A meta-analysis on m-banking research: Evidence from the UTAUT model

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Abstract

In the last few years, several studies have examined the predictors of mobile banking (m-banking) adoption using the unified theory of acceptance and use of technology (UTAUT). However, contradictory results in some of the UTAUT relationships were found in the existing literature. Therefore, we aim to clarify and synthesize the empirical findings from the m-banking studies published since 2004 by conducting weight and meta-analysis with a focus on the UTAUT theory. We also seek to identify the roles of moderating variables on each UTAUT path. A total of 364 path coefficients from 127 studies were relevant for data analysis. CMA software V3 was employed to combine the effect sizes. All UTAUT relationships were found to be significant. Performance expectancy emerged as the strongest antecedent of usage intention. We also find that usage intention is the most critical predictor of use behavior. It was also revealed that sample size and culture significantly moderated the linkages between facilitating conditions and usage intention, effort expectancy and usage intention, and usage intention and use behavior. Theoretical contributions and managerial implications are also discussed toward the end.

Keywords: Meta-analysis; Weight analysis; Moderator analysis; Mobile banking; UTAUT; Adoption

1. Introduction

Globally, 2.4 billion individuals are using digital banking in 2020, which is projected to reach 3.6 billion in the next four years (Juniper Research, 2020). This accelerating growth in digital banking worldwide has been fueled by the advancement of mobile phone penetration in conjunction with the remarkable progress of mobile Internet such as 3G and 4G connections (Owusu et al., 2020; Picoto & Pinto, 2021; Sharma, 2019). Indeed, there is about 5.2 billion mobile phone subscribers globally in 2019, a number expected to reach almost 5.8 billion subscribers by 2025 (GSMA Intelligence, 2020a). At the same time, 3.8 billion have access to

the mobile Internet in 2019, accounting for nearly half of the population worldwide (GSMA Intelligence, 2020b).

Mobile banking, also known as m-banking, is viewed as a form of digital banking (Shaikh et al., 2018). It is also considered as a subset of mobile commerce (m-commerce) (Osman & Leng, 2020), which is an extension of electronic commerce (e-commerce) (Luo et al., 2010). M-banking is mostly used by banked clients to ubiquitously and instantly interact with the bank through mobile devices such as smartphones, telephones, or tablets (Baptista & Oliveira, 2015; Kwateng et al., 2019; Laukkanen, 2016; Veríssimo, 2016). The implementation of m-banking began earlier in the 2000s in the form of text or SMS messaging (Yu, 2012). Nowadays, downloadable banking apps are mostly used to deliver this contemporary branchless service (Farah et al., 2018). For users, the functionalities of m-banking provide access to various information including bank statements request, balance checks, and even ATMs locations. This innovative technology also makes it possible to conduct real-time and secure financial transactions such as paying bills and sending or receiving money (Afshan & Sharif, 2016; Alalwan et al., 2017; Baabdullah et al., 2019a; Farah et al., 2018; Tamilmani et al., 2021). For retail banks, m-banking is not only beneficial to considerably lower labor costs and reduce the number of brick-and-mortar bank branches (Shankar & Rishi, 2020) but also to gather data about the banking habits of users, which is important for targeting and customization purposes. Interestingly, with 1.6 billion mobile phone users having no bank account (ITU, 2020), m-banking is also considered as an alternative way over conventional traditional channels to reach this unbanked category of the global population (Choudrie et al., 2018; Farah et al., 2018). However, to meet the expected success level of m-banking deployment, it is crucial to convince people to conduct banking activities through the mobile channel in daily life instead of using physical banking channels (Nguyen et al., 2020). Therefore, it is critical for decision-makers in the retail banking sector to identify and understand the influential drivers that will contribute significantly to the individual's adoption of m-banking (Giovanis et al., 2019a).

In response, a large number of researchers in the last decade (Bhatiasevi, 2015; Farah et al., 2018; Iskandar et al., 2020; Islam et al., 2019; Kishore & Sequeira, 2016; Nisha, 2016; Rachmawati et al., 2020) build on several IS theories such as the UTAUT formulated by Venkatesh et al. (2003) and the extended UTAUT (UTAUT2) proposed by Venkatesh et al. (2012) to identify the determinants leading to m-banking usage. Although these empirical studies generated a plethora of prominent insights on what predictors are related to m-banking usage behavior, a scrupulous examination of the existing literature revealed four major limitations. First, some previous studies presented mixed empirical findings about the impact of UTAUT constructs on usage intention and usage behavior such as performance expectancy (Mahfuz et al., 2016c; Merhi et al., 2019), effort expectancy (Gupta et al., 2019; Yu, 2012), social influence (Bankole et al., 2011; Tan & Lau, 2016), and facilitating conditions (Albashrawi et al., 2017; Oliveira et al., 2014). Therefore, the first purpose of the present meta-analysis is to address the inconsistent findings in the last 16 years of research on the topic of m-banking to enrich the current knowledge on which UTAUT constructs are effectively leading individuals to utilize m-banking. Second, a few attempts have been made so far to integrate and consolidate the fragmented and varying results provided by the m-banking literature using the meta-analysis technique. For instance, Baptista & Oliveira (2016) conducted a meta-analysis about the factors driving m-banking usage, nonetheless with no examination of moderators.

Therefore, the second objective of this meta-analytic study is to investigates which moderators are accounting for heterogeneity among empirical results (Jeyaraj & Dwivedi, 2020), which we consider will be richly valuable for scholars and m-banking providers around the world. Third, the meta-analysis by Baptista & Oliveira (2016) focused only on 208 effect sizes from 57 studies that were published from 2003 to 2016, thereby relatively limiting the precision of the analysis. Therefore, the third aim of this study is to maximize the number of included path coefficients by meta-analyzing 364 beta-based effect sizes reported within 127 studies on m-banking adoption that were conducted in more than 39 countries or regions since 2004. The specific focus is on empirical studies using UTAUT constructs or similar factors in their theoretical models. Fourth, we also observed that synthesizing findings of the UTAUT model with all of its path relationships in the m-banking context has yet to be examined so far. Therefore, the fourth objective of this study is to reinforce the validity of the UTAUT model in the m-banking context by summarizing the empirical results of 364 UTAUT relationships. Finally, identifying and estimating the impact of potential moderating variables on each pair of UTAUT relationships using meta-analysis remains up-to-date missing in the m-banking area. Therefore, the fifth aim of the current research is to examine the moderating effects of innovation level, culture, economic level, and sample size on each path relationship in the UTAUT model.

The remainder of this study is organized as follows. Section 2 provides a brief overview of UTAUT theory and a review of related work on m-banking. Section 3 presents the research model and develops its main theoretical hypotheses. Section 4 explains in detail the research method used in this study including the selection, coding, and analysis procedures. Section 5 reports the results of this meta-analytical study. Section 6 outlines a discussion of those findings and their contributions along with limitations and directions for future work. Lastly, Section 7 ends with the conclusions of this study.

2. Theoretical background and related work

In the last few years, numerous academic researchers have considered UTAUT as one of the most prominent and renowned IS adoption theories (Bhatiasevi, 2015; Shaikh et al., 2018; Tan & Lau, 2016). Table 1 presents a summary of prior m-banking studies using the UTAUT as a base model.

[Insert Table 1 about here]

Originally, Venkatesh et al. (2003) proposed the UTAUT by combing and integrating the constructs of eight models into one unified framework to clarify the drivers of user's adoption of a given IS (Baptista & Oliveira, 2015; Giovanis et al., 2019a). In UTAUT, behavioral intentions and actual usage of an IS are the main dependent variables (Venkatesh et al., 2003). This theory argues that behavioral intention to use a given technology is influenced by three independent predictors: performance expectancy, effort expectancy, and social influence (Kwateng et al., 2019; Luo et al., 2010). Moreover, it is also assumed that individuals will use an IS based on two influential determinants: behavioral intentions and facilitating conditions (Giovanis et al., 2019a; Oliveira et al., 2014).

In the mobile banking literature, a large number of scholars have applied the original UTAUT model as the dominant theory to investigate the antecedents associated with the

decision to adopt m-banking (Albashrawi et al., 2017, 2019; Rachmawati et al., 2020). For example, Albashrawi et al. (2019) proposed a conceptual model that is rooted in the originally formulated UTAUT model to verify the major antecedents of the actual use of mobile banking within 472 bank customers in the United States. By formulating a theoretical framework based on the original UTAUT model, the study by Rachmawati et al. (2020) empirically tested the effect of performance expectancy, effort expectancy, and social influence on the willingness of 190 Indonesian users to adopt m-banking. From the perspective of the original UTAUT model, individuals' decision to utilize m-banking was also studied in an investigation carried out by Albashrawi et al. (2017) among 516 bank customers in the United States.

Moreover, a review of empirical studies in the sphere of m-banking suggests that some earlier research works include additional antecedents to the UTAUT model to examine the predictors that influence intentions and adoption decisions towards the usage of m-banking (Bhatiasevi, 2015; Giovanis et al., 2019a; Oliveira et al., 2014). For instance, an empirical research set in Thailand by Bhatiasevi (2015) extends the UTAUT model by adding supplemental factors such as perceived credibility and perceived convenience. In a past research involving 513 mobile phone users in Greece, Giovanis et al. (2019a) applied a modified version of the UTAUT model by including the constructs of perceived risk, trust, and innovativeness. In their work, Oliveira et al. (2014) drew inspiration from the UTAUT model in conjunction with the initial trust model (ITM) and task technology fit (TTF) to measure the actual use of mobile banking among 194 mobile phone users in Portugal.

3. Research model and hypotheses development

3.1. Direct hypotheses

The present meta-analytic study employs an extended UTAUT (Venkatesh et al., 2003) as the study's research model to reinforce the validity of this framework in the context of mobile banking adoption. As shown in Fig. 1, the research model suggests that performance expectancy (H1), effort expectancy (H2), social influence (H3), and facilitating conditions (H4) are the core influencing drivers for usage intention. To follow on, this framework mention that facilitating conditions (H5) and usage intention (H6) are very influential in forming usage behavior.

[Insert Figure 1 about here]

3.1.1. Performance expectancy → Usage intention

Performance expectancy is viewed as the degree to which an individual believes that conducting certain banking tasks would be improved by employing mobile banking services (Raza et al., 2019). To put it differently, it can be seen as the expected benefits derived from the usage of m-banking such as convenient payment, fast response, and service effectiveness (Bhatiasevi, 2015). Over the past years, researchers in the field of m-banking have considerably proved the positive linkage between performance expectancy and usage intention (Albashrawi et al., 2017; Baabdullah et al., 2019b; Merhi et al., 2019). In the Jordanian context, Baabdullah et al. (2019b) carried out a research study among 343 bank customers to identify factors that enhance the individual's decision to adopt mobile banking. They highlight that performance expectancy serves as a determining indicator of usage intention towards mobile banking. A similar result

has been suggested by Albashrawi et al. (2019) who emphasize that the stronger bank customers in the United States believed that using m-banking will help them to perform certain activities, the more will be their behavioral adoption intention towards it. In their quantitative research, Merhi et al. (2019) investigated the essential elements affecting m-banking intention among 486 m-banking users in Lebanon. Using the SEM technique, those researchers contended that if the beliefs individuals hold about the benefits of m-banking are high, they will tend to adopt m-banking. In the United States, Albashrawi et al. (2017) proposed that when bank customers perceive high levels of performance expectancy the intention towards the usage of m-banking increases. However, Mahfuz et al. (2016c) came to a different conclusion. From the perspective of 115 participants in Bangladesh, they proved that performance expectancy does not play a major role in predicting behavioral intention. Taking these conflicting results into account, the next hypothesis under investigation was established as below:

H1: Performance expectancy will be positively and significantly associated with usage intention.

