 (with a *p* value of 0.000). The results of the regression analysis show that four factors, that are relative advantage, compatibility, and observability have positive significant effect and perceived risk has negative significant effect on mobile banking adoption.

Table 3. Mean, Standard Deviation, and Cronbach's Alpha Reliability

Dimension	No. of Item	Mean	Standard Deviation	Alpha
Relative Advantage	5	3.625	0.751	0.908
Compatibility	5	3.831	0.749	0.883
Complexity	3	2.913	0.935	0.843
Observability	4	3.697	0.747	0.775
Perceived Risk	3	3.336	0.958	0.858
Trialability	2	3.768	0.925	0.839
Satisfaction	5	3.515	0.820	0.918

Notes: Mean scores based on a five point scale, where 1= Strongly Disagree and 5= Strongly Agree

However, complexity and trialability are found to have no significant effect on mobile banking adoption. Further, R^2 which is 0.428 indicates that 42.8% of mobile banking adoption is explained by the model. The variance inflation factor (VIF), which indicates the degree to which each predictor (i.e. independent) variable is correlated with other predictor variables, showed that there is no evidence of multicollinearity. A threshold VIF that is less than or equal to 10 (i.e. tolerance > 0.1) suggests that multicollineariy is almost absent.

Table 4. Regression Model of mobile banking adoption

Independent Variables	B	Standard Error	T	p-value	Collinearity Statistics	
					Tolerances	VIF
Relative Advantage	.310	0.062	4.371	.000	0.554	1.816
Compatibility	.290	0.059	4.913	.000	0.509	1.964
Observability	.294	0.061	4.821	.000	0.573	1.745
Complexity	.057	0.043	1.304	.193	0.728	1.378
Trialability	-.045	0.046	-0.987	.294	0.598	1.541
Perceived Risk	-.141	0.043	-3.333	.001	0.711	1.403
Dependent Variable = Satisfaction; R^2 = 0.428; Adjusted R^2 = 0.418; F = 40.222; P-value <0.05						

Discussions. The first hypothesis, H1, which states that relative advantage has a positive impact on mobile banking adoption, has been confirmed with a t-value of 4.371 and a significance level of $p \leq 0.001$. This result is consistent with previous research on mobile commerce and supports it. Relative advantage is similar to perceived usefulness in the technology acceptance model. This indicates that customers who perceive mobile banking as a useful and convenient way to manage their finances efficiently and effectively are more likely to adopt it.

The research results indicate that compatibility is the most significant factor in predicting mobile banking adoption. This finding supports hypothesis H2 ($t=4.913$, $p \leq 0.001$) and is consistent with previous research which also found that perceived compatibility of an innovation has a positive impact on the adoption of mobile banking. This suggests that customers find mobile banking to be a suitable and convenient way to manage their finances, and it fits well with their working and lifestyle preferences, leading to their adoption of this new technology. When customers believe that mobile banking is fully compatible with their current banking practices and aligns with their preferences, they are more likely to adopt it.

The study found that H3, which states that observability has a significant impact on mobile banking adoption, is supported ($t=4.822$, $p \leq 0.001$). Observability, in the context of mobile banking, refers to the ability to see the benefits of using the service, such as having immediate access to transactions at any time and location. From the customers' point of view, mobile banking is considered a very convenient and efficient way to manage financial transactions because it is easily accessible 24/7.

The study did not find support for H4, which suggested that complexity would have a negative effect on mobile banking adoption. This result was unexpected and contradicts some previous research. One possible explanation for this finding is that the majority of the study's respondents (72.7%) were young (between the ages of 18

and 25). It is possible that young people can easily learn how to use mobile banking, making complexity a non-factor in their decision to adopt it. Young people tend to be more knowledgeable about new technologies and have more experience using them, including mobile banking.

The study did not find significant support for H5, which hypothesized that trialability would have an effect on mobile banking adoption. This aligns with previous research on phone and PC banking. However, the reasons for this lack of support are unclear. Typically, during the trial period, customers are expected to receive full support and knowledge about the mobile banking services. One possible explanation for the lack of support is that banks may not pay much attention to potential customers who want to try mobile banking. As a result, such customers may not be convinced of the benefits of mobile banking during the trial period. Another possible explanation is that consumers may already trust mobile banking, find it useful, and consider it safe and low-risk. Consequently, they may not feel the need to try it out.

The study found that H6, which states that perceived risk has a negative impact on mobile banking adoption, is supported ($t=-3.333$, $p \leq 0.001$). This aligns with previous research findings that indicate customers consider risk as a major barrier to adopting mobile banking due to concerns that their PIN codes could be lost or that their transaction information could be compromised. Banks need to address these concerns by providing assurances that mobile banking is a secure and trustworthy system to use.

Conclusions. Based on our study's results, it is recommended that banks in Vietnam should provide mobile banking services that cater to a variety of customer needs, past experiences, lifestyles, and beliefs to meet customer expectations. Improving mobile banking support and offering a range of services will increase customers' perceived usefulness and adoption of mobile banking. Therefore, banks should focus on understanding customer behavior and developing reliable mobile banking systems that meet their needs and provide high-quality services. Additionally, banks should communicate the advantages and usefulness of mobile banking over other banking channels, such as physical bank presence or using ATM machines. Banks must also reduce customer-perceived risks by offering specific guarantees to protect their customers and addressing their complaints in a timely manner.

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