

# An empirical investigation of the extended Technology Acceptance Model to explain mobile banking adoption

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## Abstract

*This study utilizes partial least square-structural equation modelling to investigate the determinants of mobile banking adoption in the case of North Cyprus. The analysis was conducted on a sample of 250 respondents gathered through a self-administrated survey. We applied a modified Technology Acceptance Model (TAM) to the data. The findings showed that consumer innovativeness, perceived enjoyment, perceived ease of use, perceived reliability, and perceived usefulness have a significant positive relationship with the intention to use mobile banking services. Obtained evidence implies that bank managers should focus on developing mobile banking applications to meet the needs of the younger generation. Besides, banks are advised to introduce innovations in financial services offered through mobile banking to gain new customers.*

*Keywords:* mobile banking, TAM, PLS-SEM, Northern Cyprus

## Introduction

Mobile banking is one of the latest technological advances that enables users to access their account information and perform financial transactions via an internet connection through a mobile electronic device such as a tablet or personal digital assistant (PDA) (Abbas *et al.*, 2018). Mobile banking allows users to access all kinds of banking services, such as account management, money transfer, bill payments, and information inquiry. Although telephone banking, automated teller machines, and internet banking provide efficient services, mobile banking is forecasted to have a ground-breaking effect on the banking services market (Safeena *et al.*, 2012).

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In recent years, the acceptance of mobile banking has been increasing rapidly due to several factors, such as rising competitiveness among financial institutions and major advances in technology and internet banking (Mortimer *et al.*, 2015). Since financial institutions offer mostly similar services, offering new services makes them more competitive and increases their market share. Many of these new services are related to mobile banking (Mortimer *et al.*, 2015). Besides, the increase in smartphones has expanded the demand for mobile banking services, which increased the market share of financial institutions, enhanced customer retention, provided more employment positions, and improved the efficiency of operations (Shaikh, 2013). Also, e-banking influences both the profitability and operations of the banks (Mansour *et al.*, 2016); therefore, it has been adopted by the majority of financial institutions around the globe (Ayo *et al.*, 2016).

Although there has been much progress in mobile banking, its use is not as high as expected, notwithstanding its potential benefits for customers and the banking industry (Shaikh and Karjaluo, 2015). Also, researchers claim that mobile banking adoption is still in its infancy stage (Zhang *et al.*, 2018). Moreover, penetration rates of mobile banking in developing countries are much lower than in developed countries where markets are mature and well-developed (KPMG, 2015). The statistics indicate significant growth opportunities in mobile banking, and the primary target will be developing countries. Thus, our study examines the determinants of mobile banking adoption in the case of North Cyprus to provide policy recommendations to increase mobile banking adoption in a developing country.

We chose North Cyprus as a case for our study for several reasons. The country has 24 universities attracting international students from all over the world, which results in a young and multicultural society with a high education rate. According to the 2019 census, the population of Northern Cyprus is 374,299, with 121,802 foreigners living in the country, which reflects the country's cultural diversity. The ministry of foreign affairs of Northern Cyprus estimated the number of international students to be 81,000 in 2015<sup>1</sup>; most rely heavily on banking services to pay for their expenses on the Island. Moreover, only 51.53% of the population uses the internet through computers. This figure is quite low compared to the number of mobile broadband subscriptions (98.4% of the population) (Amca, 2019). This situation indicates that mobile banking services have more potential to penetrate the market in Northern Cyprus. Besides, the case of a developing closed economy such as Northern Cyprus might offer valuable insights into mobile banking adoption determinants as this is the first paper to examine such a case.

Despite the vast literature on internet banking adoption, the literature on mobile banking adoption is limited despite its importance (Zhang *et al.*, 2018). Luarn

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<sup>1</sup> Deputy Prime Ministry and Ministry of Foreign Affairs (2019), (retrieved from <https://www.mfa.gov.ct.tr/>).

and Lin (2005) were the pioneers in investigating the determinants of mobile banking acceptance. Afterward, the literature on mobile banking emerged, with researchers applying different models to explain the factors influencing mobile banking adoption without reaching a consensus (Zhang *et al.*, 2018). Recently, many factors, such as the role of social media (Sharma *et al.*, 2022), electronic word of mouth (Shankar *et al.*, 2020), convenience (Shankar and Rishi, 2020; Jebarajakirthy and Shankar, 2021) have been examined as the potential determinants of mobile banking use.