3.1.2. Effort expectancy → Usage intention

In the current study, effort expectancy refers to how an individual believes that learning to use mobile banking does not require much effort (Zhou et al., 2010). In other words, it is also understood as the extent to which an individual find easy to operate and employ mobile banking technology (Bankole & Bankole, 2017). A larger body of empirical studies investigating the predictors that affect the use of m-banking at an individual level has consistently affirmed that effort expectancy is a necessary factor in forming usage intention (Bhatiasevi, 2015; Giovanis et al., 2019a; Gupta et al., 2019). Using the data of 231 m-banking users, Bankole et al. (2011) performed an empirical research in the Nigerian context to study what influences users to adopt mobile banking. The study provided evidence that the greater the mobile banking is perceived as effortless, the more likely it would be adopted by the individuals. Pursuing this line of argument, Bhatiasevi (2015) illustrated that individuals in Thailand will have more inclination to adopt m-banking, particularly when they perceive this self-service technology to be easy to use. In the same vein, Giovanis et al. (2019a) found support that the degree of ease associated with the usage of m-banking is an important factor driving the intentions of mobile phone users in Greece to adopt m-banking. In a cross-sectional study of the major determinant that could lead to the adoption intention of mobile banking in India, Gupta et al. (2019) identified effort expectancy as an influential antecedent in explaining the behavioral intention of 660 non-bank customers and underbanked people. However, a different result has been found by a study conducted by Yu (2012) in Taiwan. Applying the PLS technique, this investigation argued that intentional adoption of m-banking is not significantly shaped by effort expectancy. Considering these fragmented and varying results in the literature, the following hypothesis has been developed:

H2: Effort expectancy will be positively and significantly associated with usage intention.

3.1.3. Social influence → Usage intention

Social influence denotes an individual's perceptions of the pressure of significant others and close relations on his or her decision to use mobile banking (e.g., family, friends, co-workers, superiors) (Alalwan et al., 2017; Yu, 2012). There have been numerous studies within the context of mobile banking indicating that social influence serves as an important antecedent of usage intention (Islam et al., 2019; Kishore & Sequeira, 2016; Mahfuz et al., 2016c). By utilizing a sample comprising of 347 university students from Malaysia, Tan & Lau (2016) discovered that individuals are more likely to adopt mobile banking when they are perceiving a high level of pressure and influence from important others. Consistent with this finding, a study conducted by Kishore & Sequeira (2016) empirically tested the influence of social influence on usage intention in the case of 959 rural people in India. The research results affirmed that social influence acts as a catalyst in the formation of adoption intentions. On a similar note, Mahfuz et al. (2016c) pointed out that social influence is a strong antecedent influencing positively and significantly the intentions of individuals toward m-banking use in Bangladesh. This conclusion has been sustained by Islam et al. (2019) who examined the prominent predictors of usage intention among 186 university students in Bangladesh. Finding from PLS provided empirical evidence for the positive and significant impact of social influence on the likelihood to use m-banking. However, in a paper written by Bankole et al. (2011), social influence does not constitute a significant predictor driving the users ' behavioral intention to adopt m-banking in Nigeria. To investigate theses divergences from the literature, it sounds reasonable to hypothesize that:

H3: Social influence will be positively and significantly associated with usage intention.

3.1.4. Facilitating conditions → Usage intention

In the m-banking literature, facilitating conditions represent the perception of an individual that both technical and organizational infrastructures from the bank exist to support mobile banking use (Albashrawi et al., 2017). For example, it can consist of assistance from an account manager and availability of a helpline whenever necessary (Oliveira et al., 2014). An examination of existing works related to mobile banking has revealed a significant relationship between facilitating conditions and usage intention (Iskandar et al., 2020; Nisha, 2016; Rachmawati et al., 2020). For instance, Liang (2016) evaluated the critical factors that affect the intention of 372 bank customers to use m-banking in Taiwan. The findings of this study indicated that facilitating conditions have a significant impact on the development of usage intention towards mobile banking. A similar result has been found by Rachmawati et al. (2020) in the Indonesian context. Findings from regression analysis suggest that facilitating condition is a fundamental variable in boosting the adoption intention of m-banking users. When studying the main elements contributing to the formation of adoption behavior towards m-banking by 960 young people from Bangladesh, Nisha (2016) revealed that m-banking usage intention is significantly influenced by facilitating conditions. This finding was confirmed by Iskandar et al. (2020) who observed that facilitating condition is an influential factor contributing significantly to the willingness of bank customers in Indonesia to adopt m-banking. However, an empirical research set in Mozambique by Baptista & Oliveira (2015) found that facilitating conditions do not have a strong effect on the intentions of bank customers toward the usage of m-banking. To

address the above conflicting findings in the m-banking adoption research, the current study proposes the following hypothesis:

H4: Facilitating conditions will be positively and significantly associated with usage intention.

3.1.5. Facilitating conditions → Usage behavior

In the domain of m-banking adoption, empirical evidence that relies on the UTAUT model confirms the significant impact of facilitating conditions on usage behavior (Mahfuz et al., 2016b; Oliveira et al., 2014; Thusi & Maduku, 2020). For instance, Yu (2012) attempted to examine the core influencing predictors that affect the usage behavior of 441 m-banking users and non-users in Taiwan. The author evinced that facilitating condition was closely associated with the individual's decision-making. This is in accordance with Oliveira et al. (2014) who put forward in their study that a high degree of m-banking adoption will be generated if mobile phone users find the technical infrastructure supporting the use of m-banking in Portugal. By the same token, Mahfuz et al. (2016b) demonstrated that facilitating conditions is a key antecedent in forming bank customers' adoption decisions towards m-banking in Bangladesh. In the context of South Africa, Thusi & Maduku (2020) conducted a self-administered survey on 352 bank customers to understand the individual's decision-making towards mobile banking. According to their findings, facilitating conditions exert a strong influence on m-banking usage behavior. However, Albashrawi et al. (2017) assumed that facilitating conditions do not have a critical impact on bank customers in the United States when deciding to use m-banking. Taking into consideration the contradictory insights provided by reviewed research, we propose the following hypothesis:

H5: Facilitating conditions will be positively and significantly associated with usage behavior.

3.1.6. Usage intention → Usage behavior

Usage intention is seen as the individual's willingness or subjective probability to use mobile banking services (Bankole & Bankole, 2017; Zhou, 2012). It can also be described as the intentional plan of an individual to use mobile banking for managing accounts and making transfers in his daily life (Oliveira et al., 2014). Usage behavior denotes the actual utilization of mobile banking for balance inquiries, transferring money, paying bills, locating branches and ATMs, blocking lost cards, and downloading bank statements (Alalwan et al., 2016; Oliveira et al., 2014). Usage behavior is also regarded as the actual frequency of using mobile banking services during a period of time (Zhou, 2012). In the m-banking context, the existence of a significant linkage between usage intention and usage behavior has been clearly supported by several researchers in recent years (Iskandar et al., 2020; Thusi & Maduku, 2020; Trinh et al., 2020). Albashrawi et al. (2019), for instance, postulated that the intentions of bank customers play a key role in explaining mobile banking usage in the United States. Furthermore, Trinh et al. (2020) also provided validation of the importance of usage intention in determining usage behavior in a Vietnamese context. Based on data collected from 540 m-banking users and non-users, they stressed that the individual's behavior towards m-banking is a direct function of behavioral intentions. In a more recent m-banking study set in South Africa, Thusi & Maduku (2020) contended that the actual utilization of mobile banking is largely impacted by the

adoption intentions of bank customers. Based on the responses of 360 m-banking users, behavioral adoption intention was also found to be a major determinant of the usage behavior of m-banking in Indonesia (Iskandar et al., 2020). However, Rachmawati et al. (2020) do not corroborate these results. The findings of the research claimed that m-banking users' adoption intention is not a key antecedent variable leading to the adoption of m-banking in Indonesia. To clarify the above-indicated divergences, the current research suggests that:

H6: Usage intention will be positively and significantly associated with usage behavior.

3.2. Moderating hypotheses

In this study, we examined four categorical moderators (i.e., sample size, economic level, innovation level, and culture) and their effects on each of the six causal relationships in the proposed research model (see Fig. 1). While the hypothesized direct effects in the UTAUT model has been empirically validated in some m-banking studies (e.g., Bhatiasevi, 2015; Islam et al., 2019; Merhi et al., 2019; Thusi & Maduku, 2020; Trinh et al., 2020), a large number of scholars, however, presented findings that were found on the contrary to the UTAUT (e.g., Albashrawi et al., 2017; Bankole et al., 2011; Mahfuz et al., 2016c; Rachmawati et al., 2020; Yu, 2012). Therefore, detecting the moderating roles of sample size, economic level, innovation level, and culture in empirical studies on m-banking adoption is important because it sheds light on whether the fluctuations in some effects sizes in the UTAUT model may depend on methodological, economic, innovation, or cultural conditions (Santini et al., 2019).

3.2.1. The moderating role of sample size

In the m-banking literature, previous studies (e.g., Muñoz-Leiva et al., 2017) employed small samples (e.g., n = 103) while others (e.g., Chaouali & Hedhli, 2019) relied on large samples (e.g., n = 1245). Therefore, it was necessary to study if method variables (such as sample size) may alter the considered causal links across the empirical studies. A recent meta-analysis done by Santini et al. (2019) in the banking context dichotomized the included research into two subgroups based on sample size. They attempted to investigate whether sample size as a methodological characteristic altered the linkage between effort expectancy (ease of use) and usage intention. Their findings indicate that effort expectancy had a higher impact on usage intention in studies with small sample sizes than studies with large sample sizes. Considering this background, this study stated that:

H7a: The UTAUT relationships will be significantly stronger for studies with smaller sample sizes than for studies with larger sample sizes.

3.2.2. The moderating role of economic level

A review of the m-banking literature indicated that some studies (e.g., Koenig-Lewis et al., 2010) were set in developed economies (e.g., Germany) while others (e.g., Baptista & Oliveira, 2015) were conducted in developing economies (e.g., Mozambique). Accordingly, we considered whether the economic level might explain the inconsistencies in past empirical findings. Santini et al. (2019) investigated the moderating impact of economic level on pair-wise relationships. In their study, they pointed out that economic level account for the variance

in the link of effort expectancy to attitude. This finding suggested that the mean effect size of the effort expectancy-attitude relationship for developed economies was significantly higher than that for non-developed economies. In keeping with the above empirical evidence, we, therefore, hypothesize that:

H7b: The UTAUT relationships will be significantly stronger for developed economies than for developing economies.

3.2.3. The moderating role of innovation level

Some of the prior research of m-banking (e.g., Mojtahed et al., 2013) were set in high innovation countries (e.g., United Kingdom) while others (e.g., Bankole et al., 2011) were conducted in low innovation countries (e.g., Nigeria). Thus, we assessed how the innovation level may moderate the derived associations from the extended UTAUT model. The moderating role of innovation level on the causal paths was studied in a research by Santini et al. (2019). Results of moderator analysis indicated that the level of innovation does not have a significant moderating effect on the associations within the causal model. However, Santini et al. (2019) have called for further exploration of this non-significant result to determine whether the heterogeneity in causal relationships may be explained by the innovation level. As such, the current study responds to this call by formulating the following hypothesis:

H7c: The UTAUT relationships will be significantly stronger for high innovation countries than for low innovation countries.

