M-banking adoption from the developing countries perspective: A mediated model

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A R T I C L E   I N F O

A B S T R A C T

This study aims to examine the factors that influence M-banking adoption from developing countries' perspective (case of Tunisia) by extending Technology Acceptance Model (TAM). To achieve this, a structural equation modelling with Partial Least Square Structural Equation Modeling (PLS-SEM) has been used to analyse the data of 202 responses. The evidence found that perceived ease of use and perceived usefulness determine the intention to adopt M-banking while perceived security, satisfaction and trust were found to be statistically insignificant in terms of their relationship with M-banking adoption intention. In this study, the empirical section examines the mediating effect of trust and satisfaction. The findings reveal that trust partially mediates the relationships between perceived security and satisfaction. Based on the research findings, managerial and theoretical implications are discussed.

1. Introduction

The number of smartphone subscriptions worldwide today surpasses six billion and it is expected to grow further by several hundred million in the next few years (Statista, 2022a). The expanded use of smartphones has increased the demand for M-banking services (Choudrie, Junior, McKenna, & Richter, 2018). M-banking (M-banking) is delivered by financial institutions or banks that allow their users to make payments such as checking banking accounts, making transactions and transferring money remotely by adopting a mobile device (Baabdullah, Alalwan, Rana, Kizgin, & Patil, 2019).

M-banking is seen as one of the most revolutionary mobile technology breakthroughs in the banking sector (Sharma & Sharma, 2019). It is the most cost-effective channel for delivering banking services (Jebarajakirthy & Shankar, 2021; Shankar, Jebarajakirthy, & Ashaduzzaman, 2020), especially in developing countries where access to banking services is low (Thusi & Maduku, 2020). M-banking offers several benefits for banks and for individuals (Baabdullah et al., 2019; Jebarajakirthy & Shankar, 2021). For individuals, M-banking has the potential to improve people's quality of life (Malaquias & Hwang, 2016). It offers high usability, usefulness, and a personalized banking experience for consumers (Karjaluoto, Shaikh, Saarijärvi, & Saraniemi, 2019). In fact, due to the ubiquity feature of M-banking platforms, consumers can benefit from banking services anytime from anywhere (Shankar & Rishi, 2020).

Hence, it can save time, reduce transaction costs and facilitate financing for customers (Zhu, Lyu, Long, & Wachenheim, 2022). For banks, it can enhance efficiency, help in providing better services (Alalwan, Dwivedi, & Rana, 2017) and reduce costs (Hanafizadeh, Behboudi, Abedini Koshksaray, Tabar, & M., 2014). Thus, it can support banks to promote financial inclusion (Zhu et al., 2022). Moreover, it helps to increase transaction efficiency and productivity (Ho, Wu, Lee, & Pham, 2020).

Despite the tremendous benefits of M-banking, the adoption rates in developing countries do not reach the expected level and customers express less interest in such services (Alalwan et al., 2017). Moreover, the adoption of M-banking is considered a problematic behavior in developing and emerging markets due to the presence of internal and external environmental impediments (e.g., strong offline bank habits, lack of skills, limited wireless Internet infrastructure, unreliable general technology infrastructure to ensure sustainable and effective connections; lack of legal implications of the technologies, particularly concerning security and taxation) (Abou-Shouk, Lim, & Megicks, 2016; Chaouali, Souiden, & Ladhari, 2017; Donner & Camilo, 2008). Likewise, several developing and emerging countries are struggling to adopt M-banking. For example, in South Africa, only a limited number of retail banking customers use this innovation (Thusi & Maduku, 2020). In Jordan, customers express less interest and motivation towards online banking channels in general and M-banking in particular (Alalwan et al., 2017). In Tunisia, banks face a socioeconomic climate weakened by the

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post-revolution financial crisis and characterized by a high level of unemployment and perceived inflation (Berraies, Ben yahia, & Hannachi, 2017) and customers' reluctance to embrace traditional financial services. Indeed, 34.6% is the average penetration rate of bank account ownership in Tunisia in 2020 according to (Statista, 2022b); 40% of the adults living in urban areas in Tunisia owned a bank account while ownership in rural areas stood at 22.4%). This implies that 65.4% of the population is excluded from the traditional financial system. *However*, Tunisia is one of the leading African countries in terms of mobile telephony (Chaouali et al., 2017). Indeed, the number of smartphone subscriptions significantly exceeds the number of people in Tunisia (125.67 mobile subscriptions registered for every 100 people in 2020) (Statista, 2022c). Besides, there is an increasing interest in promoting mobile payments by the Tunisian government. Such interest could be attributed to the new regulatory framework, adopted by the Central Bank of Tunisia (BCT) related to normalisation of technical legal disclosure which aims to promote mobile payments' safety to enhance users' confidence in this new means of payment. (BCT report, 2021) . This, in its turn, could raise a question about the effectiveness of banks to match Tunisian customers' requirements and the reason behind the struggle to boost customers to adopt M-banking.

Within the context of Tunisia, few studies were conducted in M-banking context (e.g., Berraies et al., 2017; Chaouali et al., 2017; Chaouali, Lunardo, Ben Yahia, Cyr, & Triki, 2019; Chemingui & Ben Lallouna, 2013; Trabelsi-Zoghlami, Berraies, & Ben Yahia, 2018). Despite the importance of M-banking, there is a dearth of published research on M-banking in the context of Tunisia (Trabelsi-Zoghlami et al., 2018). Indeed, only the research works of Chemingui and Ben Lallouna (2013) and Chaouali et al. (2019) have examined M-Banking adoption.

This research differs from the aforementioned studies as it expands the range of factors that might affect the use of M-Banking within the context of Tunisia. This is done by extending TAM (Technology Acceptance Model) with relevant variables such as trust, perceived security and satisfaction. Moreover, the investigation of mediating impact of relevant constructs is very poor, particularly in Tunisia and generally in developing countries' studies. The study will help understand the factors that affect the adoption of mobile banking in developing countries, which can be further extended in upcoming research to improve theoretical and scholarly contributions. Furthermore, using a powerful statistical approach such as partial least square structural equation modeling (PLS-SEM) can contribute to boosting the quality of research in developing countries. In addition, the results of the study can help the Tunisian banking sector in formulating better strategies an effective delivery of financial services through mobile devices.

2. Literature review

2.1. Adoption of M-banking in developing countries

A considerable number of studies in developing and emerging countries have focused on the factors that impact the use/ adoption of M-banking (e.g., Hanafizadeh et al., 2014; Afshan & Sharif, 2016; Glavee-Geo, Shaikh, & Karjaluoto, 2017; Gumussoy, 2016; Alalwan et al., 2017; Asnakew, 2020; Baabdullah et al., 2019; Thusi & Maduku, 2020; Ho et al., 2020; Firmansyah, Yasirandi, and Utomo (2022) (see Appendix). Indeed, authors have used different approaches and a variety of theoretical foundations to formulate consumers' perceptions, attitudes, intention and behavior towards M-banking (Alalwan et al., 2017). For instance, according to Himel et al. (2021), Bangladeshi consumers' attitudes towards M-banking were significantly affected by perceived usefulness, perceived ease of use and perceived trust (PT).

In Egypt, Hassan and Wood (2019) found that perceived usefulness and trust directly affect consumers' intention while perceived ease of use, social influence and perceived risk do not appear to have a significant positive impact on behavioral intention. Moreover, culture can

influence consumers' perceptions and intentions towards M-banking. For the same country, Awad and Dessouki (2017) revealed that customer intention to adopt M-banking was positively influenced by the role of perceived usefulness while perceived compatibility, perceived risk negatively affect behavioral intention.

Ho et al. (2020) revealed that consumer intention to adopt M-banking was positively influenced by perceived behavioral control in Taiwan & Vietnam. In Brazil, Malaquias and Silva (2020) claimed that perceived ease of use, perceived usefulness and trust are the main constructs related to the use of M-banking. The study of Alalwan et al. (2017) showed that behavioral intention is significantly and positively influenced by performance expectancy, effort expectancy, hedonic motivation, price value and trust in Jordan. Recently, Islam et al. (2019) confirmed the important role of perceived credibility, facilitating conditions, social influence and effort expectancy in forming customer's intention towards M-banking in Malaysia. Likewise, Shaikh, Glavee-Geo, and Karjaluoto (2018) claimed that Pakistani customers' attitudes towards M-banking were significantly affected by performance expectations and effort expectations and ultimately enriching the customers' intention to adopt M-banking. Koksal (2016) in Lebanon found that perceived ease of use, perceived usefulness, trialability, perceived credibility and compatibility seemed to be significant factors leading to high adoption intentions, while, trust, perceived self-efficacy, normative pressure, financial costs are not associated with the adoption level of M-banking.

In Tunisia, Chemingui and Ben Lallouna (2013) found that tradition has a negative and significant impact on the intention to use mobile financial services. Whereas, compatibility, trialability and perceived enjoyment have a positive and significant impact on the intention to use such services. The result of the research of Chaouali et al. (2019) show that functional, emotional, social and epistemic value positively affect Tunisian user's intention to adopt M-banking .

The aforementioned studies have tried to understand and examine the main factors which predict customer intention of M-banking, however, a scrupulous examination of the existing literature in the context of developing countries, revealed some remarks. Firstly, Technology Acceptance Model (TAM) proposed by Davis (1989) is the most used theory by authors. Indeed, TAM is still very popular among studies in developing and emerging countries. However, authors tried to include additional constructs to TAM such as trust (Alnemer, 2022; Asnakew, 2020; Hassan & Wood, 2019; Himel et al., 2021; Malaquias & Silva, 2020), perceived security (Hsu, Wang, & Lin, 2011) and satisfaction (Kumar & Ravindran, 2012; Priya, Gandhi, & Shaikh, 2018). Moreover, several research works combined TAM with other theories, such as Theory of Planned Behavior (TPB) (Glavee-Geo et al., 2017), Diffusion of Innovation (DOI) (Awad & Dessouki, 2017); DOI & Decomposed Theory of Planned Behavior (DTPB) model (Ho et al., 2020) and innovation resistance theory (IRT) (Himel et al., 2021). Secondly, few studies have attempted to examine the mediation effect of constructs in M-banking adoption models; e.g., perceived usefulness (Hassan & Wood, 2019), attitude (Awad & Dessouki, 2017; Himel et al., 2021) and perceived value (Chaouali et al., 2019; Jebarajakirthy & Shankar, 2021). Thirdly, we noticed that authors have started to apply sophisticated statistical approaches such as structural equation modeling (SEM) to empirically test factors which affect intention and usage of M-banking (e.g., Asnakew, 2020; Hassan & Wood, 2019; Himel et al., 2021; Ho et al., 2020; Kamboj, Sharma, & Sarmah, 2022).