Factors affecting mobile banking adoption have been investigated in many countries using different approaches. Mohd Thas Thaker *et al.* (2019) examined the factors affecting the adoption of mobile banking services in the case of Malaysia. Their results suggest that perceived usefulness and risk are the two main determinants of intentions to use mobile banking services. Zhu *et al.* (2022) investigated the role of information dissemination and financial services on mobile banking adoption in Rural China using the probit model. Baabdullah *et al.* (2019) conducted a cross-sectional analysis for the case of Saudi Arabia. They proposed several factors, such as performance expectancy, price, hedonic motivation, and service quality as primary determinants of mobile banking use. Malaquias *et al.* (2018) analysed longitudinal data and found that perception of trust and ease of use are among the critical factors in adopting mobile banking in Brazil. Malaquias and Silva (2020) also used Brazil as their case and, using structural equation modeling, obtained similar findings that of Malaquias *et al.* (2018). Although there are cross-cultural studies regarding mobile banking adoption (Merhi *et al.*, 2019), they are relatively more limited, and researchers mostly focus on a single country. For the case of North Cyprus, although there is little research regarding mobile banking in terms of the econometric methodology and the model selection, we differ from each other (Cesur, 2018; Serener, 2018). Due to the limited number of studies in the literature, more research is necessary to better understand the factors influencing the adoption and intention to use mobile banking services in the case of North Cyprus.

Some other studies have employed the SEM estimation method to investigate mobile banking adoption. Chaouali and Hedhli (2019) examined the determinants of mobile banking adoption in France using structural equation modeling (SEM). They found that trust and attitudes are two of the main determinants. Elhajjar and Ouaida (2019) utilized path analysis alongside SEM in the case of Lebanon. They found that perceived risk, perceived ease of use, digital literacy, and resistance to change are the major attributes affecting the adoption of mobile banking. However, the use of PLS-SEM is quite limited in this literature. Ly and Ly (2022) is the closest study to ours in terms of the model and the econometric estimation method. Like us, they use a survey to collect data and employ the PLS-SEM method to test their hypothesis. They investigate the possible determinants of internet banking adoption by using TAM by adding a subjective norm construct for a developing country, Cambodia.

This study utilized partial least square structural equation modeling (PLS-SEM) to examine the determinants of mobile banking adoption. This method

assesses the validity and reliability of the measures of theoretical variables and estimates the relationships between these variables simultaneously. We chose variance-based SEM (PLS-SEM) over covariance SEM mainly because of the explanatory nature of the current study. PLS-SEM has more explanatory power, is better at theory building, and has higher prediction power than covariance-based SEM (Hair *et al.*, 2014). Moreover, previous literature argued that PLS-SEM is less restrictive than variance-based SEM and provides more robust results for small sample size, model complexity, and distributional assumption (Chaouali *et al.*, 2016). Besides, compared to first-generation regression models such as linear regression, SEM can test relationships among multiple dependent and independent variables at the same time (Gerbing and Anderson, 1988).

The significance of the present paper is as follows. First, the research proposes a comprehensive model to examine the effect of many variables on customers' attitudes and the adoption of mobile banking services. Second, this study utilizes PLS-SEM, which provides more robust results compared to other methodologies. Third, our study investigates customers' concerns when adopting new mobile banking technology; therefore, it offers valuable insights to bank operators on improving and promoting mobile banking services to meet the customers' expectations and increase the number of mobile banking users.

## 1. Theoretical background

Understanding the users' motives behind adopting new technology has been widely investigated and researchers developed several theoretical frameworks for this aim. The main frameworks developed to examine the users' adoption of online banking are the Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975), the Theory of Planned Behavior (TPB) (Ajzen, 1985), and the Technology Acceptance Model (TAM) (Davis, 1989). Among these three theories, TAM has been the leading one employed to assess the adoption of online banking due to its suitability for the purpose (Lee, 2009), generalizability, and relevancy to various technologies (Dajani and Yaseen, 2016).