3.2.4. The moderating role of culture

Several studies (e.g., Giovanis et al., 2019) were set in Western culture (e.g., Greece) while others (e.g., Sheng et al., 2011) examined m-banking adoption in Eastern culture (e.g., China). Hence, it is important to determine whether culture may lead to differences in direction and strength among effect sizes. In their meta-analysis, Zhang et al. (2012) carried out a subgroup analysis in which empirical studies were broken down into Eastern culture and Western culture. The results showed that culture plays a major role in shaping the strength of the linkage between effort expectancy and usage intention, such that people from Eastern culture will place more emphasis on effort expectancy when they intend to adopt wireless technologies. The work by Zhang et al. (2012) also demonstrated that culture contributes to the variability in the association of usage intention with actual usage behavior, such that the UI-UB linkage was stronger for Eastern than Western culture. In accordance with the above discussion, it is expected that:

H7d: The UTAUT relationships will be highly significant for Eastern culture than for Western culture.

4. Research method

4.1. Study selection

As summarized in the meta-analytic study by Rana et al. (2015), the first step of the selection process began with determining the appropriate search terms to locate empirical studies on mobile banking adoption more efficiently. The key terms are presented in Table 2.

[Insert Table 2 about here]

As suggested by Nardi et al. (2020), we conducted an electronic searching on the pertinent databases, such as Springer, Taylor & Francis, Science Direct, IEEE Xplore, Emerald Publishing, JSTOR, AIS, Sage, and Google Scholar by applying a combination of mobile banking and adoption terms. Furthermore, a manual search for articles was conducted on relevant journals in the fields of IS. Also, we complemented the keyword searches by scrutinizing citations in previous literature reviews and meta-analysis studies in the field of mobile banking. Finally, we retrieved articles from references for each preselected paper to find additional empirical publications from conference proceedings and book chapters. Of the papers identified, studies published between 2004 and 2020 were chosen for meta-analysis if they met all of the following criteria. First, they had to cover banking services and applications delivered by mobile phones, including cell phones, smartphones, and tablets. Second, they should be published in the English language and available online in peer-reviewed journals (Scopus Indexed or SCImago journal) or well-known IS journals. Third, they needed to provide quantitative data, such as standardized path coefficients (β), sample sizes, and reliabilities (Cronbach's α or Composite reliability). Finally, they should investigate usage intention or usage behavior in their research model with a focus on the UTAUT constructs or similar variables.

4.2. Coding data

After collecting the relevant published articles, we first begin by coding basic information for each m-banking adoption study. This includes the study name, year of publication, the methodology used, geographical origin of the sample, and major theories employed. Then quantitative data were collected for each observation of relationships between independent variables and dependent variables. This includes sample size, reliabilities, and standardized β-based effect sizes (significant and non-significant). For m-banking adoption studies that did not disclose standardized beta coefficients and measurement reliabilities, we corresponded with the authors to obtain the required missing values (Jeyaraj & Dwivedi, 2020). Following the guidelines suggested by Dwivedi et al. (2019), we used the average reliability of the empirical publications at hand to correct β values for measurement errors whenever authors may fail to report missing reliability statistics by e-mail. To avoid overlapping data and to guarantee the independence of data (Dwivedi et al., 2019; Wu & Du, 2012), some papers were excluded from the meta-analysis (e.g., Haider et al., 2018a), some datasets were combined by simple averaging (e.g., Kim & Kang, 2012), and some subgroups were treated as two separate studies (e.g., Akhtar et al., 2019) (see Table 3).

[Insert Table 3 about here]

To maximize the number of included path coefficients and therefore increase the precision of the meta-analysis, some constructs with different labels but with conceptualization and

definitions similar to the variables in the UTAUT model were merged into a single factor (Baptista & Oliveira, 2016). For example, perceived usefulness (Koenig-Lewis et al., 2010), utility expectancy (Bankole et al., 2011), and relative advantage (Kalaiarasi et al., 2017) were viewed as performance expectancy (Farah et al., 2018). Perceived ease of use (Daud et al., 2011) and expected efforts (Belousova & Chichkanov, 2015) were regarded as effort expectancy (Raza et al., 2019). Subjective norm (Amin & Ramayah, 2010), social norms (Riquelme & Rios, 2010), social factors (Bankole et al., 2011), and normative influence (Selvan et al., 2011) were viewed as social influence (Merhi et al., 2019). As a result of applying the selection criteria described above, 127 empirical studies were relevant for the meta-analysis. Among these publications, 111 were journal articles (87.4%), 13 were conference proceedings (10.2%) and three were book chapters (2.4%). The empirical studies included in the meta-analysis and their sources are presented in Table A1 in Appendix A.

4.3. Meta-analysis

A meta-analysis approach was employed to synthesis the 364 corrected estimates reported in the 127 publications in the m-banking literature using the Comprehensive Meta-Analysis V3 software. Meta-analysis is a quantitative technique that facilitates the mathematical combination of effect sizes from a large number of empirical publications by generating a summary effect size in each path relationship (Baptista & Oliveira, 2016; Borenstein et al., 2009; Dwivedi et al., 2019, 2020; Ismagilova et al., 2019, 2020b; Mishra et al., 2019; Tamilmani et al., 2019, 2020). We have used this statistical method in the context of mobile banking adoption for the following reasons. First, it helps scholars obtain a summarized view of research findings by quantitatively incorporating significant and non-significant results into the pooled outcomes (Baptista & Oliveira, 2016; Borenstein et al., 2009; Wu & Du, 2012). Second, this established technique consolidates and reinforces existing results, identifies gaps in the empirical evidence, and suggests a promising direction for future research studies (Baptista & Oliveira, 2016; Rana et al., 2015; Wu & Du, 2012). Finally, prior studies show that this in-depth examination is also very useful for hypotheses testing and moderator analysis (Aguirre-Rodriguez et al., 2012; Dwivedi et al., 2019; Jeyaraj & Dwivedi, 2020; Wu & Lederer, 2009).

In the meta-analysis literature, two major statistical models are used to estimate the summary effect (i.e., the random-effects model and the fixed-effect model). Random effects analysis assumes that effect sizes vary substantially from one study to another. On the other hand, the fixed-effect model assumes that all the empirical research included in the meta-analysis share an identical effect size (Borenstein et al., 2009). Under the random-effects model, large sample size studies are given approximately as much weight as small sample size studies to avoid that large studies dominate the statistical analysis. Under the fixed-effect model, large sample size studies are given large weight and small sample size studies are given small weight (Borenstein et al., 2009). In the current meta-analytic study, the included publications are gathered from the mobile banking adoption literature, performed in various countries, and reported varying and different effect sizes. For this reason, we assume that a random-effects model is more suitable for computing weighted mean effect sizes for each UTAUT path relationship as suggested by Borenstein et al. (2009).

4.4. Moderator test procedure

Following the method outlined by Šumak et al. (2011), moderator analysis was carried out in two stages. In the first step, we proved the existence of the moderating variables through Q and I^2. In the second step, we estimate the potential categorical moderators through subgroup analysis. Regarding moderator detection, the significance level of the Q statistic is used to offer information about the presence of overall heterogeneity among the research findings obtained in the m-banking studies. As a complement to this approach, the I^2 index is employed as an indicative of the overall level of variability across the m-banking studies. Santini et al. (2019) estimate that if the I^2 index is more than 75 per cent, it is likely that high heterogeneity among studies exists. Regarding moderator estimation, a subgroup analysis was undertaken to study the effect of sample size, economic level, innovation level, and culture as possible moderators for each of the six causal paths in the research model. As seen in Table 4, the process begins by categorizing the four potential moderators into subgroups. Consequently, sample size was subgrouped into small vs. large studies (Santini et al., 2019). The economic level was dichotomized into developing vs. developed economies (United Nations, 2020). The innovation level was subdivided into low vs. high innovation countries (WIPO, 2020). The culture was subgrouped into Eastern vs. Western culture (Zhang et al., 2012). To generate the clustered data sets, all the effect sizes from the individual studies included in the meta-analytic database were categorized based on the above-mentioned subgroups. By computing another Q-test, we meta-analyzed each of these subgroups to determine precisely whether the mean beta-based effect size across a subgroup (e.g., Eastern culture) is significantly different from the mean in the other subgroup (e.g., Western culture).

[Insert Table 4 about here]

5. Results

5.1. Descriptive analysis

Table 5 presents a detailed description of the six causal links between UTAUT variables. We have observed a wide disparity in the range of β values for the same relationship. The path coefficients for UI-usage vary from -0.649 to 0.880, for PE-intentions from -0.180 to 0.850, for EE-intentions from -0.446 to 0.511, and for SI-intentions from -0.149 to 0.721. We also observed that the attention given to each relationship is not consistent among the individual studies. For example, the PE-UI relationship was evaluated in 105 of 127 studies, the EE-UI link in 83, and the SI-UI link was examined in 68. In contrast, out of 127 m-banking adoption studies, only 23 examined the FC-UI relationship and 18 tested the FC-UB link. What is more, the majority of the empirical studies on mobile banking adoption reported β values that are consistent with the UTAUT theory. For example, 87% of the PE-UI linkage, 71% of the EE-UI linkage, 61% of the FC-UB linkage, and 85% of the UI-UB linkage were found to be positive and statistically significant. However, it is worth mentioning that for some UTAUT associations there is no unified position regarding their direction and statistical significance. For example, for the relationship between social influence and usage intention, we find that 58 per cent of the

observations are positive and significant, 27 per cent are positive and non-significant, and 14 per cent are negative and non-significant.

[Insert Table 5 about here]

5.2. Weight analysis

Table 5 present a summary of the weight analysis of UTAUT-related relationships. To examine the strength of each predictor, two criteria are taken into consideration. First, predictors are classified into two categories: "well-utilized" and "experimental" (Rana et al., 2015). The antecedents fall in the former category when they are examined five or more times, and fall in the latter category when they are tested less than five times (Rana et al., 2015). In the present study, all the relationships are examined five or more times (see Table 5). This confirms that the behavioral determinants of performance expectancy, effort expectancy, social influence, facilitating conditions, and behavioral intentions are among the most frequently used constructs across m-banking adoption literature. Second, a weight was computed for each causal link by dividing the number of significant relationships (positive or negative) by the total number of observations of each relationship (Rana et al., 2015). With a weight ≥ 0.80, performance expectancy on usage intention (Weight = 0.871), and usage intention on usage behavior (Weight = 0.879) were considered as one of the best predictors in the literature related to mobile banking adoption.