3. Theoretical framework

3.1. Adoption models

The dominant theories in the field of information system of technology adoption include: The Theory of Reasoned Action (TRA), The Technology Acceptance Model (TAM), Theory of Planned Behavior (TPB), Innovation of Diffusion Theory/ Diffusion of Innovations (IDT/

DOI) and Unified Theory of Acceptance and Use of Technology (UTAUT) (Chhonker, Verma, & Kar, 2017).

Fishbein and Ajzen (1977) proposed the theory of reasoned action (TRA) and became well established and has been broadly used to predict and explain human behavior in various domains (Zhang, Zhu, & Liu, 2012). Ajzen (1991) revised and extended TRA into the theory of planned behavior (TPB) and TAM was originally developed from TRA by Davis (1989). TRA and TPB have been largely used in the field of technology adoption. However, some authors claimed that UTAUT is the most popular theory in technology adoption context (Marinković, Đorđević, & Kalinić, 2020) alongside with TAM (Awad & Dessouki, 2017). Moreover, Zhang et al. (2012) claimed that TAM and the innovation diffusion theory (IDT) were the most prominent theories used on technology adoption studies.

3.1.1. Unified theory of acceptance and use of technology (UTAUT)

Venkatesh, Morris, Davis, and Davis (2003) proposed the unified theory of acceptance and use of technology (UTAUT). According to UTAUT, performance expectancy, effort expectancy, and social influence are theorized to influence behavioral intention to use a technology. While behavioral intention and facilitating conditions determine technology use, individual difference variables, namely age, gender, and experience are also theorized to moderate various UTAUT relationships (Venkatesh, Thong, & Xu, 2012). Since its inception in 2003, researchers have increasingly turned to testing UTAUT to explain technology adoption, primarily in organizational contexts (Oliveira, Thomas, Baptista, & Campos, 2016). Later, Venkatesh et al. (2012) extended UTAUT (UTAUT 2) and added three constructs to the original model, namely hedonic motivation, price value, and habit to study acceptance and use of technology in a consumer context. Several studies in developing countries adopted UTAUT in the sphere of M-banking (Afshan & Sharif, 2016; Bhatiasevi, 2016; Islam et al., 2019; Rachmawati, Bukhori, Majidah, Hidayatullah, and Waris (2020). While (UTAUT2) were adopted by several researchers (e.g., Alalwan et al., 2017; Baabdullah et al., 2019).

This theory has several limits. First, UTAUT is used in organizational context. However, M-banking is used in private and individual context. Second, UTAUT 2 includes habit, however Tunisian consumers are not used to this new service.

3.1.2. Diffusion of innovation (DOI/IDT)

The diffusion of innovation theory (DOI) has been widely used to investigate factors that influence an individual's decision to adopt an innovation or a new technology (Ho et al., 2020). Rogers (1983) defined innovation into five attributes that influence the behavior intention of a user: relative advantage, complexity, compatibility, trialability and observability. This theory has some limits for the M-banking studies. In fact, this theory includes observability and banking transactions are conducted privately. Thus, the involved behavior is not observable (Ho et al., 2020). Moreover, Awad and Dessouki (2017) claimed that DOI was criticized since, it acknowledges a behavioral process, a movement from awareness to acceptance, but it neither explains how attitudes are formed and lead to acceptance or rejection, nor how innovation attributes fit the process.

3.1.3. Technology acceptance model (TAM)

TAM has proven to be among the most effective models in the information systems literature for predicting user acceptance and usage behavior (Davis & Venkatesh, 1996). TAM suggests that users' intention to use is determined by one's attitude towards using and this attitude in its turn is determined by two specific beliefs: perceived usefulness (PU) and perceived ease of use (PEOU). However, the final TAM excluded the attitude construct because attitude did not fully mediate the effect of perceived usefulness on intention (Davis & Venkatesh, 1996). By considering the objective to clarify the factors that influence the intention to adopt M-banking, TAM is appropriate for our modeling purposes

as TAM was tested and proved as parsimonious and robust model of technology acceptance behaviors in a wide variety of IT (Gefen, Karahanna, & Straub, 2003) and it provides proper major factors to address the purpose of this study, namely PEOU; PU and Intention to adopt MB . However, recent studies have criticized TAM as it has focused solely on perceived usefulness and perceived ease of use. Thus, it has oversimplified the complex process of decision-making (Marinković et al., 2020). To address this issue, Zhang, Lu, and Kizildag (2018) suggest to reconceptualise TAM to include selective constructs reflecting the m-commerce banking context and the specifics of banking services. Indeed, several studies tried to extend TAM with different constructs; such as trust (Al-Husein & Sadi, 2015; Asnakew, 2020; Awad & Dessouki, 2017; Gu, Lee, & Suh, 2009; Hanafizadeh et al., 2014; Hassan & Wood, 2019; Sharma, Govindaluri, Al-Muharrami, & Tarhini, 2017; Zhang et al., 2018). Indeed, M-banking is considered as a revolutionary technology and the major concern of most people when adopting new technologies is trust (Hanafizadeh et al., 2014). However, the majority of previous studies have focused on trust as an independent variable or outcome (Geebren, Jabbar, & Luo, 2021). Hence, the role of trust as mediator has not yet been fully addressed in the relevant studies in M-banking. Furthermore, recent studies have proposed that perceived security should be an antecedent of intention to use M-banking (Changchit, Lonkani, & Sampet, 2017; Hsu et al., 2011; Shareef, Baabdullah, Dutta, Kumar, & Dwivedi, 2018). Indeed, perceived security is extremely important in affecting adoption and it is the greatest predictor of trust (Shareef et al., 2018). Yet, the majority of prior studies into M-banking have focused on examining the direct effect of perceived security on intention. Thus, it is suggested in this study that perceived security could have a direct effect on intention and an indirect impact on intention through trust. On the other hand, Arcand, PromTep, Brun, and Rajaobelina (2017) believe that it is important to examine M-banking not only from an adoption standpoint but also from another perspective. In fact, the user of M-banking is not only a technology user but s/he is a consumer and s/he pays the service. In the same vein, Pedersen, Methlie, and Thorbjornsen (2002) argued that the consumer perspective is almost absent and it does not seem to have been widely applied to studies of 3G services and mobile services. Hence, banks have to pay attention whether their consumers are satisfied or not in order to adopt M-banking. Furthermore, customer satisfaction has not been studied well specifically in M-banking context (Saleem & Rashid, 2011). Additionally, there are few attempts to examine the mediating role of satisfaction in M-banking adoption/ use models (e.g., Kamboj et al., 2022; Priya et al., 2018; Sharma & Sharma, 2019).

The research of Sharma and Sharma (2019) extended the DeLone & McLean information systems (D&M IS) success model to understand users' actual usage of M-banking. This study employed a two-staged analytical approach by combining structural equation modeling and neural network analysis and proved that satisfaction mediates the relationship between service quality, information quality and trust with intention to use M-banking in Oman and negates with that the system quality.

Kamboj et al. (2022) proposed a M-banking failure model (MBFM) by integrating four failure dimensions (functional, system, information and service) based on Tan's failure model and DeLone and Mclean's Information Success model. The result of this study suggests that user satisfaction towards M-banking acts as a partial mediator between the use of M-banking and customer engagement.

Priya et al. (2018) used a cross-sectional survey research design to empirically examine the factors affecting M-banking adoption among young Indian consumers. The findings of the study suggest that user satisfaction partially mediates the relationship between perceived usefulness, perceived ease of use, perceived credibility and structural assurance and behavioral intention to use the service.

While few studies have investigated the role of satisfaction as mediator between trust and intention of adoption (e.g., Sharma & Sharma, 2019) and between the main constructs of TAM (perceived ease

of use & perceived usefulness) and behavioral intention (Priya et al., 2018), this current study finds that there are no studies that consider the role of satisfaction as mediator between perceived security and intention to adopt M-banking from our exhaustive literature review.

The contributions of this study are two folded. First, we seek to answer the question: what are the factors that influence the intention of adoption of M-banking in Tunisia?

Second, the present study is an attempt to clarify the mediating role of satisfaction and trust in the mobile banking adoption by Tunisian banking customers.

4. Conceptual model and hypotheses development

The conceptual model of this study extended TAM to identify the factors that affect the intention of adoption of M-banking in Tunisia. As it can be seen in Fig. 1, factors that are extracted from the TAM model include M-banking Adoption Intention (MBAI), Perceived Ease of Use (PEOU), Perceived Usefulness (PU). Furthermore, this study adopts User Satisfaction (US), Trust (T) and Perceived Security (PS) as the independent variables that influence the (MBAI) variable.

4.1. User satisfaction

User satisfaction is defined as the net feeling of pleasure or displeasure that results from aggregating all the benefits that a person hopes to receive from interaction with the information system (Seddon & Kiew, 1996). User satisfaction has often been used as the dependent variable for IT success (Al-Jabri & Sohail, 2012). However, Yin and Lin (2022) argued that there are still problems with consumer satisfaction related to M-banking services, in developing countries. Additionally, it is seen as a critical construct in M-banking because it is related to other important variables including systems analysis and design (Lee & Chung, 2009) and especially for the use and adoption of M-banking. Indeed, users' satisfaction could be regarded as the most vital parameter that determines a user's intention (Foroughi, Iranmanesh, & Hyun, 2019). In the same vein, Sharma and Sharma (2019) found that satisfaction is a key factor that precedes the intention to use M-banking in Oman. Furthermore, satisfaction has been accepted as a crucial construct of M-banking intention in India (Priya et al., 2018). Lately, higher intention to use has been proved to have a positive association with satisfaction towards Unified Payment Interface (UPI) in India (Fahad & Shahid, 2022). Therefore, we formulate the following hypothesis:

H1. User satisfaction has a positive impact on M-banking adoption intention.