Davis (1989) introduced the TAM as an attempt to better understand customers' behaviour toward technology acceptance. The Model explores the customers' behavioural intentions to use new technology and offers a deeper insight into the factors influencing this decision. Under the framework of TAM, behavioural intention to use new technology is a function of attitude directly and perceived usefulness (PU) and perceived ease of use (PEU) indirectly. With regard to TAM and frameworks discussed in the mobile banking literature, we formulated the following hypotheses to test in the present study.

PU is defined as the expected benefit from using the target system. Benefits provided by mobile banking give it an advantage over conventional banking (Zhang *et al.*, 2018). PU is the first central part of the TAM model included in many studies

examining technology adoption (Haider *et al.*, 2018; Hanafizadeh *et al.*, 2014) and was found to be an influential factor. Previous literature indicated that PU positively affects the intentions of customers to use internet banking (Alalwan *et al.*, 2016; Lee *et al.*, 2012). Due to the reasons mentioned above, this study hypothesizes: PU has a significant and positive relationship with ATT (H1).

PEU is the second central part of the TAM, which is defined as the level of effort required to use new technology (Zhang *et al.*, 2018). The authors suggested that customers use an application because of the options it has and the level of difficulty of these options. People will not be eager to try a new system unless they think that it does not require much effort (Davis, 1989). Previous studies have examined the effect of PEU on the users' attitudes toward adopting new technology and found a significant positive influence (Chitungo and Munongo, 2013; Zhao and Zhou, 2018). Researchers in the mobile internet domain also validated PEU's positive influence on attitude (Lin, 2011; Mohammadi, 2015). However, some researchers couldn't find any evidence regarding the effect of PEU on attitude and intention to use mobile banking services (Oliveira *et al.*, 2014). Therefore, the examination of the impact of PEU on attitudes is crucial. Thus, this study assumes the following hypothesis: PEU positively influences ATT (H2).

Attitude (ATT) represents the reaction of a person to particular objects or concepts (Ajzen and Fishbein, 1977). In the framework of mobile banking services adoption, literature has documented a positive relationship between attitudes toward new technology and intention to adopt the target technology (Akturan and Tezcan, 2012; Lin, 2011; Mohammadi, 2015). However, researchers still haven't agreed about ATT's influence on the intention to use new technology. Based on the existing literature and to clarify the relationship between attitudes and intentions, we formulate the following hypothesis: There is a positive link between INT and ATT (H3).

Even though TAM has been widely used in internet banking to explain technology adoption, the distinctive characteristics of mobile banking require modifying the TAM by including particular constructs to reflect the unique nature of mobile banking services. Previous research modified the TAM (Chitungo and Munongo, 2013; Safeena *et al.*, 2012) or tested the TAM alongside other models (Aboelmaged and Gebba, 2013; Briz-Ponce *et al.*, 2017) to examine the determinants of internet banking adoption. Following previous literature, this paper extends the TAM by adding constructs that are applicable to mobile banking services adoption. Following Zhang *et al.* (2018), we added trust (TRU), perceived reliability (PR), perceived privacy (PP), perceived enjoyment (PE), and consumer innovativeness (CI) to the basic TAM model to have a more comprehensive understanding of the determinants of mobile banking adoption.

Many researchers focus on the importance of trust in technology acceptance. Page and Luding (2003) argued that trust is a vital influencer of internet banking adoption. Gefen (2003) stated that TAM must include trust mainly when examining

relationships that might consist of risk and uncertainty, such as internet banking. Koenig-Lewis *et al.* (2010) show that trust indirectly influences the intention to adopt the new technology through attitude towards the target technology. Numerous researchers validated the relationship between trust and mobile banking adoption (Koksal, 2016; Oliveira *et al.*, 2014; Zhang *et al.*, 2018). Therefore, the fourth hypothesis of this research is as follows: TRU positively affects ATT (H4).

Perceived reliability (PR) is conceptualized as the users' belief in the level of dependability of new technology. Meso *et al.* (2005) suggested that the level of reliability of technology will affect the degree of trust in the new system and the usage level. Moreover, the lack of reliability might insinuate less technological advancement (Johnson *et al.*, 2009). Increased technology reliability positively affects mobile technology use (Meso *et al.*, 2005) and mobile banking services (Rahman *et al.*, 2017; Sagib and Zapan, 2014). Therefore, we posit the following hypothesis: A positive relationship between ATT and PR is present (H5).