[Insert Table 6 about here]

5.3. Meta-analytic findings

Table 6 presents the weighted mean effect sizes, the estimated level of significance, and 95% confidence intervals. The results of the meta-analysis confirm all the associations in the UTAUT model (see Fig. 2). More specifically, performance expectancy (H1: $\beta = 0.401$; $p < 0.001$) emerged as the most important antecedent of mobile banking usage intention, followed by effort expectancy (H2: $\beta = 0.199$; $p < 0.001$), social influence (H3: $\beta = 0.193$; $p < 0.001$), and then facilitating conditions (H4: $\beta = 0.139$; $p < 0.001$). Regarding the drivers of usage behavior in the context of m-banking, usage intention (H6: $\beta = 0.496$; $p < 0.001$) appears to be the most important antecedent of the actual adoption of mobile banking, followed by facilitating conditions (H5: $\beta = 0.272$; $p < 0.001$). Regarding the precision of the estimates, some mean effect sizes were found to be more precise than others. For example, the 95 % confidence interval for effort expectancy on usage intention (0.162 to 0.234) and performance expectancy on usage intention (0.349 to 0.451) were found to be narrow, which reflect more precise estimates of the mean effect size in the EE-UI and PE-UI linkages (Borenstein et al., 2009). In contrast, the 95 % confidence interval for usage intention on actual usage (0.348 to 0.619) and facilitating conditions on usage behavior (0.141 to 0.395) were found to be large, meaning that the estimates of the mean effect size in the UI-UB and FC-UB linkages are less precise (Borenstein et al., 2009).

[Insert Figure 2 about here]

5.4. Moderator analysis

For each of the six causal paths under study, the Q-test for heterogeneity evidence that all Q-values are statistically significant at $p < 0.001$ (see Table 6). Also of importance, the results show that more than 75 per cent of the total variability among the beta-based effect sizes is attributable to true heterogeneity (I-squared > 75%). Thus, by employing these two tests, we find support for a high heterogeneity among m-banking studies, which leads to reject the null homogeneity hypothesis and consequently prove the presence of potential moderating variables (Santini et al., 2019). As seen in Table 7, Table 8, Table 9, and Table 10, the subgroup analysis corroborated only three significant moderating effects (shown in bold). Results from Table 7 showed a significant Q statistic for the moderating effect of sample size on the relationship between facilitating conditions and usage intention ($Q = 5.864$; $p < 0.05$). This finding suggests that sample size moderates the FC-UI linkage. Specifically, this relationship was stronger in studies with small sample size ($\beta_{small} = 0.230$; $p < 0.001$) than for studies with large sample size ($\beta_{large} = 0.095$; $p < 0.01$). Although economic level did not significantly moderated the UTAUT relationships, Table 8 proved that the mean effect size in the developing economy subgroup was stronger than that for the developed economy subgroup with regards to the linkage between PE and intention ($\beta_{developing} = 0.408$, $\beta_{developed} = 0.354$; $p < 0.001$) and the relationship between SI and intention ($\beta_{developing} = 0.202$, $\beta_{developed} = 0.141$; $p < 0.05$). As indicated in Table 9, innovation level was not a significant moderator of the UTAUT associations. However, we revealed that the mean path coefficient in the low innovation subgroup was stronger than that for the high innovation subgroup with regards to some UTAUT relationships, such as EE and intention ($\beta_{low\_innovation} = 0.207$, $\beta_{high\_innovation} = 0.188$; $p < 0.001$), FC and intention ($\beta_{low\_innovation} = 0.159$, $\beta_{high\_innovation} = 0.104$; $p < 0.05$), and FC and actual usage ($\beta_{low\_innovation} = 0.310$, $\beta_{high\_innovation} = 0.189$; $p < 0.05$). In Table 10, we found that the Q statistic for the moderating effect of culture on the relationship between effort expectancy and usage intention is statistically significant ($Q = 13.609$; $p < 0.001$). This finding confirms the moderating influence of culture on the EE-UI linkage. Specifically, this relationship is stronger for Eastern culture ($\beta_{eastern} = 0.237$; $p < 0.001$) in comparison with Western culture ($\beta_{western} = 0.089$; $p < 0.05$). Finding from the current meta-analytic study showed a significant Q statistic for the moderating effect of culture on the relationship between usage intention and usage behavior ($Q = 3.832$; $p \leq 0.05$). This result suggests that culture moderates the UI-UB linkage. Specifically, this relationship is stronger for Eastern culture ($\beta_{eastern} = 0.597$; $p < 0.001$) when compared with Western culture ($\beta_{western} = 0.333$; $p < 0.01$). A summary of the subgroups analysis results is shown in Fig. B1, Fig. B2, Fig. B3, and Fig. B4 in Appendix B.

[Insert Table 7 about here]

[Insert Table 8 about here]

[Insert Table 9 about here]

[Insert Table 10 about here]

6. Discussion

6.1. Direct associations

In the context of the m-banking adoption literature, some empirical research presented contradictions in results. For example, in the case of the link FC-intention, out of 25 relationships in the meta-analytic database, 14 were positive and significant (56%), six were positive and non-significant (24%), and the remaining five were negative and non-significant (20%). To address the above mixed and contradictory findings in the literature, the present research conducted a meta-analysis to consolidate the hypothesized relations in the UTAUT framework and to reinforce the current knowledge in the field of m-banking adoption. The meta-analytic results supported all the direct associations in the UTAUT model. Specifically, this study revealed that performance expectancy plays a significant role in forming usage intention (H1). This implies that individuals will be more likely to use mobile banking if they perceive that the technology will provide benefits in conducting banking activities (Albashrawi et al., 2019). This result is consistent with Merhi et al. (2019) who showed that the intention towards the usage of m-banking is highly affected by performance expectancy. It was also found that effort expectancy is an influential antecedent in explaining usage intention in the m-banking context (H2). This suggests that the easier a mobile banking service is to learn and conduct banking tasks, the better should be the inclination to engage in the technology (Bankole et al., 2011). This finding was confirmed by Gupta et al. (2019) who pointed out that effort expectancy constitutes a major antecedent of the willingness to adopt m-banking. In the same vein, this investigation demonstrated that social influence is a crucial variable in strengthening usage intention (H3). Therefore, if an individual perceives that relations or friends believe he or she should use mobile banking services, a high degree of adoption intention will be generated (Tan & Lau, 2016). This is congruent with the findings put forward by Kishore & Sequeira (2016). The authors highlighted that social influence is a major determinant leading to a high degree of m-banking usage intention. The findings of this study contended that facilitating condition is a core influencing driver for usage intention (H4). This meta-analytic finding has been sustained by other research where the intention to adopt m-banking is strongly enhanced by facilitating conditions (Liang, 2016). In this sense, it would seem that individuals who believe that organizational and technical infrastructure exists to support the use of mobile banking are expected to have a high propensity to use the system (Nisha, 2016). The research results proposed that facilitating condition is a salient factor in shaping usage behavior (H5). This result from the meta-analysis is in line with the claims of Thusi & Maduku (2020) who noted that the decision to adopt m-banking is an outcome of facilitating conditions. It can be concluded that the more individuals perceive that banks provide the necessary support for using mobile banking (e.g. promotional activities), the stronger is the decision to adopt m-banking (Oliveira et al., 2014). The findings from the meta-analysis proved that usage intention is strongly and positively associated with usage behavior (H6). This finding of the meta-analysis is consistent with Iskandar et al. (2020) who opined that behavioral intention is a necessary factor in forming the individual's behavior towards m-banking. More to the point, this significant linkage indicated that the better the likelihood to use m-banking, the greater the individuals' adoption decisions (Trinh et al., 2020).

6.2. Moderator effects

The present meta-analysis asserted that a wide heterogeneity in the effect sizes is present across m-banking research, ranging from -0.053 to 0.420 for the relationship between FC and intention, -0.446 to 0.511 for the relationship between EE and intention, and -0.649 to 0.880 for the relationship between UI and usage. Such variance across the UTAUT relationships motivated the current study to detect potential moderating variables that might be responsible for the heterogeneity among standardized beta coefficients. In particular, the present meta-analytic study examined how sample size, economic level, innovation level, and culture moderate the causal relationships in the UTAUT model. The results reported in the moderator analysis showed that sample size moderates significantly the effect of facilitating conditions on usage intention (FC-UI) at $p < 0.05$ level. This suggests that the link of facilitating conditions and the intentions of individuals toward the adoption of m-banking was stronger for studies with small sample sizes, as compared to studies with large sample sizes. This finding confirmed the meta-analysis by Santini et al. (2019) who affirmed that stronger path relationships are produced in studies with small sample sizes. In terms of cultural moderations, the findings of this study indicated that culture moderates significantly the effect of effort expectancy on usage intention (EE-UI) at $p < 0.001$ level. This implies that the perceived effortlessness of using m-banking has a higher impact on the behavioral adoption intention in Eastern culture than in Western culture. This finding was expected, as the meta-analysis by Zhang et al. (2012) evidenced that the causal association between EE and UI is stronger in studies conducted in Eastern countries. In the case of the relationship between behavioral intentions and usage behavior (UI-UB), it can be observed through the subgroup analysis that culture is a significant moderator at $p \leq 0.05$ level. We concluded that the effect of m-banking usage intention on the decision to adopt the technology was more important for Eastern culture in comparison with Western culture. This is in accordance with the meta-analytic research by Zhang et al. (2012) who claimed that the impact of behavioral intentions on actual usage behavior is more important in Eastern culture. However, we could not detect any significant differences for the six path relationships investigated in the UTAUT model in regard to innovation and economic moderations. This result is not consistent with the assumption of an investigation by Santini et al. (2019) who discovered that the cumulative path coefficient of a given causal linkage will increase as the economic level increase. However, this finding reinforced the results of the meta-analytic study conducted by Santini et al. (2019) who showed that the moderating effect of innovation level to be non-significant in the banking context. Thus, it is quite possible that other potential moderators may be responsible for the amount of variability across the effect sizes in empirical m-banking studies such as subject type (e.g., users vs. non-users), geographical origin (e.g., Europe vs. Asia), type of response scale (e.g., five points vs. seven points), and years of publication (e.g., before 2015 vs. after 2015).

6.3. Theoretical contributions

In conducting the present meta-analysis, this study brings several contributions to the existing body of m-banking adoption literature. The research findings consolidated the applicability of the UTAUT model and reinforced its validity in the m-banking context by presenting cumulative insights of results from previous empirical research. Regrettably, there is a dearth of investigations using the meta-analysis technique in areas concerned with m-banking

adoption. To our knowledge, there is only one meta-analytic study by Baptista & Oliveira (2016) that has used 208 effect sizes from 57 m-banking studies published between 2003 and 2016. Therefore, the present research enriches the literature by including a large number of empirical m-banking studies using the meta-analysis approach. Specifically, this study has used 364 effect sizes from 127 empirical studies published between 2004 and 2020. From the weight analysis, we indicated that the linkages between PE-UI and UI-UB were tested in 116 and 33 individual studies respectively. We also discovered that these path relationships have a weight greater than 0.80. By proving that these UTAUT determinants are among the well-utilized factors and best predictors in the m-banking literature, scholars can gain an idea about which antecedents are the most important in explaining intention and m-banking adoption. The current meta-analysis tie in with the calls by Ismagilova et al. (2020a) who recommend scholars to investigate the effect of moderating variables on consumer behavior.