4.2. Trust

Trust is defined as the willingness to take risks in order to fulfil a need without prior experience and it is relying on individual's certain perspectives in order to use the technology (Afshan & Sharif, 2016). The concern of most people when adopting new technologies is trusting technology for doing jobs (Hanafizadeh et al., 2014). Moreover, users must have strong level of trust on M-banking technologies to be optimally used (Masrek, Mohamed, Daud, & Omar, 2014).

Apparently, no matter where they live, consumers who trust M-banking providers and M-banking applications are more likely to use this innovation (Hassan & Wood, 2019). Thus, customer's trust plays an essential role in explaining and solving the problems of adopting M-banking (Lin, 2011). Moreover, trust is essential to mitigate the uncertainty of financial transactions to motivate the consumer to use M-banking (Giovanis, Assimakopoulos, & Sarmaniotis, 2019). Indeed, viruses and Trojan horses may exist and lead to long-term financial and technological difficulties, which in their turn increase users' concern about payment security (Choudrie et al., 2018).

Prior studies proved that trust is a crucial factor that predicts intention of adopting M-banking (Afshan & Sharif, 2016; Alalwan et al., 2017; Giovanis et al., 2019; Gu et al., 2009; Hanafizadeh et al., 2014; Hassan & Wood, 2019; Liu, Min, & Ji, 2009; Malaquias & Silva, 2020; Merhi, Hone, & Tarhini, 2019; Saparudin, Rahayu, Hurriyati, Sultan, & A., 2020; Sharma & Sharma, 2019; Xiong, 2013).

Therefore, we suggest the following hypothesis:

H2. Trust has a positive impact on M-banking adoption intention.

4.2.1. Trust and user satisfaction

On the other hand, trust is an important variable in customer satisfaction for the M-banking environment (Lee & Chung, 2009). In the same vein, Arcand et al. (2017) demonstrate that trust acts as a powerful determinant of satisfaction. Sharma and Sharma (2019) state that trust is the most influential predictor of the satisfaction towards M-banking in Oman. Additionally, authors have found that trust has a positive impact on the satisfaction of users (Berraies et al., 2017; Geebren et al., 2021; Koo & Wati, 2010; Lee & Chung, 2009; Poromatikul, De Maeyer, Lee-lapanyalert, & Zaby, 2019; Trabelsi-Zoghlami et al., 2018). Thus, we hypothesize:

H3. Trust has a positive impact on user satisfaction.

4.3. Perceived security

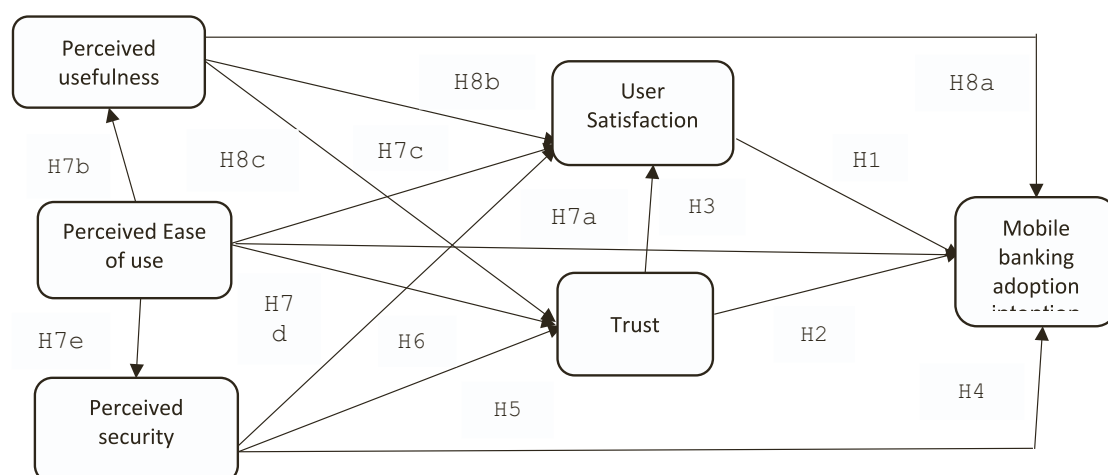Perceived security is defined as the degree to which users perceive

Fig. 1. Proposed research model.

that it is safe to disclose personal and financial information during interaction and transaction with M-banking system and users are also assured that the system does not disclose or share their information with others or misuse for any purpose (Shareef et al., 2018). Security remains the biggest concern and one of the most critical barriers facing mobile and e-banking acceptance and growth (Merhi et al., 2019). For that reason, companies are expected to protect their customers' personal data during transaction processes via building security systems (Hsu et al., 2011). Hence, perceived security can play a crucial role to convince users to use M-banking. This view is supported by several prior studies that have proved that perceived security has a significant effect on intention to adopt M-banking (Changchit et al., 2017; Johnson, Woolridge, Wang, & Bell, 2020; Merhi et al., 2019; Shareef et al., 2018). Therefore, we propose the following hypothesis:

H4. Perceived security has a significant positive impact on M-banking adoption intention.

4.3.1. Perceived security and trust

Concerns about security issues are important to consumers despite the great convenience the M-banking system may bring, (Shen, Huang, Chu, & Hsu, 2010). Indeed, consumers were concerned about banking's security due to the distinct possibility of data breaches and leakage or theft by hackers (Merhi et al., 2019). This lack of confidence in the degree of provided security can cause customers to worry that their money may disappear from their account without any track (Changchit et al., 2017).

Hence, unsurprisingly perceived security is the greatest predictor of trust for consumers (Shareef et al., 2018). Indeed, customers are more likely to trust the new service if adequate security is provided for their transaction data (Singh & Srivastava, 2018). Moreover, the study of Arcand et al. (2017) demonstrates the importance of security/privacy for building trust. Hence, we suggest the following hypothesis:

H5. Perceived Security has a positive impact on trust.

4.3.2. Perceived security and satisfaction

Security is considered as one of the benefits of M-banking apps (Sampaio, Ladeira, & Santini, 2017). Seddon and Kiew (1996) state that each user has a set of expected benefits or aspirations for the information system, to the extent that the system meets or fails to meet each of these aspirations, the user is more or less satisfied. Hence, if a customer perceives the highest degree of safety and security while conducting a transaction via mobile, that will lead certainly to satisfaction. Few studies have explored the effect of the security of banking on satisfaction (e.g., Li, Lu, Hou, Cui, & Darbandi, 2021). However, different studies have explored the relationship between perceived security/privacy and satisfaction (Yin & Lin, 2022). It is noteworthy that concepts like security and privacy should not be jumbled together but rather treated as different levels of constructs (Laukkanen, 2007). We therefore hypothesize:

H6. Perceived Security has a positive impact on satisfaction.

4.4. Perceived ease of use (PEOU)

Perceived ease of use is defined as "the degree to which a person believes that using a particular system would be free of effort." (Davis, 1989). Alalwan et al. (2017) argued that PEOU could play a crucial role in determining the customers' intention due to the particular nature of M-banking that requires a certain level of knowledge and skills. A user-friendly interface with visible interface, suitable content and graphical layouts, help functions, clear commands, symbols and meaningful error messages are required to tempt users to adopt M-banking technology. Moreover, Priya et al. (2018) observed that perceived ease of use, is a strong determinant of behavioral intention to use M-banking service by young Indian consumers. Malaquias and Silva (2020) also confirmed

that perceived ease of use has a positive relationship with M-banking use in Brazil so did Hanafizadeh et al. (2014) with Iranian bank clients and Gu et al. (2009) with Korean users. However, the relationship of ease of use and intention to adopt/use M-banking was not significant in the study of Makanyeza (2017) in Zimbabwe. However, M-banking in Tunisia and in developing countries in general, is a new service and users are not familiar with this technology. Hence, the perception of ease of use will impact the intention to adopt M-banking. Moreover, Priya et al. (2018) confirmed that there is a positive relationship between usage intention and perceived ease of use. Based on the findings of the earlier studies as mentioned above, we propose the following hypothesis:

H7 a. Perceived ease of use has a positive impact on M-banking adoption intention.

Perceived ease of use is hypothesized to have a significant direct effect on perceived usefulness (Davis, 1993). Consistent with TAM research, perceived ease-of-use is the most important construct on perceived usefulness for South Korean M-banking users (Gu et al., 2009). Indeed, when the consumers perceive that learning and using M-banking is easy, their positive perceptions of usefulness increase (Akturan & Tezcan, 2012). Moreover, Nguyen and Nguyen (2020) state that perceived ease of use can influence perceived usefulness because, while other things are equal, the easier the technology to use is, the more useful it can be. In addition, the relationship between PEOU and PU has been largely proven by many researchers in the context of M-banking (Alalwan, Dwivedi, Rana, & Williams, 2016; Awad & Dessouki, 2017). Hence, we formulate the following hypothesis:

H7 b. Perceived ease of use has a positive impact on perceived usefulness.

For mobile services, Revels, Tojib, and Tsarenko (2010) state that there is evidence to suggest that the complexity of m-services will influence overall user satisfaction. In other words, when a customer finds that a system is easy, this creates a positive impact and leads to satisfaction (Kahandawa & Wijayanayake, 2014). For South Korean M-banking users, the direct effect of perceived ease of use on customer satisfaction is meaningful (Kim & Lee, 2013). In addition, past studies have proved that perceived ease of use has a positive impact on user satisfaction (Kahandawa & Wijayanayake, 2014; Kim & Lee, 2013; Le, Pham, Chu, Nguyen, & Ngo, 2020; Priya et al., 2018). Thus, we suggest the following hypothesis:

H7 c. Perceived ease of use has a positive impact on user satisfaction.