Perceived privacy (PP) is defined as the capability of users to manage the collection and processing of their personal information (Kim *et al.*, 2007). The main concern of users in an online environment is the misplacement or revealing of their personal data, which might have an unfavourable outcome for users (Bansal *et al.*, 2010). In the context of mobile banking, users have more privacy concerns as mobile devices hold personal information such as addresses, phone numbers, bank account numbers, and passwords (Zhang *et al.*, 2018). Previous literature has demonstrated the positive link between privacy and intention to use mobile banking services (Morosan and DeFranco, 2014; Zhang *et al.*, 2018). Thus, we hypothesize: A positive relationship between ATT and PP is present (H6).

Perceived enjoyment (PE) is conceptualized as happiness, joy, or cheerfulness when using the target system (Venkatesh *et al.*, 2012). Many of these factors are significant determinants of users' acceptance of new technology and hint at hedonic motivations (Morosan and Defranco, 2016). Researchers reported a significant positive link between perceived enjoyment and intention to adopt the technology in the case of mobile phone banking (Yen and Wu, 2016). Therefore, we develop the following hypothesis: There is a positive relationship between ATT and PE (H7).

Consumer innovativeness is defined as the willingness of users to try new products and services (Lu *et al.*, 2005). Kim *et al.* (2010) suggested that many users of mobile banking services still lack the necessary skills to accomplish various tasks, which emphasizes the importance of consumer innovativeness. Users with high innovativeness adopt new technology faster (Lee *et al.*, 2012). Previous studies examined the relationship between CI and technology acceptance and found a positive link (Chitungo and Munongo, 2013; Mohammadi, 2015). Thus, we hypothesize: CI positively affects ATT (H8).

## 2. Research method and empirical findings

### 2.1. Data collection

We used a survey prepared by Zhang *et al.* (2018) to gather data. Four hundred bank customers were invited to participate in the survey. We carried out the survey both online and distributed it to university students using mobile internet banking. We adopted convenience sampling following previous literature (Ozretic-Dosen and Zizak, 2015; Tsoukatos and Mastrojianni, 2010). Only qualified participants were invited to complete the survey with the criteria of having a bank account operating in North Cyprus and using mobile internet banking. The survey had a cover letter attached to explain the purpose of the study and disclose the confidentiality of the information acquired. Data collection took around a month. After initial screening and removing invalid responses and missing values, we included 250 valid responses in the analysis.

The sample consists of 70.8% male respondents and 29.2% females. Most respondents are between the ages of 18 to 35 (94%), while only 6% are in the range of 36-55. More than 66% of the respondents are students, followed by 23.2% employees, 3.2% self-employed, 2.4% businessperson, and 4.8% in other occupations. The mainstream of respondents is enrolled in bachelor's degree (49.2%), followed by master's degree (28%), high school/diploma (15.6%), and Ph.D. (7.2%). The range of years using internet banking among respondents included 1-3 years (34.8 %), 3-5 years (24.8 %), less than a year (22.4 %), and more than five years (18%). The sample demographics are presented in Table (1) below.

**Table 1. Sample demographics**

Measure	Item	Frequency	Percentage
Gender	Female	73	29.2
	Male	177	70.8
Age	18-25	145	58.0
	26-35	90	36.0
	36-45	14	5.6
	46-55	1	0.4
Education level	Up to high school/diploma	39	15.6
	Bachelor's degree	123	49.2
	Master's degree	70	28.0
	Doctorate's degree	18	7.2
Monthly income in dollars	<500	99	39.6
	500-1000	84	33.6
	1000-4000	52	20.8
	>4000	15	6.0
Occupation	Student	166	66.4
	Businessman/woman	6	2.4

Years using internet banking	Employee	58	23.2
	Self-employed	8	3.2
	Other	12	4.8
	<1	56	22.4
	1-3	87	34.8
	3-5	62	24.8
	>5	45	18.0

Source: Authors' representation

## 2.2. Methodology

PLS-SEM algorithm to assess latent variables and estimate the coefficients of the relationships consists of two stages. In the first stage - the measurement model - the latent variables are measured using the PLS-SEM algorithm using the four steps mentioned below:

1. Inner weights

$$v_{ji} \begin{cases} \text{sign cov}(Y_j; Y_i) & \text{if } Y_j \text{ and } Y_i \text{ are adjacent} \\ 0 & \text{otherwise} \end{cases}$$