To the best of our knowledge, this research is one of the first meta-analyses that sheds light on what moderating variables are responsible for the amount of variance across the existing UTAUT based relationships reported in studies on m-banking adoption. By dividing the empirical studies on m-banking into subgroups, this study provides a clear understanding of how culture and sample size can moderate the UTAUT relationships. In particular, we demonstrated how the effects of facilitating conditions on usage intention, effort expectancy on usage intention, and usage intention on use behavior differ depending on culture and sample size. For researchers, this clearly shows that culture and sample size are important moderating variables in explaining the amount of heterogeneity in the empirical finding of m-banking studies. From a methodological viewpoint, this study could also serve as a guideline for the meta-analysts in the IS field. By offering a synthesis of the findings in the earlier literature, which have so far been conflicting and fragmented, the current research has illustrated that meta-analysis is an important approach for empirical generalizations and hypothesis testing.

6.4. Managerial implications

From a practical standpoint, the current meta-analytic findings also provide some important implications for managers who aim at attracting more m-banking users. Considering that an increase in usage intention results from an increase in performance expectancy, special attention should be paid to the basic usability aspects of the m-banking apps so that users can be more prone to check account balance, transfer money, and pay bills through mobile phones anytime and anywhere. The significant association between effort expectancy and usage intention indicates that practitioners at financial institutions should proactively prioritize their focus on how to make m-banking services user-friendly and less difficult to use in order to save the users' time and effort. As a case in point, we strongly recommend retail banks avoid whenever possible encumbering the m-banking apps with too many utilitarian features and design the m-banking interface in a way that is as simple as an ATM interface looks.

In this meta-analysis, social influence appears to be a vital factor in determining usage intention. Therefore, when designing advertising campaigns, marketers in the banking sector should make sure that peers, family members, or authority figures are sharing their positive opinions about m-banking with potential users. As facilitating conditions were found to be one

of the central predictors of both behavioral intentions and usage decisions, it would be very interesting for banking organizations to offer whenever possible, free trials, appropriate virtual assistants, proper online consultation, and adequate training programs. This is worthwhile because m-banking users often need assistance to overcome potential difficulties when using the service. Given that culture moderates significantly the EE-UI and UI-UB relationships, organizations developing m-banking activities at an international level may find it beneficial to design multi-language m-banking apps to improve the digital experience of users. Such an initiative may have the potential to encourage more individuals to adopt m-banking.

6.5. Limitations and future research directions

Like any other individual-level meta-analysis, the current study certainly encountered several limitations that need to be addressed in further investigations. In the present study, we focused on the causal associations found in the UTAUT model. However, other important antecedents of usage intention such as trust (Oliveira et al., 2014; Trinh et al., 2020), perceived risk (Tan & Lau, 2016; Thusi & Maduku, 2020), attitude (Liang, 2016; Shaikh et al., 2018), and perceived credibility (Islam et al., 2019; Osman & Leng, 2020) remained untested in the present research. Therefore, future meta-analysis should take into consideration those predictors along with the UTAUT model for a profound understanding of the determinants of behavioral intention towards m-banking. In this meta-analysis, some UTAUT relationships have been investigated in a few individual studies. Specifically, we found a limited number of path coefficients related to the linkages between FC and UI (n = 25) and FC and UB (n = 18). To overcome this issue, future meta-analytic studies in the m-banking context should adjust the research findings by providing additional effect sizes regarding these causal associations. During the inclusion process, m-banking studies not reporting standardized beta coefficients (β) necessary for the meta-analysis were not considered in this investigation. Follow-on meta-analysis may therefore employ metrics other than beta coefficients such as the Pearson correlation coefficients (r) to identify a large number of empirical research within the m-banking domain.

The current meta-analysis also excluded doctoral dissertations and some studies not indexed in the SCImago database. Given that unpublished research may also serve to compute a pooled conclusion from previous empirical findings, it may be useful to include this type of studies in future meta-analyses. Of the six paths in the UTAUT model, the current research has only identified the moderators responsible for heterogeneity in three relationships. To put it differently, subgroup analysis could not detect the presence of any moderating effects on the relationships between PE and UI, SI and UI, and FC and UB. Therefore, future meta-analysis studies can focus on how other moderators such as respondents' type and geographical origin of the sample may alter these UTAUT relationships. Furthermore, this investigation did not consider studies conducted in Taiwan when examining innovation level as a moderator (Ho et al., 2020; Liang, 2016; Yu, 2012, 2015). This is because the classification by WIPO (2020) omitted the innovation level of this country. In the future, this shortcoming could be addressed by incorporating more primary studies in the subgroup analysis, which may increase the significance level of the Q statistic. In this meta-analysis, we covered only the empirical studies conducted over the area of mobile banking. Therefore, it may be helpful to investigate the differences between other forms of mobile financial services (MFS) such as mobile money (m-

money) and mobile wallet (m-wallet). This may further clarify the moderating role of the innovation type among UTAUT relationships.

7. Conclusion

In the last 16 years, empirical research in the field of m-banking adoption has increased considerably. However, we observed that the effect sizes reported in these studies are divergent and contradictory. To address these fragmented results, the purpose of this study was to perform a meta-analysis, weight analysis, and moderator analysis on the UTAUT based empirical findings reported in 127 m-banking studies. Descriptive analysis showed that PE, EE, and SI were the most employed UTAUT variables where 83%, 65%, and 54% of m-banking studies used these factors in their theoretical models respectively. The current meta-analytic findings indicated that all path relationships in the UTAUT model are statistically significant. PE has emerged as the prominent influencing driver for usage intention ahead of EE, SI, and FC. Furthermore, UI has been identified as the strongest antecedent of usage behavior ahead of facilitating conditions. Furthermore, the subgroup analysis revealed that sample size and culture significantly moderated the effects of FC on UI, EE on UI, and UI on UB. For scholars, this meta-analysis served as the advancement of the current knowledge on m-banking adoption and UTAUT theory by clarifying the confusion surrounding the conflicting empirical results provided by the existing literature. For managers, we highlighted that financial institutions should make sure that m-banking apps are useful, easier to use, and socially approved. Along with providing the necessary assistance, these aspects will particularly enhance the likelihood to adopt m-banking and capture market share.

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Table 1
Summary of prior m-banking studies using UTAUT as a base model.

No.	Study	Sample	Method	Main findings
1	Luo et al. (2010)	122 university students in the United States	PLS	Perceived risk ➔ Performance expectancy (S-) Trust ➔ Performance expectancy (NS+) Trust ➔ Perceived risk (NS-)
2	Zhou et al. (2010)	250 participants in China	SEM	Effort expectancy ➔ Performance expectancy (S+) Task technology fit ➔ Performance expectancy (S+) Technology characteristics ➔ Effort expectancy (S+)
3	Bankole et al. (2011)	231 m-banking users in Nigeria	MRA	Satisfaction ➔ Performance expectancy (S+) Satisfaction ➔ Effort expectancy (S+) Performance expectancy ➔ Intention (S+)
4	Yu (2012)	441 participants in Taiwan	PLS	Self-efficacy ➔ Usage (NS+) Perceived cost ➔ Intention (S-) Facilitating conditions ➔ Usage (S+)
5	Oliveira et al. (2014)	194 mobile phone users in Portugal	PLS	Task technology fit ➔ Performance expectancy (S+) Task technology fit ➔ Usage (NS+) Trust ➔ Intention (S+)
6	Bhatiasevi (2015)	272 respondents in Thailand	SEM	Perceived convenience ➔ Intention (S+) Perceived credibility ➔ Intention (S+) Intention ➔ Usage (S+)
7	Afshan & Sharif (2016)	151 university students in Pakistan	SEM	Effort expectancy ➔ Trust (S+) Performance expectancy ➔ Trust (S+) Trust ➔ Intention (S+)
8	Tan & Lau (2016)	347 university students in Malaysia	MRA	Effort expectancy ➔ Intention (S+) Performance expectancy ➔ Intention (S+) Social influence ➔ Intention (S+)
9	Kishore & Sequeira (2016)	959 rural people in India	MRA	Attitude ➔ Intention (S+) Perceived risk ➔ Intention (S-) Effort expectancy ➔ Intention (S+)
10	Liang (2016)	812 customers in Vietnam and Taiwan	SEM	Effort expectancy ➔ Attitude (S+) Performance expectancy ➔ Attitude (S+) Facilitating conditions ➔ Attitude (S+)
11	Nisha (2016)	960 young people in Bangladesh	PLS	Responsiveness ➔ Performance expectancy (S+) Information quality ➔ Performance expectancy (S+) Privacy ➔ Performance expectancy (S+)
12	Bankole & Bankole (2017)	220 respondents in South Africa	PLS	Effort expectancy ➔ Performance expectancy (S+) Social influence ➔ Intention (S+) Intention ➔ Usage (S+)
13	Albashrawi et al. (2017)	516 bank customers in the United States	PLS	Intention ➔ Usage (S-) Social influence ➔ Intention (S+) Experience ➔ Usage (S-)
14	Shaikh et al. (2018)	189 mobile phone users in Pakistan	PLS	Performance expectancy ➔ Attitude (NS+) Effort expectancy ➔ Attitude (S+) Attitude ➔ Intention (S+)
15	Albashrawi et al. (2019)	472 bank customers in the United States	SEM	Experience ➔ Usage (S+) Facilitating conditions ➔ Usage (S-) Facilitating conditions ➔ Intention (NS+)

Table 1 (*continued*)

No.	Study	Sample	Method	Main findings
16	Baabdullah et al. (2019b)	343 bank customers in Jordan	SEM	Perceived risk ➔ Intention (S-) Facilitating conditions ➔ Usage (S+) Social influence ➔ Intention (S+)
17	Giovanis et al. (2019a)	513 mobile phones users in Greece	PLS	Innovativeness ➔ Intention (S+) Trust ➔ Intention (S+) Perceived risk ➔ Intention (S-)
18	Gupta et al. (2019)	660 respondents in India	SEM	Social influence ➔ Perceived credibility (S+) Performance expectancy ➔ Perceived credibility (S+) Perceived credibility ➔ Intention (S+)
19	Islam et al. (2019)	186 university students in Bangladesh	PLS	Performance expectancy ➔ Intention (NS-) Perceived credibility ➔ Intention (S+) Facilitating conditions ➔ Intention (S+)
20	Rachmawati et al. (2020)	190 m-banking users in Indonesia	MRA	Intention ➔ Usage (NS+) Effort expectancy ➔ Intention (S+) Performance expectancy ➔ Intention (S+)

[**Legend** (S+) denotes significant positive relationships; (S-) denotes significant negative relationships; (NS+) denotes non-significant positive relationships; (NS-) denotes non-significant negative relationships; SEM denotes Structural Equation Modeling; PLS denotes Partial Least Squares; MRA denotes Multiple Regression Analysis.]

Table 2
The search words employed for mobile banking and adoption terms.

Mobile banking terms	Mobile banking	M-banking	Cell phone banking	Smartphone banking	Mobile phone banking	SMS banking	Telephone banking
Adoption terms	Adoption	Usage behavior	Intention to adopt	Usage intention	Adoption intention	Intention to use	Intention to adopt

Table 3
Individual analysis of articles relevant to mobile banking adoption.

No.	Case	Decision	Example of studies
1	Two or more m-banking adoption studies were based on the same data set and carried out by the same authors	Only one study was included for meta-analysis	Haider et al. (2018b) Haider et al. (2018a)
2	A single study presented multiple data sets collected from the same sample and the same research model	We combined the data sets by simple averaging	Kim & Kang (2012)
3	A study reported multiple data sets based on the same sample but with different research models	Quantitative data were reported separately for each subgroup	Giovanis et al. (2019a)
4	A study presented multiple data sets collected from different samples (e.g.two countries)	We treated each subgroup as an independent study in the analysis	Akhtar et al. (2019)

Table 4
An overview of the four categorical moderating variables tested in the current meta-analysis.