By drawing from the literature on information technology (IT), PEOU has been identified as a crucial construct that influences trust towards a particular technology (e.g., Chinomona, 2013; Cho, Kwon, & Lee, 2007; Gefen et al., 2003; Ramli et al., 2021; Trabelsi-Zoghlami et al., 2018). Indeed, if users anticipate effortless experience when using mobile software, it is likely that they will end up trusting that mobile software (Chinomona, 2013). In e-commerce context, PEOU contributes to trust (Gefen et al., 2003). PEOU also increases trust in mobile & internet commerce (Cho et al., 2007). For M-banking, the results of the study of Ramli et al. (2021) show that perceived ease of use has a positive and significant influence on trust in Indonesia. In Tunisia, customers valorise ease of use to trust M-banking applications (Trabelsi-Zoghlami et al., 2018). Therefore, we posit the following hypothesis:

H7 d. Perceived ease of use has a positive impact on trust.

Numerous researchers have studied the effect of perceived security on PEOU for mobile payment services (e.g., Leong, Tan, Puah, & Chong, 2020; Lwoga & Lwoga, 2017; Sohn & Groß, 2020) but few studies have investigated the impact of PEOU on PS (e.g., Hsu et al., 2011; Kavitha & Kannan, 2020). Hsu et al. (2011) point out that if difficulties of use could not be overcome, then the user might not perceive any security towards using M-banking and consequently abandons usage. Moreover,

perceived security has a positive relationship with PEOU for mobile payment services (Leong et al., 2020) and for M-banking (Hsu et al., 2011). Leong et al. (2020) reported that studies examining the relationship between PS and PEOU have been sparse and limited. Then, it is argued that it warrants additional examination. Thus, we propose the following hypothesis:

H7 e. Perceived ease of use has a positive impact on perceived security.

4.5. Perceived usefulness (PU)

Usefulness is the degree to which a person believes that using a particular system would enhance his or her job performance (Davis, 1989). For Nguyen and Nguyen (2020), perceived usefulness of M-banking could be because of transactions (like online request for cheque/demand draft, sending monthly e-statements, online payments, etc.) that improve performance, save time and increase effectiveness of service. Thus, when users perceived the usefulness of M-banking they will accept it. PU has been widely proved to have a significant direct effect on intention to adopt M-banking (Alalwan et al., 2016; Gu et al., 2009; Hanafizadeh et al., 2014; Malaquias & Silva, 2020). Hence, we formulate the following hypothesis:

H8 a. Perceived usefulness has a positive impact on M-banking adoption intention.

4.5.1. Perceived usefulness & user satisfaction
If the M-banking is useful, customers can be motivated to use the facilities and services very frequently and thereby improve their satisfaction level (Kahandawa & Wijayanayake, 2014). Priya et al. (2018) found that PU have a very strong impact on intention to use M-banking and on satisfaction as well. It is suggested that the more useful a technology is, the more satisfactory it is (Chen, Chen, & Chen, 2009). Indeed, when customers are fully convinced that M-banking services offer benefits, it gives them a better customer satisfaction (Kahandawa & Wijayanayake, 2014). Evidence from empirical studies shows that PU has a positive effect on user satisfaction (Foroughi et al., 2019; Kahandawa & Wijayanayake, 2014; Kim & Lee, 2013; Koo & Wati, 2010; Kumar & Ravindran, 2012; Priya et al., 2018; Yuan, Liu, Yao, & Liu, 2014). Thus, we suggest the following hypothesis:

H8. Perceived usefulness has a positive impact on user satisfaction.

4.5.2. Perceived Usefulness & Trust
M-banking is something that should be present in one person's life because of the benefits it can bring (Van et al., 2020). By getting more reliable banking services, customers can get the ultimate benefits (Gu et al., 2009). With the perception of such benefits, users tend to develop trust in various mobile services (Sarkar, Chauhan, & Khare, 2020). Thus, when users perceive M-banking as useful, they are willing to trust it. Previous studies posit that perception of usefulness positively influences trust in M-banking (Afshan & Sharif, 2016; Maroofi, Kahrarian, & Dehghani, 2013; Ramli et al., 2021). Therefore, we hypothesize:

H8 c. Perceived usefulness has a positive impact on trust.

4.6. Mediating impact of satisfaction

According to previous related studies mentioned in a previous section, PEOU and PU have positive impact on user satisfaction and satisfaction has a positive effect on intention to adopt M-banking. Hence, if customers perceive M-banking to be easy to use, they will be likely to have high level of satisfaction in M-banking and will be willing to have intention to use such a service. However, several studies have discussed the relationship between PU, PEOU and satisfaction without investigating the mediating effect of the latter variable (Kahandawa &

Wijayanayake, 2014; Kim & Lee, 2013). Moreover, Priya et al. (2018) have recently showed that user satisfaction partially mediates the relationship between perceived ease of use, perceived usefulness and M-banking adoption intention. Thus, we propose the following hypotheses:

H9. User satisfaction mediates the relationship between of PU and M-banking adoption intention.

H10. User satisfaction mediates the relationship between of PEOU and M-banking adoption intention.

According to Silic and Ruf (2018), satisfaction seems to play an important role in the relationship between trust and intention to use M-banking. When a consumer trusts a certain technology, he or she will be satisfied with the service and will be likely to adopt this technology. Moreover, Sharma and Sharma (2019) have investigated the mediation effect of satisfaction between trust and intention to use M-banking and they argued that users are expected to use M-banking if they are satisfied with the service which comes from trust. Thereby, we posit the following hypothesis:

H11. User satisfaction mediates the relationship between trust and M-banking adoption intention.

On the other hand, Montoya-Weiss, Voss, and Grewal (2003) have proved that there is a relationship between security perceptions, satisfaction, and usage in the context of online services. Therefore, if customers perceive M-banking to be highly secure, that leads to high degree of satisfaction and satisfied customers are more likely to adopt M-banking. According to our exhaustive literature review, there are no studies that examine the mediating impact of satisfaction between perceived security and M-banking adoption intention. Thus, we suggest the following hypothesis:

H12. User satisfaction mediates the relationship between Perceived security and M-banking adoption intention.

4.7. Mediating impact of trust

Arcand et al. (2017) show that trust, which is a determinant of satisfaction, is directly associated with a utilitarian dimension. Their study proved that trust completely mediates the relationship between security and satisfaction. Hassan and Wood (2019) argued that trust could help in reducing customers' fears and concerns regarding security of banking transactions carried out through mobile devices. Hence, it leads customer to be satisfied and be willing to adopt M-banking. Thus, we hypothesize:

H13. Trust mediates the relationship between perceived security and user satisfaction.

Increasing users' perception of security may build customers' trust (decrease their perception of security threats and transaction risk) and thus increase their behavioral intention (Hsu et al., 2011). It is thus thought that security could effectively enhance trust and lead customer to adopt M-banking. Indeed, Chiu, Bool, and Chiu (2017) have proved that the relationship between security and behavioral intention to use M-banking is fully mediated by trust. Hence, we propose the following hypothesis:

H14. Trust mediates the relationship between perceived security and M-banking adoption intention.

5. Methodology

5.1. Instrument development

A convenience sampling was conducted to collect the required data using a questionnaire survey devoted to 202 Tunisian customers in order to validate the conceptual model and examine the research hypotheses.

A structured questionnaire, consisting of two sections, was designed to collect data from Tunisian M-banking users. The first section of the questionnaire collected data related to the samples' demographics (gender, age, educational qualification, employment status and M-banking usage). The second section of the questionnaire was developed based on the detailed review of existing literature on technology adoption models and their extensions in the context of M-banking and focused to measure various constructs related to M-banking adoption. In addition, this study used measurement scales that have been validated in previous studies. A list of 21 items under 6 constructs were incorporated in the conceptual research model (perceived security, trust, satisfaction, perceived usefulness, perceived ease of use, and M-banking adoption intention) .

The three items measuring perceived security were taken from Shareef et al. (2018). The three items measuring trust were taken from Malaquias and Hwang (2016). The four items measuring satisfaction were obtained from Geebren et al. (2021). Items measuring PEOU (three items) and PU (four items) were taken from Hassan and Wood (2019). The four items of intention to adopt were obtained from Alalwan et al. (2017). A five-point Likert scale was applied to measure the main constructs of the conceptual model. A pioneer study has been conducted with 30 Tunisian customers. All respondents confirmed that the length of the questionnaire was acceptable and the language used was intelligible.

6. Results

6.1. Respondents' profile and characteristics

Two hundred two valid questionnaires of M-banking were completed by Tunisian customers. 69.3% of the respondents were female compared to 30.7% of the total respondents who were male. In relation to the respondents, it was noticed that the age group of 20–30 captured the largest part of the total valid sample (86.1%) while the group age above 30 represent (13.9%). With reference to occupation, the vast majority of respondents (82.7%) are students followed by employees (15.8%) and then job seekers (1.5%). Demographic characteristics of the sample are illustrated in Table A1. (see appendix).

6.2. Structural equation modeling analysis

To validate the current study model and test the research hypotheses, a two-stage approach of structural equation modeling (SEM) has been applied. Thus, the constructs were subjected to the measurement model analyses followed by the structural model analyses. SEM is used with partial least squares (PLS).

6.2.1. Assessment of the measurement model

To evaluate the reliability of indicators, the indicator (items) loadings are examined. Then, internal consistency reliability is measured by using Cronbach's alpha and composite reliability (CR). The convergent validity was addressed using the average variance extracted (AVE) values for all indicators on each construct. Table 1 summarizes the assessment of the measurement model. As shown in Table 1, the loadings of all items are above (0.70) except for five indicators (item PU1, PS3, PEOU3, Trust3, S3 & S4). However it is common to find that at least several measurement items in an estimated model have loadings below the 0.7 (Hulland, 1999). Moreover, Barclay, Higgins, and Thompson (1995) considered that threshold loadings of at least 0.5 are acceptable. Hair et al. (2021) state that indicators with loadings between 0.40 and 0.70 should be considered for removal only when deleting the indicator leads to an increase in the internal consistency reliability or convergent validity. In our study, only three items were removed (PEOU1, PU2 and Intention 4). (removing PEOU1 & Int4 increased the internal consistency reliability and removing PU2 improved the convergent validity).