2. Inside approximation

$$\tilde{Y}_j = \sum_i v_{ji} Y_i$$

3. Outer weights; solve for  $w_{kj}$  in

$$y_{kjn} = \tilde{w}_{kj} \tilde{Y}_{jn} + e_{kjn}$$

4. Outside approximation

$$Y_{jn} = f_i \sum_{kj} \tilde{w}_{kj} y_{kjn}$$

Where  $v_{ji}$  are the inner weights,  $Y_j$  are the latent variables,  $\tilde{w}_{kj}$  is a weight coefficient,  $y_{kjn}$  are the observed variables used to measure the latent variables.

In the second stage - the structural model - the path and loading coefficients are estimated using ordinary least squares regression. In both stages, observed and latent variables are treated as deviations from their means.

In the following section, we will discuss the measurement and structural models. First, we calculate the outer loadings, composite reliability, average variance extracted, and Cronbach alpha to ensure the correct measurement of the unobserved variables. Then, we check Fornell and Larker criterion to measure the discriminant validity and ensure that the unobserved variables are different from each other. After confirming the robustness of the unobserved variables quantified through the



measurement model, we continue with the structural Model and parameters estimation.

We chose Technology Acceptance Model (TAM) over other models as it is the most tested, most influential, and best-operationalized approach (Schöpfel and Azeroual, 2021). Assegaff (2015) suggested that TAM is the most widely used framework and most acceptable model when comparing TAM, Unified Theory of Acceptance and Use of Technology (UTAT), and Task Technology Fit (TTF). In addition, due to its few factors, TAM is easily readable and has shown a high level of efficiency in many contexts (Venkatesh and Bala, 2008).

### **Instrument development**

The survey used to collect the data was developed by Zhang *et al.* (2018) and includes 28 items derived from previous literature on the TAM. The survey consists of two parts; the first contains the demographical profile of the participants alongside internet banking usage habits such as gender, age, education level, monthly income, occupation, and the number of years using internet banking. The second part includes 28 items to measure nine concepts: PU, PEU, TB, PP, PR, PEN, CI, AT, and IN. Three and four items that measure PU and PEU, respectively, adapted from the paper of Huh *et al.* (2009). Three questions used to measure TB were derived from Srivastava *et al.* (2010). Factors measuring PP and PR were tailored from the study of Morosan (2014). PE was measured by three factors drawn from Morsan and Jeong's (2008) study. All three items used to measure CI were taken from Lu *et al.* (2005). Items used in measuring AT and IN were derived from Morsan and Jeong (2008) and Huh *et al.* (2009). A five-point Likert scale (1= strongly disagree, 5= strongly agree) was used to measure all the items in the survey.

### **2.3. Analysis of the measurement model**

The PLS-SEM algorithm was applied to measure the latent variables included in the study. We analysed several indicators - outer loadings, Cronbach's alpha, composite reliability, and average variance extracted - to confirm the reliability of the measured latent variables. Outer loadings should be significant and exceed the threshold of 0.5 to indicate reliability. The outer loading values shown in table 2 are all significant at  $p = 0.01$  and ranging from 0.672 to 0.935, reflecting the latent variables' reliability, as suggested by Fornell and Larcker (1981). Obtained Cronbach's alpha scores (see Table 2) are higher than the threshold of 0.7 (except Perceived Reliability) and hence indicate valid and reliable constructs (Garson, 2016). Although the perceived reliability score is 0.678, for exploratory purposes, this score is acceptable (Garson, 2016). We used composite reliability criteria to confirm the results provided by Cronbach's alpha. Values for composite reliability, ranging from 0.819 to 0.922 (refer to Table 2), exceeded the suggested threshold of

0.8 (Henseler, Ringle, and Sarstedt, 2012). These results indicate that construct reliability is confirmed. The average variance extracted (AVE) values presented in table 2, ranging from 0.604 to 0.847, surpassed the 0.5 threshold criterion set by Fornell and Larcker (1981). AVE indicates that factors can explain 60.4% to 84.7% of the variance of their respective indicators, which means convergence validity. Overall, the convergence validity and construct reliability are met and confirmed. All latent variables are measured correctly.