Moderators	Description
Sample size Small Large	Subgroups in this category were generated employing the median sample size for the studies integrated into the meta-analysis (M = 252.5). Specifically, studies with a sample size below 252.5 were considered as small studies and vice versa.
Economic level Developing economy Developed economy	Following the latest report on the world economic situation by the United Nations (2020), the countries where the m-banking studies have been conducted were categorized into developing and developed economies.
Innovation level Low innovation High innovation	The included studies were subdivided according to the median value of the Innovation Index (M = 30.94), which was obtained from the latest data reported by WIPO (2020). Countries with an Innovation Index below 30.94 were considered as low innovation countries and vice versa.
Culture Eastern Western	Drawing inspiration from Zhang et al. (2012), the countries where the m-banking studies have been conducted were broken down into Eastern and Western countries.

Table 5

Descriptive and weight analysis of pair-wise relationships in the UTAUT framework.

Path	k	n	Range of β values	AVG β	Sample size				Positive sig β		Positive non-sig β		Negative sig β		Negative non-sig β		Weight analysis	
					MIN	MAX	AVG	Total	No.	%	No.	%	No.	%	No.	%	Sig β	Weight
PE ➔ UI	105	116	-0.180 to 0.850	0.325	103	960	304	35297	101	87%	10	9%	0	0%	5	4%	101	0.871
EE ➔ UI	83	91	-0.446 to 0.511	0.165	115	960	326	29693	65	71%	18	20%	1	1%	7	8%	66	0.725
SI ➔ UI	68	81	-0.149 to 0.721	0.149	113	1245	366	29666	47	58%	22	27%	1	1%	11	14%	48	0.593
FC ➔ UI	23	25	-0.053 to 0.420	0.119	115	960	392	9805	14	56%	6	24%	0	0%	5	20%	14	0.560
FC ➔ UB	18	18	-0.124 to 0.647	0.219	115	516	296	5323	11	61%	5	28%	1	6%	1	6%	12	0.667
UI ➔ UB	33	33	-0.649 to 0.880	0.379	115	960	324	10700	28	85%	2	6%	1	3%	2	6%	29	0.879

[**Legend** k = Number of studies; n = Number of occurrences; AVG β = Arithmetic mean of β values; MIN = Minimum; MAX = Maximum; AVG = Average values; Sig = Significance; PE = Performance expectancy; EE = Effort expectancy; SI = Social influence; FC = Facilitating conditions; UI = Usage intention; UB = Usage behavior.]

Table 6

Meta-analysis of UTAUT-related relationships and results of heterogeneity test.

Path	k	n	TSS	Meta β	p-value (β)	Z-value (β)	95 % CI (β)		Heterogeneity test			
							Lowest	Highest	Q-value	df (Q)	p-value	I^2
PE ➔ UI	105	116	35297	0.401	0.000	13.679	0.349	0.451	3836.044	115	0.000	97.002
EE ➔ UI	83	91	29693	0.199	0.000	10.521	0.162	0.234	943.044	90	0.000	90.456
SI ➔ UI	68	81	29666	0.193	0.000	6.815	0.138	0.246	1886.311	80	0.000	95.759
FC ➔ UI	23	25	9805	0.139	0.000	4.996	0.085	0.193	175.783	24	0.000	86.347
FC ➔ UB	18	18	5323	0.272	0.000	3.970	0.141	0.395	435.666	17	0.000	96.098
UI ➔ UB	33	33	10700	0.496	0.000	5.925	0.348	0.619	2825.611	32	0.000	98.868

[**Legend** k = No. of studies; n = No. of occurrences; TSS = Total sample size; Meta β = Weighted mean effect size; CI = Confidence interval; PE = Performance expectancy; EE = Effort expectancy; SI = Social influence; FC = Facilitating conditions; UI = Usage intention; UB = Usage behavior.]

Table 7
The moderation effect of sample size.

Subgroups	**PE ➔ UI**	**EE ➔ UI**	**SI ➔ UI**	**FC ➔ UI**	**FC ➔ UB**	**UI ➔ UB**
Small sample size						
No. of studies	55	41	31	9	9	16
No. of occurrences	61	45	36	9	9	16
Total sample size	11304	8921	6756	1812	1701	3319
Meta β	0.407	0.188	0.241	0.230	0.348	0.496
p-value (β)	0.000	0.000	0.000	0.000	0.000	0.000
Z-value (β)	9.960	6.805	5.651	4.961	3.691	4.054
Large sample size						
No. of studies	50	42	37	14	9	17
No. of occurrences	55	46	45	16	9	17
Total sample size	23993	20772	22910	7993	3622	7381
Meta β	0.395	0.208	0.155	0.095	0.196	0.496
p-value (β)	0.000	0.000	0.000	0.003	0.040	0.000
Z-value (β)	9.298	8.000	4.140	2.921	2.054	4.201
Heterogeneity						
Q-statistic	0.045	0.319	2.373	5.864	1.432	0.000
p (heterogeneity)	0.832	0.572	0.123	**0.015**	0.231	0.999

[**Legend** PE = Performance expectancy; EE = Effort expectancy; SI = Social influence; FC = Facilitating conditions; UI = Usage intention; UB = Usage behavior.]

Table 8
The moderation effect of economic level.

Subgroups	PE ➔ UI	EE ➔ UI	SI ➔ UI	FC ➔ UI	FC ➔ UB	UI ➔ UB
Developing economy						
No. of studies	90	74	59	19	14	28
No. of occurrences	97	79	67	21	14	28
Total sample size	29249	25344	22365	7649	3904	9039
Meta β	0.408	0.218	0.202	0.134	0.276	0.544
p-value (β)	0.000	0.000	0.000	0.000	0.001	0.000
Z-value (β)	12.690	11.072	6.403	4.264	3.479	6.431
Developed economy						
No. of studies	15	11	11	4	4	5
No. of occurrences	17	11	13	4	4	5
Total sample size	5753	4189	7166	2156	1419	1661
Meta β	0.354	0.094	0.141	0.164	0.259	0.169
p-value (β)	0.000	0.078	0.048	0.019	0.080	0.447
Z-value (β)	4.532	1.760	1.982	2.342	1.750	0.761
Heterogeneity						
Q-statistic	0.503	5.040	0.629	0.154	0.011	3.253
p (heterogeneity)	0.478	0.025	0.428	0.695	0.916	0.071

[**Legend** PE = Performance expectancy; EE = Effort expectancy; SI = Social influence; FC = Facilitating conditions; UI = Usage intention; UB = Usage behavior.]

Table 9
The moderation effect of innovation level.

Subgroups	PE ➔ UI	EE ➔ UI	SI ➔ UI	FC ➔ UI	FC ➔ UB	UI ➔ UB
Low innovation						
No. of studies	39	31	23	13	8	16
No. of occurrences	41	31	24	13	8	16
Total sample size	12036	10054	7451	4139	2007	4828
Meta β	0.439	0.207	0.155	0.159	0.310	0.536
p-value (β)	0.000	0.000	0.000	0.000	0.001	0.000
Z-value (β)	8.947	6.467	3.648	4.002	3.329	4.535
High innovation						
No. of studies	64	52	45	10	9	15
No. of occurrences	71	57	52	11	9	15
Total sample size	22238	18751	20490	5294	2875	4818
Meta β	0.380	0.188	0.194	0.104	0.189	0.403
p-value (β)	0.000	0.000	0.000	0.013	0.033	0.002
Z-value (β)	10.010	7.953	6.846	2.491	2.127	3.144
Heterogeneity						
Q-statistic	1.158	0.234	0.624	0.956	0.958	0.809
p (heterogeneity)	0.282	0.629	0.430	0.328	0.328	0.369

[**Legend** PE = Performance expectancy; EE = Effort expectancy; SI = Social influence; FC = Facilitating conditions; UI = Usage intention; UB = Usage behavior.]

Table 10
The moderation effect of culture.

Subgroups	**PE ➔ UI**	**EE ➔ UI**	**SI ➔ UI**	**FC ➔ UI**	**FC ➔ UB**	**UI ➔ UB**
Eastern culture						
No. of studies	75	62	47	13	10	19
No. of occurrences	82	67	54	15	10	19
Total sample size	24547	21326	17904	5787	2574	6506
Meta β	0.421	0.237	0.224	0.184	0.332	0.597
p-value (β)	0.000	0.000	0.000	0.000	0.000	0.000
Z-value (β)	12.160	11.293	6.441	5.269	3.803	6.047
Western culture						
No. of studies	30	23	22	10	8	14
No. of occurrences	33	24	26	10	8	14
Total sample size	10615	8367	11627	4018	2749	4194
Meta β	0.350	0.089	0.124	0.073	0.197	0.333
p-value (β)	0.000	0.012	0.013	0.087	0.047	0.009
Z-value (β)	6.289	2.506	2.475	1.711	1.986	2.613
Heterogeneity						
Q-statistic	1.452	13.609	2.779	4.170	1.159	3.832
p (heterogeneity)	0.228	**0.000**	0.096	0.041	0.282	**0.050**

[**Legend** PE = Performance expectancy; EE = Effort expectancy; SI = Social influence; FC = Facilitating conditions; UI = Usage intention; UB = Usage behavior.]

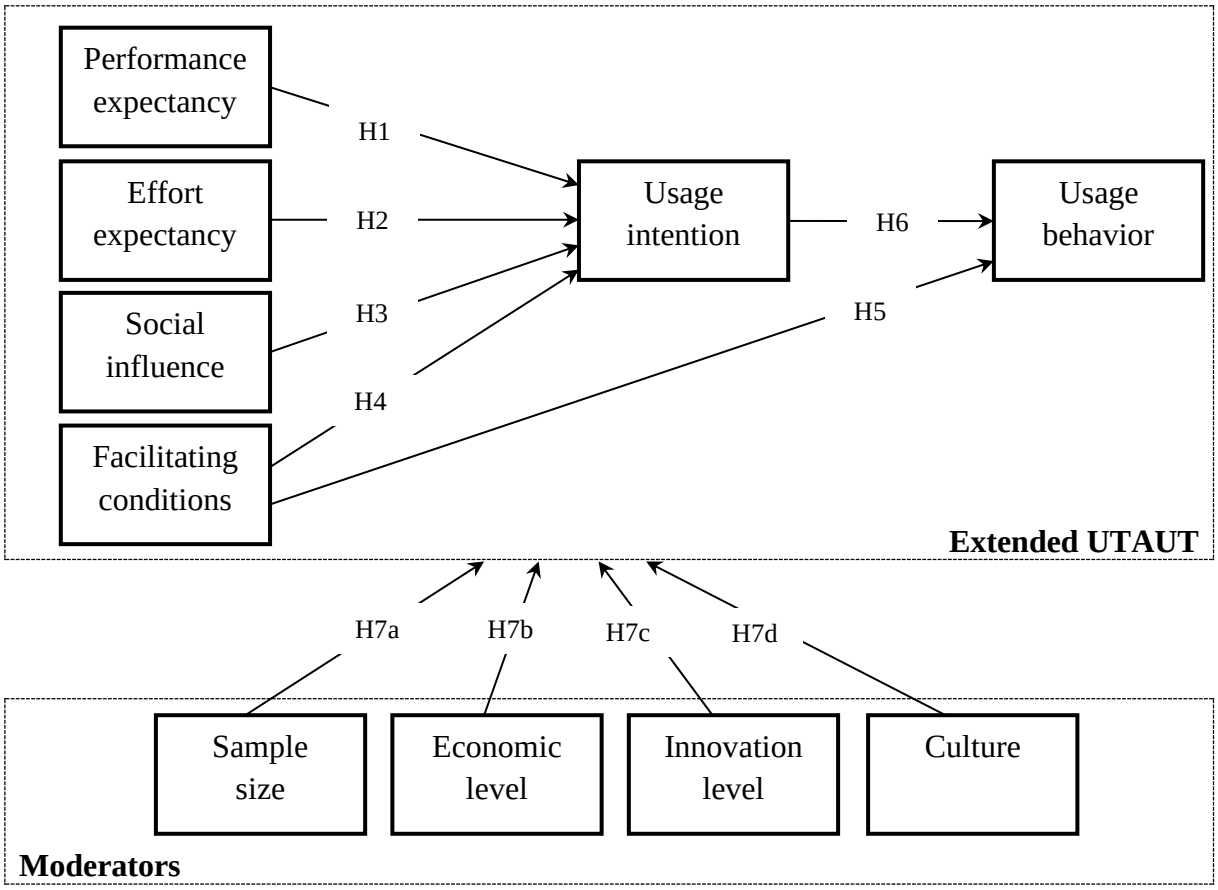

Fig. 1. Research model (Adapted from Venkatesh et al. (2003)).