The Cronbach's alpha values of all constructs are ranged from 0.528

Table 1
Measurement model summary.

Constructs	Items	FL
Perceived Security (AVE = 0.559, CR = 0.791, α = 0.604)	PS1 M-banking service channel is safe to interact with for financial purposes.	0.740
	PS2 M-banking service channel protects information about my account information.	0.806
	PS3 M-banking service channel does not share my personal information with other sites.	0.692
Trust (AVE = 0.514, CR = 0. 759, α = 0.528)	T1 I believe that M-banking is trustworthy	0.785
	T2 I believe that M-banking keeps its promises	0.725
	T3 I believe that M-banking keeps users' interests in mind.	0.632
Satisfaction (AVE = 0.532, CR = 0.819, α = 0.709)	S1 I strongly recommend M-banking to others.	0.775
	S2 I think that I made the correct decision to use M-banking.	0.818
	S3 I am satisfied with the way that M-banking has carried out transactions.	0.654
	S4 I am satisfied with the service I have received from M-banking.	0.657
Perceived usefulness (AVE = 0.510, CR = 0.757, α = 0.522)	PU1 I think that managing my banking activities is/would be more effective using M-banking.	0.681
	PU3 I think that using M-banking improves/would improve my performance in doing banking transactions.	0.727
	PU4 Overall, I think that M-banking services are/would be very useful.	0.735
Perceived ease of use (AVE = 0.741, CR = 0.851, α = 0.650)	PEOU2 I think that interactions with M-banking applications are/would be clear and understandable	0.863
	PEOU3 It is/would be easy for me to use M-banking applications to perform banking transactions.	0.859
M-banking adoption intention (AVE = 0.675, CR = 0.861, α = 0.758)	IN 1 I intend to use Mobile banking in the future.	0.848
	IN2 I will always try to use Mobile banking in my daily life.	0.773
	IN3 I plan to use Mobile banking in future.	0.841

to 0.758. For Hair, Hult, Ringle, and Sarstedt (2017), Cronbach's alpha is sensitive to the number of items in the scale and generally tends to underestimate the internal consistency reliability, hence it is appropriate to apply a different measure of internal consistency reliability, which is referred to as composite reliability. One of the primary measures used in PLS-SEM is Jöreskog's (1971) composite reliability rho (c) and the values between 0.70 and 0.90 range from "satisfactory to good" (Hair et al., 2021) . In this study, all the composite reliability rho (c) values are above 0.7.

The AVE values ranged from 0.510 to 0.675, exceeding 0.5. AVE value of 0.50 or higher indicates that, on average, the construct explains more than half of the variance of its indicators (Hair et al., 2017). Thus, this research model testifies sufficient convergent validity. Then, discriminant validity is checked following the Fornell-Larcker criterion

Table 2
Results of discriminant validity (Fornell and Larcker criterion).

	MBAI	PEOU	PU	PS	Satisfaction	Trust
MBAI	0.821					
PEOU	0.492	0.861				
PU	0.519	0.435	0.714			
PS	0.420	0.312	0.279	0.747		
Satisfaction	0.420	0.325	0.516	0.519	0.730	
Trust	0.388	0.344	0.362	0.428	0.527	0.717

approach. As shown in Table 2, the value of the square root of the AVE (along the diagonal) is greater than the correlations of the latent variables.

In addition, Henseler, Ringle, and Sarstedt (2015) strongly recommend drawing on the HTMT criteria for discriminant validity assessment because neither the Fornell-Larcker criterion nor the assessment of the cross-loadings allow users of variance based SEM to determine the discriminant validity of their measures. Table 3 shows that all HTMT ratios are lower than 0.90 which means that there are no discriminant validity problems according to this criterion which are the recommended thresholds (Henseler et al., 2015).

6.2.2. Assessment of the structural model

In this section, there is focus on the assessment structural model assessment procedure as suggested by Hair et al. (2017). There are six steps (**Step 1**: assess structural model for collinearity issues; **Step 2**: assess the significance and relevance of the structural model relationships; **step 3**: assess the level of R^2; **Step 4**: assess the f^2 effect size; **Step 5**: assess the predictive relevance q^2; **Step 6**: assess the Q^2 effect size). In addition, Hair, Risher, Sarstedt, and Ringle (2019) recommend applying the PLS predict procedure to assess the model's out-of-sample predictive power since R^2 only indicates the model's in-sample explanatory power.

First, the structural model for collinearity issues is checked by examining the VIF values (Hair et al., 2017). Ideally, the VIF values should be close to 3 and lower. (Hair et al., 2019). As shown in Table 4, the values are between 1.102 and 1.850, hence, all the VIF values are below 3. Thus, there is no significant indication of multi-collinearity issues. Secondly, there is a need to check the significance of the path coefficients (Step 2). The bootstrapping procedure is used in SmartPLS with 5000 subsamples to examine the significance of the hypothesized relationships summarized in Table 7. This table shows that 9 out of the 14 hypotheses were supported. PEOU ($\beta = 0.280$, $p < 0.001$), PU ($\beta = 0.295$, p < 0.001), are significantly associated with the intention to adopt M-banking. Conversely, PS ($\beta = 0.044$, $p = 0.540$), Trust ($\beta = 0.117$, $p = 0.081$), have no influence on the intention to adopt M-banking. Furthermore, PS ($\beta = 0.311$, p < 0.001), PU ($\beta = 0.334$, p < 0.001), trust ($\beta = 0.278$, p < 0.001) are significantly associated with satisfaction. Moreover, PS ($\beta = 0.322$, p < 0.001) and PU ($\beta = 0.204$, $p < 0.05$) are significantly associated with trust and PEOU ($\beta = 0.435$, p < 0.001) is significantly associated with PU. Then, the R^2 values of the endogenous latent variables are examined. This coefficient is a measure of the model's predictive power (Hair et al., 2017).

This model explained 38.9% of the variance in intention to adopt M-banking. Furthermore, the model explained 47.6% of the variance in satisfaction; 26.5% of the variance in trust and 18.9% of the variance in perceived usefulness. According to Hair et al. (2019), the R^2 values of 0.75, 0.50, and 0.25 can be considered substantial, moderate and weak. However, the R^2 should always be interpreted relative to the context of the study, based on the R^2 values from related studies as well as models of similar complexity (Hair et al., 2021). Moreover, R^2 values of 0.20 are considered high in disciplines such as consumer behavior (Hair et al., 2017) Hence, the results show a moderate level for intention, satisfaction and trust whereas the R^2 value of PU is rather weak (Table 6).

For Chin (1998), Q^2 represents a measure of how well observed values are reconstructed by the model and its parameter estimates; $Q^2 >$

0 implies the model has predictive relevance whereas $Q^2 < 0$ represents a lack of predictive relevance. In this study, Q^2 values are above zero, which implies that the structural model has a high predictive relevance (Table 6).

The effect size f^2 is a measure used to assess the relative impact of a predictor construct on an endogenous construct. F^2 values of 0.02, 0.15 and 0.35 indicate an exogenous construct of small, medium or large effect respectively, on an endogenous construct (Hair et al., 2017; Hair et al., 2019). Table 5 shows that trust (0.015), PS (0.002) and satisfaction (0.007) do not affect the intention to adopt M-banking while PEOU (0.096) and PU (0.092) all have small effects on intention to adopt. Furthermore, PEOU (0.108) has a small effect on PS.

PS (0.144), and PU (0.161) all have small effects on satisfaction while PU (0.161) has a medium effect on satisfaction. Moreover, PEOU (0.025), PU (0.045) and PS(0.124) all have small effects on trust. Finally, PEOU (0.233) has a medium effect on PU (Table 5).

The model presented in this study shows a high explanatory power and predictive relevance of the in-sample model. There is a need to assess the model's out-of-sample predictive by applying the PLS predict procedure as suggested by (Hair et al., 2019). PLSpredict is applied with 10 folds in SmartPLS to get prediction statistics (RSME and MAE) for all indicators of the endogenous variables for both the PLS path model and the linear model LM. Then, the Q^2 predict statistics are evaluated to verify that the predictions outperform the most naive benchmark; defined as the indicator means from the analysis sample. In the case of this study, all Q^2 predict are above zero, which demonstrate that all the indicators of endogenous constructs outperform the naive benchmark (Table 8). Then, there is a need to compare the RMSE (or MAE) values with the LM values. The rule of thumb in the view of (Shmueli et al., 2019):

PLS-SEM < LM for none of the indicators: the model lacks predictive power;

PLS-SEM < LM for a minority of the indicators: this indicates that the model has a low predictive power;

PLS-SEM < LM for a majority of the indicators: this indicates a

Table 4
Results of structural model assessment: **VIF.**

	VIF
Intention1	1.824
Intention2	1.305
Intention3	1.850
PEOU2	1.302
PEOU3	1.302
PSecurity1	1.189
PSecurity2	1.286
PSecurity3	1.186
PU1	1.130
PU2	1.140
PU4	1.113
Satisfaction1	1.397
Satisfaction2	1.490
Satisfaction3	1.260
Satisfaction4	1.274
Trust1	1.159
Trust2	1.148
Trust3	1.102

Table 3
Results of discriminant validity (HTMT criterion).

	MBAI	PEOU	PU	PS	Satisfaction	Trust
MBAI.						
PEOU	0.697					
PU	0.812	0.742				
PS	0.460	0.491	0.508			
Satisfaction	0.542	0.475	0.827	0.796		
Trust	0.597	0.582	0.675	0.752	0.844	

Table 5
Results of structural model assessment: **F².**

	MBAI	PEOU	PU	PS	Satisfaction	Trust
MBAI						
PEOU	0.096		0.233	0.108	0.000	0.025
PU	0.092				0.161	0.045
PS	0.002				0.144	0.124
Satisfaction	0.007					
Trust	0.015				0.108	

Table 6
Results of structural model assessment: Q^2 & R^2.