Furthermore, we applied the discriminant validity criterion - Fornell and Larcker criterion - to establish the robustness of the latent variables and confirm their uniqueness. Discriminant validity examines the difference between a latent variable and its measures from another latent variable and its measures (Bagozzi *et al.*, 1991). To ensure discriminant validity, Fornell and Larcker (1981) suggested that correlations between two latent variables should not exceed the square root of the average variance extracted (AVE) of the latent variable. Table 3 reports the correlations between latent variables and the square root of the AVE. As shown in Table 3, all the correlations between latent variables are less than the square root of the AVE, satisfying the criterion imposed by Fornell and Larcker and indicating the discriminant validity of the instruments.

**Table 2. Construct reliability and convergent validity**

Construct	Item	Factor loading	t-value	Composite reliability	Average variance extracted	Cronbach's Alpha
Perceived Usefulness	Q1PU	0.897	35.342	0.922	0.797	0.872
	Q2PU	0.903	52.719			
	Q3PU	0.878	36.868			
Perceived Ease of Use	Q4PE	0.790	20.548	0.886	0.661	0.830
	Q5PE	0.787	23.817			
	Q6PE	0.853	34.095			
	Q7PE	0.819	27.948			
Trust	Q8TB	0.817	28.753	0.850	0.653	0.736
	Q9TB	0.822	22.976			
	Q10TB	0.784	18.801			
Perceived Privacy	Q11PP	0.935	57.158	0.917	0.847	0.821
	Q12PP	0.905	34.576			
Perceived Reliability	Q14PR	0.783	19.712	0.819	0.604	0.678
	Q15PR	0.672	11.286			
	Q16PR	0.863	34.053			
Perceived Enjoyment	Q17PEN	0.834	30.539	0.869	0.689	0.778
	Q18PEN	0.899	54.960			
	Q19PEN	0.750	14.632			
Consumer Innovativeness	Q20CI	0.876	45.050	0.882	0.714	0.805
	Q21CI	0.786	18.850			
	Q22CI	0.871	36.741			

Attitude	Q23AT	0.866	41.440	0.874	0.698	0.782
	Q24AT	0.870	49.046			
	Q25AT	0.767	21.601			
Intention	Q26IN	0.819	35.930	0.856	0.664	0.749
	Q27IN	0.833	26.745			
	Q28IN	0.792	24.449			

Source: Authors' representation

**Table 3. Fornell-Larcker criterion**

Construct	Attitude	Consumer Innovativeness	Intention	Perceived Enjoyment	Perceived Ease of Use	Perceived Privacy	Perceived Reliability	Perceived Usefulness	Trust
Attitude	0.835								
Consumer Innovativeness	0.483	0.845							
Intention	0.666	0.410	0.815						
Perceived Enjoyment	0.520	0.489	0.446	0.830					
Perceived Ease of Use	0.504	0.274	0.457	0.345	0.813				
Perceived Privacy	0.294	0.218	0.265	0.296	0.166	0.921			
Perceived Reliability	0.441	0.234	0.402	0.409	0.330	0.352	0.777		
Perceived Usefulness	0.493	0.230	0.420	0.347	0.645	0.118	0.386	0.892	
Trust	0.411	0.289	0.419	0.414	0.445	0.467	0.413	0.342	0.808

Note: Top diagonal elements are square roots of average variance extracted.

Source: Authors' representation

## 2.4. Analysis of the structural model

Table 4 shows the standardized coefficients of the direct and indirect relationships tested. Attitude towards the adoption of mobile devices for facilitating banking services was jointly predicted by customer innovativeness ( $\beta = 0.244$ ,  $p < 0.01$ ), perceived enjoyment ( $\beta = 0.182$ ,  $p < 0.01$ ), perceived ease of use ( $\beta = 0.186$ ,  $p < 0.01$ ), perceived reliability ( $\beta = 0.142$ ,  $p < 0.01$ ), and perceived usefulness ( $\beta = 0.181$ ,  $p < 0.01$ ). These constructs jointly explained 49.1% of the variation in attitude toward the adoption ( $R^2 = 0.491$ ). Therefore, hypotheses 1, 2, 5, 7, and 8 were confirmed. However, the coefficients of perceived privacy and trust were insignificant. Hence, we don't have enough evidence to support hypotheses 4 and 6.