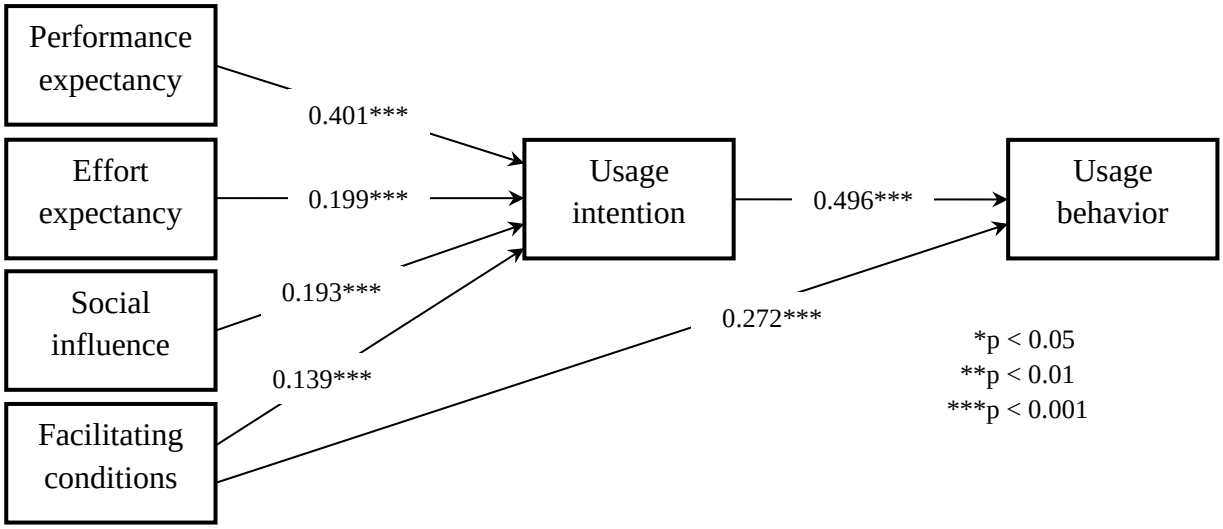

Fig. 2. The meta-analytic outcomes of the extended UTAUT.

Appendix A
Included empirical studies

Table A1
Publications included in the meta-analysis.

No.	Study	Source	Country of sample	Sample size
1	Tang et al. (2004)	CP	Taiwan	267
2	Luarn & Lin (2005)	JA	Taiwan	180
3	Amin (2007)	JA[a]	Malaysia	195; 203
4	Amin et al. (2008)	JA	Malaysia	158
5	Chu & Yao-bin (2009)	CP	China	313
6	Chung & Kwon (2009)	JA	South Korea	156
7	Crabbe et al. (2009)	JA	Ghana	271
8	Gu et al. (2009)	JA	South Korea	910
9	Kim et al. (2009)	JA	South Korea	192
10	Liu et al. (2009)	CP	China	438
11	Shan & Lu (2009)	CP	China	313
12	Amin & Ramayah (2010)	JA	Malaysia	115
13	Koenig-Lewis et al. (2010)	JA	Germany	155
14	Luo et al. (2010)	JA	United States	122
15	Püschel et al. (2010)	JA[a]	Brazil	333; 333
16	Riquelme & Rios (2010)	JA	Singapore	681
17	Wessels & Drennan (2010)	JA	Australia	314
18	Zhou et al. (2010)	JA	China	250
19	Bankole et al. (2011)	JA	Nigeria	231
20	Daud et al. (2011)	JA	Malaysia	300
21	Selvan et al. (2011)	JA	India	303
22	Sheng et al. (2011)	CP	China	210
23	Sripalawat et al. (2011)	JA	Thailand	195
24	Zhou (2011)	JA	China	210
25	Akturan & Tezcan (2012)	JA	Turkey	435
26	Bankole et al. (2012)	CP	South Africa	220
27	Kim & Kang (2012)	JA	South Korea	247
28	Lee et al. (2012)	JA	South Korea	240
29	Sun et al. (2012)	JA	Multiple countries	135
30	Teo et al. (2012)	JA	Malaysia	193
31	Yu (2012)	JA	Taiwan	441
32	Zhou (2012)	JA	China	200
33	Kim et al. (2013)	JA	South Korea	231
34	Mojtahed et al. (2013)	JA	United Kingdom	130
35	Wei et al. (2013)	JA	China	224
36	Bidar et al. (2014)	CP	Turkey	128
37	Goh et al. (2014)	JA	Malaysia	183
38	Hanafizadeh et al. (2014)	JA	Iran	361
39	Oliveira et al. (2014)	JA	Portugal	194
40	Pavithran et al. (2014)	JA	India	289
41	Singh & Srivastava (2014)	JA	India	120
42	Song (2014)	JA	China	257
43	Talukder et al. (2014)	JA	Australia	242

Table A1 (*continued*)

No.	Study	Source	Country of sample	Sample size
44	Al-Jabri (2015)	JA	Saudi Arabia	253
45	Baptista & Oliveira (2015)	JA	Mozambique	252
46	Belousova & Chichkanov (2015)	JA	Russia	160
47	Bhatiasevi (2015)	JA	Thailand	272
48	Bryson et al. (2015)	JA	India	263
49	Ewe et al. (2015)	JA	Malaysia	368
50	Mohammadi (2015a)	JA	Iran	128
51	Mohammadi (2015b)	JA	Iran	128
52	Mortimer et al. (2015)	JA[a]	Thailand; Australia	175; 173
53	Yu (2015)	JA	Taiwan	613
54	Afshan & Sharif (2016)	JA	Pakistan	151
55	Alalwan et al. (2016)	JA	Jordan	343
56	Kishore & Sequeira (2016)	JA	India	959
57	Koksal (2016)	JA	Lebanon	776
58	Liang (2016)	CP[a]	Vietnam; Taiwan	440; 372
59	Mahfuz et al. (2016a)	CP	Bangladesh	220
60	Mahfuz et al. (2016b)	CP	Bangladesh	115
61	Mahfuz et al. (2016c)	CP	Bangladesh	115
62	Mehrad & Mohammadi (2016)	JA	Iran	384
63	Nisha (2016)	JA	Bangladesh	960
64	Pattansheti et al. (2016)	JA	India	201
65	Sreejesh et al. (2016)	JA	India	320
66	Tan & Lau (2016)	JA	Malaysia	347
67	Tran & Corner (2016)	JA	New Zealand	183
68	Abdinoor & Mbamba (2017)	JA	Tanzania	200
69	Alalwan et al. (2017)	JA	Jordan	343
70	Albashrawi et al. (2017)	CP	United States	516
71	Awad & Dessouki (2017)	JA	Egypt	461
72	Bankole & Bankole (2017)	JA	South Africa	220
73	Baptista & Oliveira (2017)	JA	Brazil	326
74	Boonsiritomachai & Pitchayadejanant (2017)	JA	Thailand	480
75	Glavee-Geo et al. (2017)	JA	Pakistan	189
76	Goswami (2017)	JA	India	233
77	Kalaiarasi et al. (2017)	JA	India	345
78	Khasawneh & Irshaidat (2017)	JA	Jordan	404
79	Kumar & Shenbagaraman (2017)	JA	India	130
80	Kumar et al. (2017)	JA	India	144
81	Makanyeza (2017)	JA	Zimbabwe	232
82	Munir & Ilyas (2017)	JA	Indonesia	200
83	Muñoz-Leiva et al. (2017)	JA	Spain	103
84	Raza et al. (2017)	JA	Pakistan	300
85	Gumussoy et al. (2018)	CB	Turkey	225
86	Farah et al. (2018)	JA	Pakistan	368

Table A1 (*continued*)

No.	Study	Source	Country of sample	Sample size
87	Haider et al. (2018a)	JA[a]	Pakistan	113;130
88	Mutahar et al. (2018a)	JA	Yemen	482
89	Mutahar et al. (2018b)	JA	Yemen	482
90	Priya et al. (2018)	JA	India	269
91	Saji & Paul (2018)	JA	India	214
92	Sathitwiriyawong & Phuttaraksa (2018)	CP	Thailand	444
93	Shaikh et al. (2018)	JA	Pakistan	189
94	Singh & Srivastava (2018)	JA	India	855
95	Akhtar et al. (2019)	JA[a]	Pakistan; China	270; 300
96	Albashrawi et al. (2019)	JA	United States	472
97	Baabdullah et al. (2019a)	JA	Saudi Arabia	429
98	Baabdullah et al. (2019b)	JA	Jordan	343
99	Chaouali & Hedhli (2019)	JA	France	1245
100	Chaouali et al. (2019)	JA	Tunisia	213
101	Giovanis et al. (2019a)	JA	Greece	513
102	Giovanis et al. (2019b)	JA	Greece	931
103	Goularte & Zilber (2019)	JA	Brazil	400
104	Gupta et al. (2019)	JA	India	660
105	Hong (2019)	JA	South Korea	707
106	Islam et al. (2019)	JA	Bangladesh	186
107	Kwateng et al. (2019)	JA	Ghana	300
108	Merhi et al. (2019)	JA[a]	Lebanon; United Kingdom	486; 415
109	Raza et al. (2019)	JA	Pakistan	229
110	Sharma (2019)	JA	Oman	225
111	Sharma & Sharma (2019)	JA	Oman	227
112	Siyal et al. (2019)	JA	Pakistan	200
113	Agyei et al. (2020)	JA	Ghana	482
114	Hassan & Wood (2020)	JA[a]	Egypt; United States	132; 366
115	Ho et al. (2020)	JA[a]	Taiwan; Vietnam	164; 213
116	Iskandar et al. (2020)	JA	Indonesia	360
117	Kumar et al. (2020)	JA	India	203
118	Leoveanu et al. (2020)	CB	Romania	237
119	Nawaz et al. (2020)	JA	Sri Lanka	576
120	Nguyen et al. (2020)	CB	Vietnam	220
121	Osman & Leng (2020)	JA	Malaysia	200
122	Owusu et al. (2020)	JA	Ghana	517
123	Rachmawati et al. (2020)	JA	Indonesia	190
124	Shankar & Rishi (2020)	JA	India	432
125	Singh & Srivastava (2020)	JA	India	420
126	Thusi & Maduku (2020)	JA	South Africa	352
127	Trinh et al. (2020)	JA	Vietnam	540

[**Legend** [a]Studies with two subsamples; JA = Journal articles; CP = Conference proceeding; CB = Chapter book.]