Constructs	$Q^2 = (1-SSE/SSO)$	R^2
P Security	0.050	0.097
PEOU		
PU	0.091	0.189
Satisfaction	0.239	0.476
Trust	0.124	0.265
MBAI	0.239	0.389

medium predictive; PLS-SEM < LM for all indicators: the model has high predictive power.

In this study, the majority of the indicators in PLS-SEM produce low prediction errors compared to naive benchmark (except for Perceived security 3). Hair et al. (2019) recommend that the focus be on the model's key endogenous construct when interpreting PLSpredict results. Hence, this model has a high predictive power.

6.3. Mediation analysis

In recent years, serval approaches have been developed to assess the mediation effect (Baron & Kenny, 1986; Nitzl, Roldan, & Cepeda, 2016; Zhao, Lynch Jr, & Chen, 2010). Geebren et al. (2021) argued that the most popular technique to analyse the mediation effect was proposed by Baron and Kenny (1986). However, in recent years, Baron and Kenny's (1986) causal-step approach for determining mediating effects has been challenged considerably by authors who call for a reconsideration of Baron and Kenny's (1986) method and suggest applying new procedures (Nitzl et al., 2016). In fact, Zhao et al. (2010) recommend that to establish mediation the Baron-Kenny "three tests + Sobel" steps can be replaced with only one test: the bootstrap test of the indirect effect a x b. Hence, in order to establish mediation, what matters is that the indirect effect is significant. Then, they recommend classifying the type of mediation by estimating the coefficients a, b, and c. The first thing to note is whether the direct effect c is significant to distinguish if there is mediation or non-mediation. There are three types of mediation and two types of non-mediation:

a x b is significant but c is not - > indirect only (mediation).

a x b is not significant but c is significant - > direct only (non-mediation).

Neither a x b nor c is significant - > no effect (non-mediation).

Both a x b and c are significant, determine the sign of a x b x c by multiplying the three coefficients, or by multiplying c by the mean value of a x b from the bootstrap output:

a x b x c is positive - > Partial mediation (complementary mediation).

a x b x c is negative - > Partial mediation (competitive mediation).

In this research, the adopted method is suggested by Zhao et al. (2010). The first step in the mediation analysis is to test the indirect effects of the independent variables: PEOU and PS on intention through trust. Then, PU, PEOU, trust and PS on intention through satisfaction and finally PS on satisfaction through trust. Table 9 shows that only 1 out of 6 indirect effects in our model is significant which indicate that trust only plays the role of mediator between perceived security and satisfaction (perceived security t = 3.032, P < 0.05). Next step is testing the direct effect between perceived security and satisfaction to distinguish the type of the mediation. See Table 7 for direct effect. Table 7 shows significant direct effects between perceived security and satisfaction (t = 4.792, p < 0.001). Hence, Trust is partially mediating the relationships between perceived security and satisfaction. According to Zhao et al. (2010), it is a complementary mediation. .

7. Results

Perceived Ease of Use (PEOU) (B = 0.280, p < 0.001) and Perceived Usefulness (PU) (B = 0.295, p < 0.001) are significant in influencing M-banking adoption intention (MBAI), thus confirming H7a & H8a . Perceived usefulness plays the vital contribution in effecting M-banking adoption intention. When PU is raised by one standardized unit, MBAI is enhanced by 0.295 standardized units. Unexpectedly, Satisfaction, Trust and perceived security had no direct significant influence on M-banking adoption intention. Therefore, H1, H2 and H4 are rejected. The findings of this study also highlighted that perceived ease of use (B = 0.435, p < 0.001) has a positive impact on perceived usefulness. Thus, H7b is confirmed. Perceived security (PS) (B = 0.311, p < 0.001), Perceived Usefulness (PU) (B = 0.334, p < 0.001), Trust (B = 0.278, p < 0.001), are significant in influencing user satisfaction (US), hence confirming H6, H8b, H3 . Thus, PU is a vital construct in explaining user satisfaction followed by PS and then Trust . However, perceived ease of use does not affect user satisfaction. Hence, H7c is rejected. In addition, perceived security (B = 0.322, p < 0.001) is significant in influencing trust. H5 is confirmed. PU (B = 0.204, p < 0.05) are significant in influencing trust, which confirms the findings of previous study of Ramli et al. (2021). Hence, H8c is confirmed. While, PEOU is non-significant in affecting trust. Thus, H7d is rejected. Moreover, this study showed that PEOU (B = 0.312, p < 0.001), was statistically significant with PS. H7e is confirmed.

When considering the mediating effects of user satisfaction and trust, it is noteworthy that the Trust only mediates the relationship between perceived security and satisfaction (Complementary mediation). Hence, H13 is confirmed. However, Trust does not mediate the relationship between perceived security and M-banking adoption intention. Thus, H14 is rejected. Surprisingly, satisfaction does not mediate the relationship between (Perceived ease of use, perceived usefulness) and M-banking adoption intention (direct only). Hence, H9 and H10 are rejected. Furthermore, satisfaction does not mediate the relationship between (trust, perceived security) and M-banking adoption intention

Table 7
Hypotheses testing Direct effect.

		Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Result
H1	US- > MBAI	0.093	0.094	0.093	1.007	0.314[NS]	Unsupported
H2	T - > MBAI	0.117	0.117	0.067	1.748	0.081[NS]	Unsupported
H3	T - > US	0.278	0.275	0.064	4.343	0.000	Supported
H4	P S - > MBAI	0.044	0.048	0.071	0.613	0.540[NS]	Unsupported
H5	PS- > T	0.322	0.325	0.077	4.181	0.000	Supported
H6	PS - > US	0.311	0.311	0.065	4.792	0.000	Supported
H7a	PEOU- > MBAI	0.280	0.275	0.076	3.698	0.000	Supported
H7b	PEOU - > PU	0.435	0.440	0.069	6.265	0.000	Supported
H7c	PEOU - > US	−0.013	−0.014	0.065	0.207	0.836[NS]	Unsupported
H7d	PEOU- > Trust	0.155	0.151	0.085	1.821	0.069[NS]	Unsupported
H7e	PEOU- > PS	0.312	0.316	0.073	4.297	0.000	Supported
H8a	PU - > MBAI	0.295	0.299	0.069	4.282	0.000	Supported
H8b	PU - > US	0.334	0.338	0.052	6.378	0.000	Supported
H8c	PU- > Trust	0.204	0.208	0.084	2.448	0.014	Supported

MBAI = M-banking adoption intention, PS: Perceived security; US: User satisfaction, PU: perceived usefulness; PEOU, perceived Ease of use, T = Trust.

Table 8

Results of PLS Predict.

PLS Predict				LM Predict		LM-PLS	
	RMSE	MAE	$Q^2\_predict$	RMSE	MAE	RMSE	MAE
Intention1	0.913	0.668	0.177	0.920	0.671	0.007	0.003
Intention2	0.824	0.625	0.168	0.831	0.630	0.007	0.005
Intention3	0.854	0.616	0.110	0.862	0.620	0.008	0.004
PU1	0.897	0.644	0.070	0.908	0.651	0.011	0.007
PU2	0.835	0.624	0.083	0.843	0.630	0.008	0.006
PU4	0.798	0.597	0.109	0.804	0.598	0.006	0.001
PS1	0.844	0.585	0.036	0.851	0.589	0.007	0.004
PS2	0.855	0.703	0.073	0.860	0.698	0.005	−0.005
PS3	1.095	0.916	0.027	1.107	0.928	0.012	0.012
Satisfaction1	0.945	0.787	0.031	0.950	0.799	0.005	0.012
Satisfaction2	0.884	0.704	0.079	0.891	0.706	0.007	0.002
Satisfaction3	0.841	0.672	0.043	0.848	0.675	0.007	0.003
Satisfaction4	0.885	0.703	0.037	0.895	0.710	0.01	0.007
Trust1	0.864	0.705	0.080	0.872	0.706	0.008	0.001
Trust2	0.834	0.683	0.031	0.837	0.687	0.003	0.004
Trust3	0.897	0.735	0.045	0.901	0.740	0.004	0.005

Table 9

Assessment of mediations.

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Result
PU - > Satisfaction - > MBAI	0.031	0.032	0.032	0.971	0.332[NS]	Direct only (no mediation)
PEOU - > Satisfaction - > MBAI.	0.001	−0.000	0.009	0.147	0.883[NS]	Direct only (no mediation)
Trust - > Satisfaction - > MBAI	0.026	0.026	0.027	0.970	0.332[NS]	No effect (no mediation
P Security - > Satisfaction - > MBAI	0.029	0.027	0.028	1.040	0.299[NS]	No effect (no mediation)
P Security - > Trust - > Satisfaction	0.090	0.089	0.030	3.032	0.002**	Complementary mediation.
P Security - > Trust - > MBAI.	0.038	0.037	0.024	1.593	0.111[NS]	No effect (No mediation)

****P < 0.001; ***P < 0.01; **P < 0.05; *P < 0.1, [NS]P ≥ 0.1.

(No effect). Hence, H11 and H12 are rejected.

8. Discussion

The aim of this study is to investigate the factors that influence the intention to adopt M-banking in Tunisia. In line with Davis and Venkatesh (1996), the theoretical model developed in this research on the basis of a thorough literature review outlines the impact of PEOU, PU, Satisfaction on M-banking intention and the effect of PEOU & PU on satisfaction, perceived security, and trust. In addition, the mediating roles of satisfaction and trust are investigated.

The results, showed in the aforementioned sections, proved that our research model observed in this study was capable to attain the acceptable level in terms of predictive power extracted by dependent constructs: M-banking Adoption Intention (39%), satisfaction (48%), trust (27%).

In this research, perceived usefulness, perceived ease of use, satisfaction, trust, perceived security were acknowledged, investigated in many studies and tested in the Tunisian context. PEOU, PU were found empirically significant in influencing Tunisian users' intention to adopt M-banking. This finding is consistent with a number of studies conducted in the previous M-banking studies (Cheah, Teo, Sim, Oon, & Tan, 2011; Chitungo & Munongo, 2013; Hanafizadeh et al., 2014; Koksal, 2016). Indeed, Souiden, Ladhari, and Chaouali (2020) carried out a systematic review of 389 studies in M-banking adoption literature and proved that the two most significant determinants of intentions to adopt M-banking are PEOU & PU.