Intention to use mobile banking was predicted directly by attitude towards the adoption ( $\beta = 0.666$ ,  $p < 0.01$ ), which supports hypothesis 3. Attitude towards adoption explained 44.3% of the variance in intention to use mobile banking ( $R^2 = 0.443$ ). Moreover, indirect relationships were confirmed between intention to use mobile banking and customer innovativeness ( $\beta = 0.163$ ,  $p < 0.01$ ), perceived enjoyment ( $\beta = 0.121$ ,  $p < 0.01$ ), perceived ease of use ( $\beta = 0.124$ ,  $p < 0.01$ ), perceived reliability ( $\beta = 0.094$ ,  $p < 0.05$ ), and perceived usefulness ( $\beta = 0.12$ ,  $p < 0.01$ ). However, both indirect effects of perceived privacy and trust on intention to use mobile banking were insignificant.

**Table 4. Direct and indirect effects**

Construct	Attitude	Intention to use	
	Direct effects	Direct effects	Indirect effects
Attitude		0.666*	
Consumer Innovativeness	0.244*		0.163*
Perceived Enjoyment	0.182*		0.121*
Perceived Ease of Use	0.186*		0.124*
Perceived Privacy	0.071		0.047
Perceived Reliability	0.142*		0.094**
Perceived Usefulness	0.181*		0.120*
Trust	0.029		0.019

Source: Authors' representation

The results of this study provide evidence and support for Figure 1 and all the hypotheses, excluding H4 and H6. The overall exploratory power of the model is 49.2% for the attitude model and 44.3% for the intention model, which shows that both models can explain a high amount of variance in attitudes and intention. Several important findings were noted and will be presented below.

Perceived usefulness and perceived ease of use are both positively significant and affect the attitude toward using mobile banking directly, which provides evidence of the TAM and is consistent with the findings of Hanafizadeh *et al.* (2014) and Zhang *et al.* (2018). Users will adopt technology faster when they perceive this technology as useful (Premkumar and Bhattacharjee, 2008). Many researchers claimed that perceived usefulness significantly and favourably affects the intention to use (Alavi and Ahuja, 2016; Munir and Ilyas, 2017, Priya *et al.*, 2018). Tam and Oliveira (2017) revealed that perceived usefulness positively affects one's behavioural intention to use mobile banking services. Customers who utilize mobile banking services do so because they find them beneficial. Sharma and Sharma (2019) found that management students' intentions to utilize mobile banking are significantly impacted by perceived usefulness. Perceived ease of use is more critical in the case of our sample than usefulness; if the product is more user-friendly, customers tend to use mobile banking services. These results are consistent with Lee (2009), who confirmed that since online systems are becoming more standardized and user-friendly, people are becoming more efficient and more likely to use the mobile banking system. However, unlike the results found by Lee (2009), PEU has a more substantial influence than PU in the case of North Cyprus, which reveals that the complication of the process involved is more important than the actual usefulness that the application is providing. In Taiwan, Tanzania, Malaysia, and Zimbabwe, perceived ease of use was also observed to directly impact the intention to utilize mobile banking (Anthony and Mutalemwa, 2014; Shanmugam *et al.*, 2014; Mbengo and Phiri, 2015). Attitude towards using internet banking is influenced by customer innovativeness the most, as the coefficient of customer innovativeness is the highest

( $\beta = 0.244$ ,  $p < 0.01$ ). This finding underlines that customers in North Cyprus have a higher probability of accepting technology innovations (Lou *et al.*, 2010).

Findings reveal that perceived enjoyment positively affects attitudes towards adopting mobile banking services, which aligns with the results of Zhang *et al.* (2018) and confirms the influence of hedonic motivation noted by Baptista and Oliveira (2015). Perceived reliability was found to be a major factor positively influencing attitudes in the case of North Cyprus. The results were similar to those reported by Park *et al.* (2015) and Zhang *et al.* (2018). Results show that enough evidence was not found to support any relationship between perceived privacy and attitudes alongside trust and attitudes, which is consistent with Sánchez-Torres *et al.* (2018) as they found perceived privacy to be insignificant. Besides, Featherman and Pavlou (2003) mentioned that since younger generations are familiar with online transactions and are more technology-oriented, they are less concerned about perceived privacy and perceived risk. Moreover, Akturan and Tezcan (2012) found that because of the young generation's technological literacy, their attitudes are not influenced by security or perceived risk. Thus, in the case of North Cyprus, due to their technology orientation, university students do not consider the potential dangers while adopting mobile banking services.