Appendix B
Summary of subgroups analysis results

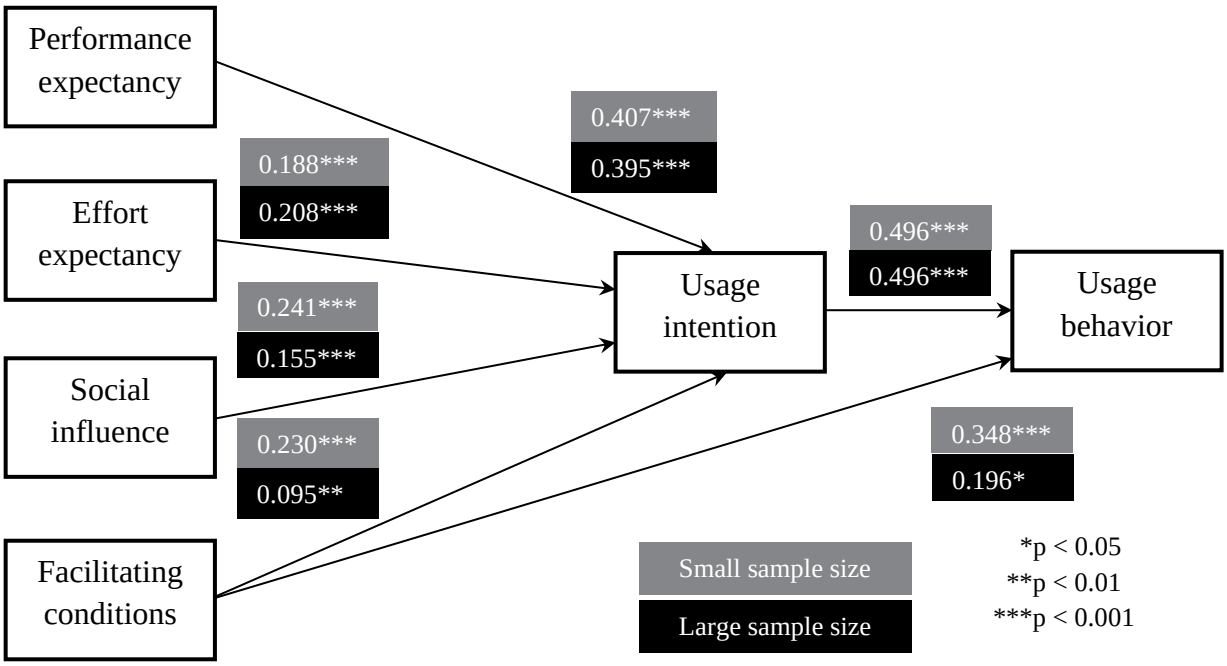

Fig. B1. Results of the subgroups analysis by sample size.

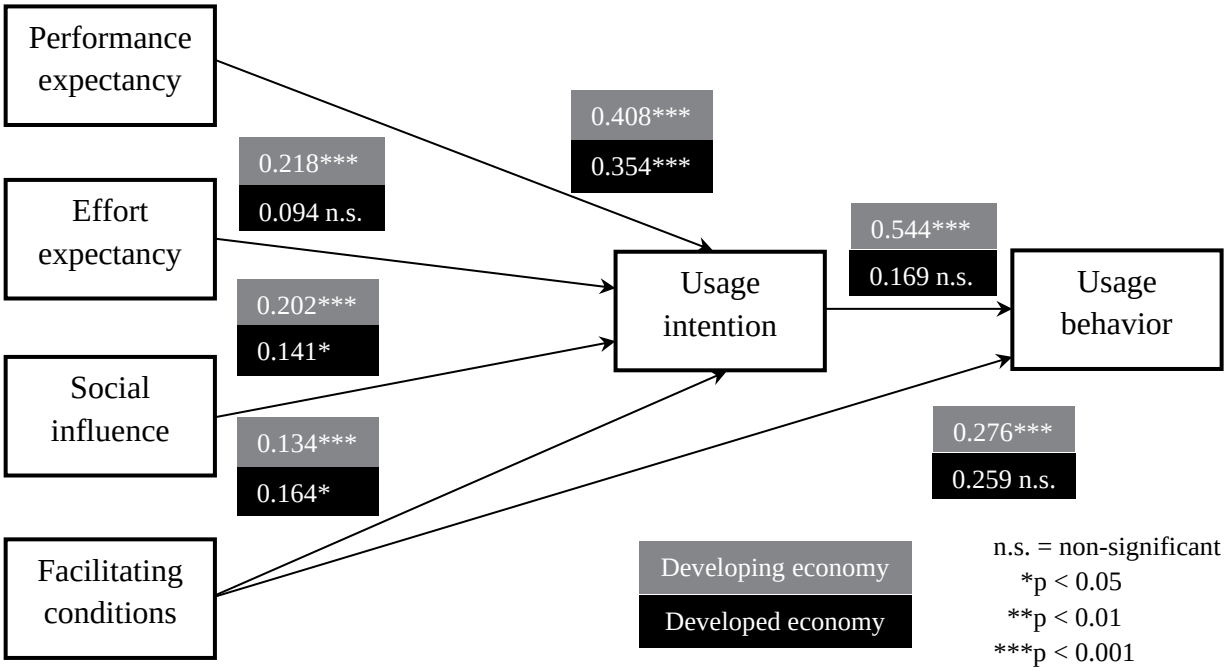

Fig. B2. Results of the subgroups analysis by economic level.

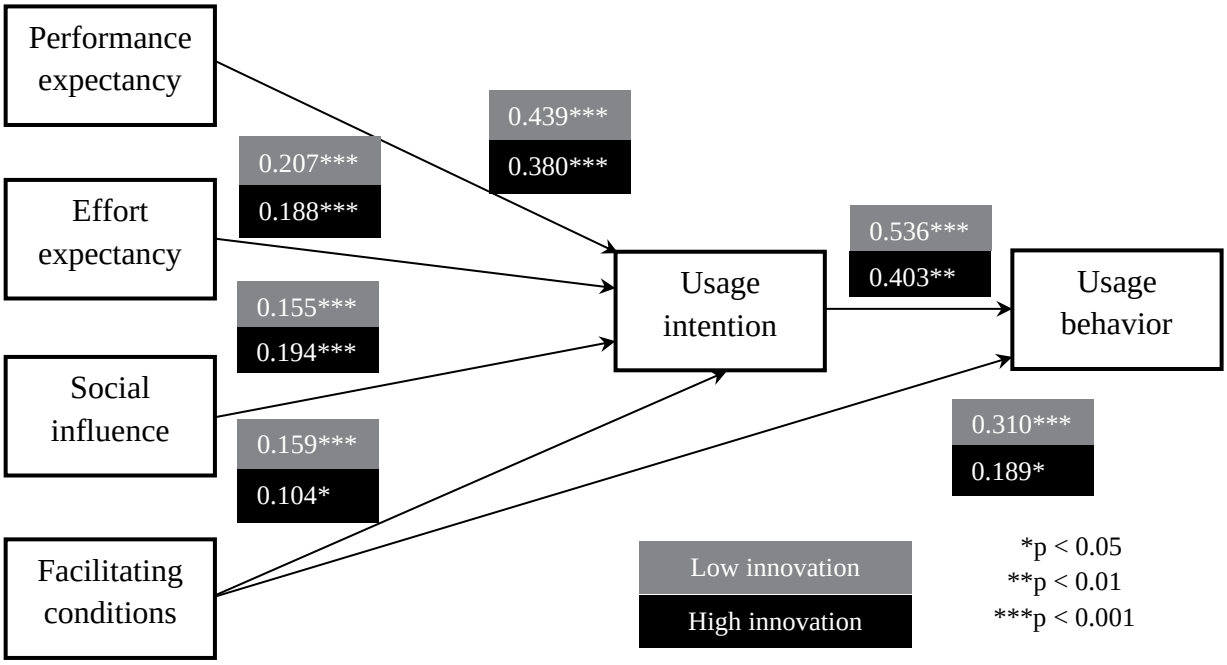

Fig. B3. Results of the subgroups analysis by innovation level.

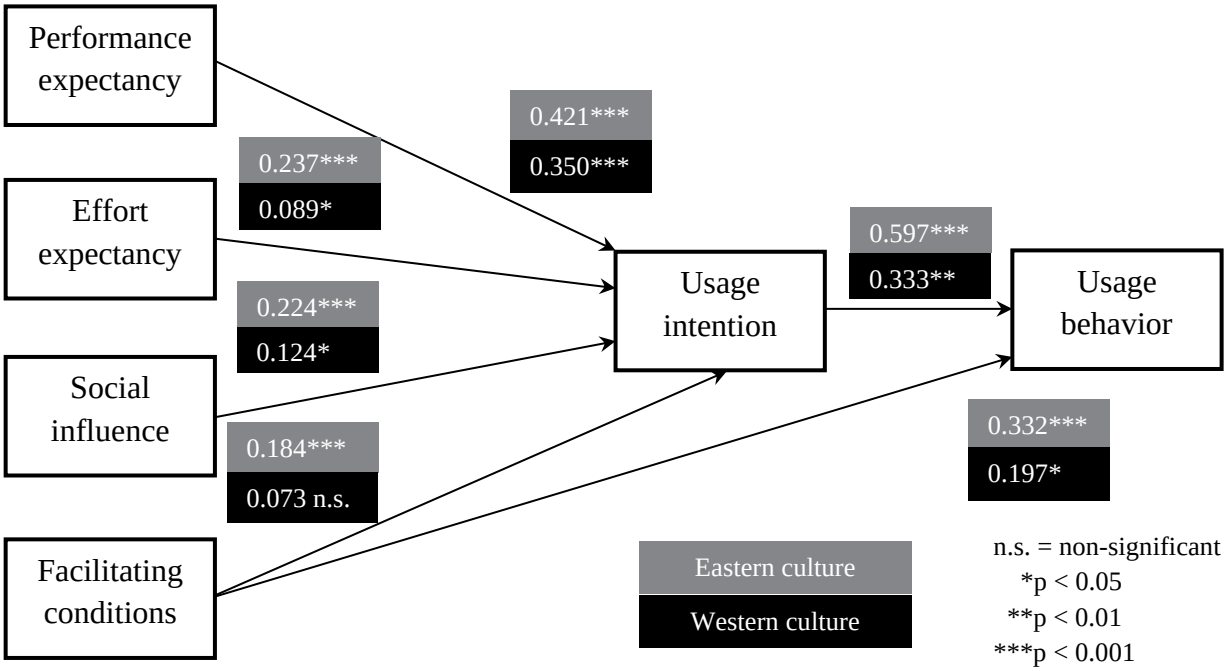

Fig. B4. Results of the subgroups analysis by culture.