In this research; PU had the strongest positive influence on Tunisian consumers' intention to adopt M-banking (followed by PEOU). This indicates that the extent to which consumers perceive that M-banking is useful and easy positively influences their intention to adopt M-banking.

According to the findings, satisfaction does not influence M-banking adoption intention in Tunisia.

This is not consistent with previous research (e.g. Priya et al., 2018). According to Arcand et al. (2017), satisfaction is a complex emotional response to a consumption experience. In fact, having high positive experience when using a service would result in higher satisfaction among users (Baabdullah et al., 2019). However, mobile banking is a new service in Tunisia and consumers don't have a big experience in using such services. Moreover, satisfaction is closely associated with use (Saleem & Rashid, 2011), hence satisfaction may not impact the intention to use m-banking for consumers without big experience.

Unexpectedly, trust was not found significant in influencing Intention to adopt M-banking. This result is consistent with the findings reported in the M-banking literature by multiple researchers (Koening-Lewis, Palmer, & Moll, 2010; Koksal, 2016; Singh & Srivastava, 2018; Susanto, Chang, & Ha, 2016). In fact, trust will not always have a positive influence on service use because trust may positively affect short-term relationships but not long-term relationships (Susanto et al., 2016). Moreover, Koening-Lewis et al. (2010) state that there is a problem in measuring trust due to the multidimensional nature of the construct and the ambiguity of respondents whether they are identifying trust in a bank, trust in the telephone operators or trust in any other third party involved in delivering a service. Another reason behind the non-significant relationship made by Singh and Srivastava (2018); who claim that the trust construct may appear insignificant because customers consider banks to be among the most trustworthy institutions.

The insignificant relationship between perceived security and intention to adopt M-banking went in contrary to our expectation. This finding is in line with the research of Hsu et al. (2011) who found that perceived security did not appear to drive use because users may feel that the security protection in the context of a mobile environment is a factor influencing only an individual's attitude.

The findings of this study also highlighted that perceived ease of use

has a positive impact on perceived usefulness. Hence, the easier to use, the more useful they feel M-banking is. These results are not different from other studies that have examined the impact of PEOU on PU (Akturan & Tezcan, 2012; Alalwan et al., 2016; Gu et al., 2009).

The results indicated that perceived usefulness exerted significant effect on user satisfaction. Therefore, when a customer finds that M-banking useful, it will lead to his/her satisfaction. These results are consistent with a number of previous M-banking studies (Kahandawa & Wijayanayake, 2014; Kim & Lee, 2013; Priya et al., 2018). However, Perceived Ease of use does not affect satisfaction. This finding contradicts previous studies (Kahandawa & Wijayanayake, 2014; Kim & Lee, 2013; Le et al., 2020; Priya et al., 2018).

The results of this study show that trust has significant effect on satisfaction. Numerous studies confirmed this finding(Berraies et al., 2017; Geebren et al., 2021; Koo & Wati, 2010; Lee & Chung, 2009; Poromatikul et al., 2019; Trabelsi-Zoghlami et al., 2018). While Arcand et al. (2017) and Sharma and Sharma (2019) found that trust was the most influential predictor of satisfaction, in our study, trust is the second strongest factor (after PEOU) that influences satisfaction.

The findings also highlighted that perceived security has a positive impact on user satisfaction. Thus, confirming previous research findings (Arcand et al., 2017; Yin & Lin, 2022). For Susanto et al. (2016), security is a must-have in banking services and it is possible that its absence will negatively affect user satisfaction.

In this study, the relationship between PEOU and trust is insignificant. This finding contradicts the study of Ramli et al. (2021) and Trabelsi-Zoghlami et al. (2018).

On the other hand, the direct relationship between PEOU and perceived security is significant. Previous research confirmed this finding (Hsu et al., 2011; Kavitha & Kannan, 2020). However, the relationship between PU and Trust is significant. This finding is consistent with those of Maroofi et al. (2013); Afshan and Sharif (2016) and Ramli et al. (2021) who found that PU is a determinant of customers' trust in a M-banking context. Findings also outline that perceived security significantly influences trust. The literature has previously highlighted the irrefutable role of perceived security in building trust (Shareef et al., 2018; Susanto et al., 2016).

Finally, this research provides empirical evidence that satisfaction does not mediate the relationship between trust and M-banking adoption intention. This finding is not consistent with those few studies which emphasised the relevance of the role of satisfaction as a mediator between trust and intention behavior in M-banking context especially in developing countries (e.g., Sharma & Sharma, 2019).

The findings also highlighted the mediating effect of trust between perceived security and satisfaction The results show that this effect is partial (Complementary). This complementary mediation hypothesis suggests that the intermediate variable explains, possibly confounds, or falsifies the relationships between the independent and dependent variables (Nitzl et al., 2016). Whereas Zhao et al. (2010) called it as the 'positive confounding'. Hence, the effect is a complementary means that a portion of the effect of Perceived security on satisfaction is mediated through trust. Whereas perceived security still explains a portion of satisfaction that is independent of trust.

Contrary to what is expected, trust and satisfaction do not mediate the relationship between perceived security and M-banking adoption intention. According to the exhaustive literature review conducted in this research, there are no studies that examine the mediating impact of satisfaction between perceived security and M-banking adoption intention. However, the outcome of this study regarding no-mediation effect of trust between perceived security and Intention to adopt M-banking is not consistent with the study of Chiu et al. (2017) who proved that the relationship between security and intention to use M-banking is fully mediated by trust. Moreover, the current study failed to prove the mediating role of satisfaction between (Perceived ease of use, perceived usefulness). This finding contradicts the study of Priya et al. (2018) who proved that the relationship between PEOU & PU and intention to use

M-banking is partially mediated by satisfaction.

9. Conclusion

M-banking as a new technology is facing many difficulties to spread generally in developing countries and particularly in Tunisia. Banks in developing countries have a challenge to convince customers to use this innovative channel. In fact, there is a limited number of studies that have addressed the related issues of M-banking in Tunisia. This, in its turn, motivates the current study to examine the factors that influence M-banking adoption in developing countries especially in Tunisia. Indeed, this study has successfully extended TAM with trust, perceived security and satisfaction. The main results highly support the current model's predictive validity. For instance, the model found in this study explains a 39% of variance in M-banking adoption intention, 48% of variance in customer satisfaction 27% of variance in trust.

9.1. Theoretical contribution

This study offers several theoretical contributions. First, this research contributes to the understanding of the factors that impact the intention to adopt M-banking since there is a dearth of published research on M-banking in the context of developing countries such as Tunisia (Trabelsi-Zoghlami et al., 2018) . Moreover, to the best of our knowledge, only the research of Chemingui & Ben Lallouna (2013) and Chaouali et al. (2019) tried to understand the factors that affect intention to adopt M-banking in Tunisia.

Second, we extended Technology Acceptance Model by introducing trust, satisfaction and perceived security. This study responds to the call of several authors that claim that TAM has partial capacity to explain the variance of consumer behavior to adopt M-banking and needs to be extended by several variables (e.g., Shareef et al., 2018). While PU and PEOU plays the crucial role to form the intention to adopt M-banking, PU seems more important than PEOU to drive Tunisian customer to adopt M-banking. This is an interesting insight, since it suggests that perception of usefulness is more important than ease of use of the M-banking for Tunisian customers. This finding sheds the light on the crucial role of PU and proved that the uselessness of the service may be the main barrier to adopt M-banking. Whereas, Chemingui and Ben Lallouna (2013) found that tradition is the main barrier to the intention to use it and Tunisians are struggling to change their habits and behaviors in order to adopt M-banking. Third, this study also contributed to prove that PU is not only the strongest determinant for intention but also for satisfaction and also contributes in building trust .

Fourth, a review of empirical studies in the sphere of developing countries suggests that some earlier research focused on studying the adoption of M-banking from technology perspective (e.g., Awad & Dessouki, 2017; Glavee-Geo et al., 2017; Shaikh et al., 2018). Only few studies have shed the light on the consumer perspective (e.g., Chaouali et al., 2019; Gumussoy, 2016). The studies which combined the two perspectives were also scarce (e.g., Alalwan et al., 2017; Priya et al., 2018). Hence, the current study enriched the existing literature in M-banking context.

Finally, this research is one of the forefront studies examining the mediating role of satisfaction and trust in M-banking from developing countries' perspective. Indeed, several authors in developing countries, extended TAM with trust (e.g., Hanafizadeh et al., 2014; Alnemer, 2022; Koksal, 2016; Malaquias and Silva (2020); Singh & Srivastava, 2018; Sharma 2019) or satisfaction (e.g., Rejikumar & Ravindran, 2012; Yuan et al., 2014) without investigating their mediating roles . There are few attempts to investigate the mediating role of satisfaction (e.g., Priya et al., 2018) and Trust (e.g., Asnakew, 2020). However, to the best of our knowledge, no research has studied the mediating role of both satisfaction and trust in developing countries and especially in Tunisia.

Further, few studies have explored the effect of perceived security (PS) on satisfaction especially in developing countries' context (e.g., Yin

& Lin, 2022). However, no study has explored the mediating role of satisfaction between PS and BI to the best of our knowledge. While we confirmed the effect of PS on satisfaction, we demonstrated that PS has also an indirect effect on satisfaction via trust. This finding is in line with Arcand et al. (2017).

9.2. Managerial contribution

The practitioners in financial services can get deep insight from the findings of the current study. These findings can be used for proposing appropriate strategies, which help to improve the adoption of M-banking. According to the current study, the key determinants of behavioral intention of M-banking adoption are perceived ease of use and perceived usefulness.