Attitude towards adopting mobile phone banking has a highly significant positive impact on the intention to use mobile banking. Many researchers found the same result (Mohammadi, 2015; Shaikh and Karjaluoto, 2015; Zhang *et al.*, 2018). Customers' actual usage of a technology is aligned with their attitudes; therefore, enhanced intention to use mobile banking services is directly linked to consumers' attitudes toward the service. Moreover, ease of use, usefulness, enjoyment, reliability, and customer innovativeness have positive indirect relationships with the intention to use mobile banking services through attitude towards adopting mobile banking. Some researchers suggested that including attitude in the model is unnecessary (Heijden, 2003). However, the significant impact of attitude on intention and its mediation role shown in our model has proven otherwise.

## Conclusion

We applied the extended TAM model to explain customers' behavioral intentions regarding the adoption of mobile banking services. The findings confirmed the explanatory power of the proposed model and the validity of the model in predicting the customers' behavioural intentions. Obtained empirical results indicate that participants' attitude toward mobile banking is motivated by multiple drivers, including the technical features of the application (usefulness, ease of use, reliability), the reactions motivated by using the application (enjoyment), and the participant's openness to adopt new technologies (innovativeness). These factors affect the attitude and intentions positively to adopt mobile banking services.

The present study's findings shed light on some critical issues regarding the factors influencing customers' intention to use mobile banking and have several policy implications. These findings are essential, particularly for bank management, to broaden their customer base. Governments in many developing nations aim to increase financial inclusion by utilizing technology. Given the significance of financial inclusion, mobile banking services might alleviate the problems associated with the absence of a banking network. Banks have been hesitant to establish branches in remote areas due to viability concerns. As a result, services like mobile banking applications can efficiently meet that demand and serve as a valuable tool for achieving greater financial inclusion. In addition, this study demonstrates how consumers' attitudes toward the decision to adopt mobile banking services is influenced by the perceived usefulness of this technology. Creating user-centric applications must be the primary goal for mobile money app developers to raise users' awareness of their utility and operational simplicity. In turn, this should result in a rise in mobile-based financial transactions.

Financial institutions are advised to focus on developing mobile banking applications to consider the technical aspects that can attract new users. For instance, mobile banking application developers should consider the app's user-friendliness and transform complicated tasks to be easier to complete. The application's ease of use is pivotal to the success of mobile banking services for our sample, as the population values it the most. Moreover, the reliability of the mobile banking application should be boosted through technical support and a well-developed marketing strategy to ensure that the users are well-informed about all the updates in the application. Also, all technical breakdowns or transaction errors should be handled immediately through strong customer service provided to users. This is crucial in the case of North Cyprus, as students mainly rely on transactions from their families to pay their expenses and school fees. Any delays to the process will result in difficulties for students and loss of customers for the bank. Besides, management should consider the enjoyment factor and focus on enriching the customers' experience to satisfy the hedonic needs of users through the incorporation of offers, raffles, and competitions. Given that the young and educated population of North Cyprus is open to trying and using new technologies, bank executives should focus on introducing new products and services that can attract more users.

Furthermore, it is crucial to emphasize how essential customer innovativeness is in influencing consumers' attitudes and intentions toward using mobile banking. To make it easier for users to utilize mobile banking services, business providers should promote individual innovation since it influences user behavior. This indicates that customers of these services look for more than just the service's functionality; innovation is an essential concept for them. Service providers should dedicate a part of their marketing efforts to creative applications. Innovative customers can provide crucial feedback in the early stages of designing new products or services. Since mobile phones can collect large amounts of data on consumer

behavior and habits, artificial intelligence might be used to profile each consumer and provide individualized service that the client would find creative and valuable.

The limitations of this research open the door for further investigation. Future research may experimentally explore the effects of moderating variables, including age, gender, and individual consumers' experiences with mobile banking and other mobile financial services. In addition, the model used is cross-sectional; hence it examines perceptions, attitudes, and intentions at a particular time. However, as people acquire experience, their perspectives change over time. Therefore, the research question might be explored in several periods, and the comparison of the obtained findings may provide further insight into mobile banking acceptance.

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