In order to enhance the perception of ease of use, banks are invited to create simple tutorials (to explain how to use the M-banking services) and emphasize that M-banking services are free from difficulties. They can use social media to spread short videos and post them on YouTube, Facebook and Instagram to influence and convince the target customers. When the customer perceives the service is easy to use, this will help him/her perceive the usefulness and the security of the service.

On the other hand, banks should rely upon increasing perception of usefulness by clearly communicating to their consumers the benefits and the advantages of using their services. In addition, banks need to make extra effort to ensure that M-banking applications are designed to help customers conduct transactions, consult accounts and transfer money, etc. Enhancing the perception of usefulness will increase the user satisfaction and the feeling of trust towards mobile banking. Furthermore, banks should convince their customers that their services are secure and the transactions will be kept safe and free from attacks and malicious threats. Thus, practitioners and financial experts need to

implement the most effective techniques to protect the personal information and financial details of customers. By increasing the perceptions of security, banks will enhance trust in their M-banking services. Moreover, a high trust level will be translated to a high level of customer satisfaction towards M-banking.

9.3. Limitations and future research directions

The current study provides various theoretical and practical contributions; however, there are some limitations. First, the sample of this study is limited to 202 respondents. Hence, researchers can extend the number of participants in order to bring greater insights into the factors that influence M-banking behavioral intention. Second, the current study did not take into account the demographic variables; however, they are of great importance and can be taken into account in upcoming studies.

In spite of these limitations, this study has enriched the limited literature in M-banking context in developing countries and has helped professionals in financial services to understand the factors affecting its adoption. Finally, future research could conduct a qualitative study to provide further factors that can affect M-banking behavioral intention.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A. Appendix

Table A1
Sample structure.

Demographic variable	Categories	Number of respondents	Percentage
Gender	Male	62	69.3
	Female	140	30.7
Age group	18–25	162	80.2
	26–30	12	5.9
	31–35	9	4.5
	>35	19	9.4
Status	Employee	32	82.7
	Student	167	15.8
	job seeker	3	1.5

Table A2
Summary of the empirical research on M-banking in developing and emergent countries.

No.	Author	Findings	Country	Theory/ Method Analysis	Mediation (Partial/ Total)
1	Chemingui and Ben Lallouna (2013) (N = 300)	Compatibility, trialability, perceived enjoyment and system quality. Tradition → (-S) BI Compatibility, trialability, perceived enjoyment → (+S) BI System quality → (+S) Trust. Trust → (NS) BI	Tunisia	DOI/ SEM	No
2	Chitungo and Munongo (2013) (N = 275)	Perceived usefulness, perceived ease of use, relative advantages, personal innovativeness and social norm → (S) BI	Zimbabwe	Extended TAM/ Linear Regression Analysis	No
3	Bidar, Fard, Salman, Tunga, and Cheng (2014) (N = 128)	Perceived usefulness, compatibility, and social influence → Use m-banking PEOU, Facilitating Conditions, Facilitating Conditions, perceived Cost → (NS) use of m-banking	Turkey	Extended TAM /Regression analysis	No

(continued on next page)

Table A2 (*continued*)

No.	Author	Findings	Country	Theory/ Method Analysis	Mediation (Partial/ Total)
4	Hanafizadeh et al. (2014) (*N* = 361)	Perceived usefulness, perceived ease of use, need for interaction, perceived risk, perceived cost, compatibility with life style, perceived credibility and trust → Intention to use	Iran	Extended TAM/ SEM	No
5	AlSoufi and Ali (2014) (*N* = 372)	PU, PEOU - > (S) BI Perceived cost, perceived risk → (NS) BI	Bahrain	Extended TAM/ linear regression analyses.	No
6	Afshan and Sharif (2016) (*N* = 361)	Task technology fit (TTF), Initial trust (IT) and facilitating condition (FC) with intention to adopt m-banking.	Pakistan	UTAUT, TTF and ITM/ CFA + SEM	No
7	Bhatiasevi (2016) (*N* = 272)	Performance expectancy, effort expectancy, social influence, perceived credibility, perceived convenience → (S) BI. Financial cost, facilitation conditions → (NS) BI.	Thailand	Extended UTAUT/SEM path analysis	No
8	Mortimer, Neale, Hasan, and Dunphy (2015) (Responses from Thaïland: *N* = 175)	Results(Thailand): perceived usefulness, perceived risk and social influence → BI perceived risk→ (-S) BI need for interaction - > (NS) BI	Thailand/ Australia	Extended TAM/EFA + CFA	No
9	Koksal (2016) (*N* = 776)	PEOU, PU, Trialability, Perceived credibility, Compatibility → (S) BI Trust, Perceived selfefficacy, Normative pressure, Financial costs → (NS) BI Income (− S) → BI	Lebanon	Social psychology theory+ extended TAM, +DOI / Binary logistic regression works	No
10	Gumussoy (2016) (*N* = 369)	Satisfaction→ continued usage intention Task-technology fit→ (NS) continued usage intention.	Turkey	TTF model and satisfaction/ SEM	–
11	Awad and Dessouki (2017). (*N* = 461)	Perceived compatibility, Perceived risk → (− S) BI perceived usefulness,Attitude → IB	Egypt	TAM + DOI/ Simple Linear Regression +, MRA	Attitude: Perceived Usefulness / BI (Partial)
12	Chaouali et al. (2017) (*N* = 557)	Attitude - > BI	Tunisia	Theory of Trying/ PLS	No
13	Alalwan et al. (2017) (*N* = 343)	Performance expectancy, effort expectancy, hedonic motivation, price value and trust. → BI	Jordan	Extended UTAUT2 / SEM.	No
14	Glavee-Geo et al. (2017) (*N* = 189)	Perceived behavioral control (PBC) / Attitude (ATT) - > m-banking adoption intentions.	Pakistan	TAM and TPB/ PLS-SEM	No
15	Shaikh et al. (2018) (*N* = 189)	Performance expectation, and effort expectation, on both consumer attitude → BI	Pakistan	TPB+ UTAUT/ PLS	No
16	Islam et al. (2019) (*N* = 186)	Perceived credibility, Facilitating conditions, Social influence, Effort expectancy- > BI performance expectancy → (NS) BI.	Malaysia	Adapted UTAUT/ PLS – SEM	No
17	Malaquias and Silva (2020) (*N* = 115)	Results for Brazil: PEOU, PU, Social influence, Trust→ Use of m-banking	Brazil	Extended TAM/ SEM	No
18	Chaouali et al. (2019) (*N* = 281)	Functional value, Emotional value, Social value will, Epistemic value → BI	Tunisia	S–O–R model + the theory of consumption values/ PLS-SEM	Perceived value: Design aesthetics/BI (Total)
19	Baabdullah et al. (2019) (*N* = 429)	Performance expectancy, price value, facilitating conditions, hedonic motivation, habit, system quality and service quality - > actual use behavior	Saudi Arabia	UTAUT2 and the D&M IS Success Model/ SEM	No
20	Asnakew (2020) (*N* = 202)	Attitude, trust → continuance intention	Ethiopia	Extended TAM/ PLS-SEM analysis	Attitude: PU /BI (Total) PEOU/ BI (Partial) Trust/BI (Partial) Trust: Reputation/ BI(Total) Structural assurances/ BI(Total) propensity/BI(No effect)
21	Rachmawati et al. (2020) (*N* = 190)	Performance expectancy, performance expectancy, social influence, facilitating conditions → BI	Indonesia	UTAUT/ MRA	No
22	Ho et al. (2020) (Responses from Vietnam: *N* = 213)	Results in Vietnam: Attitude, Perceived Behavioral Control →(S) intention to Adopt M-banking subjective norms → (NS) Intention to Adopt M-banking *Vietnam: -Innovativeness in New Technologies→ (S) Intention to Adopt M-banking	Vietnam/ Taiwan	DOI + TAM+ DTPB/ CFA + SEM	No
23	Hassan and Wood (2019) (Responses from Egypt: *N* = 132)	Results for Egypt: PU- > BI Trust- > BI PEOU→(NS) BI Social influence →(NS) BI perceived risk → (NS) BI/	Egypt/ USA	Extended TAM/ SEM	Perceived Usefulness: PEOU/ intention (Total)
24	Himel et al. (2021) (*N* = 196)	Perceived usefulness (PU), perceived ease of use (PEOU) and perceived trust (PT) → (S) Attitude Attitude → BI.	Bangladesh	TAM & IRT/ PLS + SEM+ focus group	Attitude: PU/BI PEOU/BI PT/BI

Table A2 (*continued*)

No.	Author	Findings	Country	Theory/ Method Analysis	Mediation (Partial/ Total)
25	Jebarajakirthy and Shankar (2021) (*N* = 446)	Perceived utilitarian values, Perceived hedonic values, Access convenience, transaction convenience, benefit convenience, and post-benefit convenience → BI Search convenience, Evaluation convenience→ (NS) BI	India	Extended S–O-R theory / The covariance-SEM and PROCESS macro	Barriers to acceptance /BI Perceived hedonic value: convenience dimension/ BI (Partial) Perceived utilitarian value: Evaluation convenience /BI (Total) Transaction convenience / BI (Partial) Benefit convenience / BI (Partial) Post-benefit convenience / BI (Partial).
26	Kamboj et al. (2022) (*N* = 338)	M-banking failure dimensions (functional, system, information and service) affect the use of m-banking, which in turn affects user satisfaction towards m-banking and customer engagement	India	Extended Tan's failure model + DeLone and Mclean's Information Success model/ SEM	Satisfaction: customer engagement /use of m-banking (Partial)

(S): significant relationship; (NS): non-significant relationship; (BI): Behavioral intention; (PEOU): perceived ease of use; (PU): perceived usefulness; (PT): perceived trust; (TAM): technology Acceptance Model; (UTAUT): Unified Theory of Acceptance and Use of Technology; (DTPB): the Decomposed Theory of Planned Behavior; (DOI): Diffusion of Innovations; (SOR): stimulus-organism-response; (IRT): innovation resistance theory; (TTF): Task technology fit.(ITM): Initial trust model; (SEM): Structural Equation Modeling; (PLS): Partial Least Squares; (MRA): Multiple Regression Analysis.

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