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Review of Technology Adoption frameworks in Mobile Commerce

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Abstract

The purpose of this study is to review the literature of mobile commerce adoption based on technology adoption frameworks. This study reviewed 201 articles and adopted systematic literature review to analyze and highlight the usage of technology adoption theories in mobile commerce. Usage of TAM is popular than other TA frameworks whereas risks, trust and UTAUT gaining attention by to identify BI of mobile commerce users. The selection of articles is bound to the articles published in English only and not in other foreign language, inaccessible articles and articles from 2008-2016 shortlisted for this systematic review.

1. Introduction

Owing to the rapid rise in internet technology and emergence of mobile devices, user-end market has changed its ways of doing many activities. It was only a decade ago that electronic commerce was a breakthrough technology innovation. However, it was replaced by mobile commerce in no time. One the major reasons of this transition is that the scope of this innovation is complex and wider. Since, its inception on mobile devices, mobile commerce has appeared as an extension to electronic commerce. The mobile commerce technology is essentially a synergy between a mobile device, wireless internet and a supporting software. Some of the studies targeted to explore the technical facet of mobile commerce evolution whereas others had focus on its application for commercial/business purpose such as mobile banking [1], mobile ticketing for railways, buses, and airway [2], mobile shopping [3], location-based services [4].

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The following definitions of mobile commerce evolved in the past ten years. According to Thakur and Srivastava, mobile commerce refers to *"all activities related to a (potential) commercial transaction conducted through communication networks that interface with wireless devices"* [5], whereas, Chong defined m-commerce which is *"any transaction, involving the transfer of ownership or rights to use goods and services, which is initiated and/or completed by using mobile access to computer-mediated networks with the help of mobile devices"* [6]. Therefore, after reviewing these definitions mobile commerce can be considered for "all the activities (direct or indirect), via telecommunication wireless services using handheld electronic devices, which are related to monetary consumption or exhaustion of data services provided by private or public networks".

Nonetheless, mobile commerce is still in its evolving phase and gaining attention phenomenally till date. Diverse studies were conducted by many academicians and scholars to explore the significant growth of mobile commerce adoption and factors affecting behavioural intentions, attitude and usage, in the past few years. It was found that developing nations of Asia like India, China, Taiwan, Japan and Singapore are the most potential markets in the world for mobile commerce acceptance, in contrast to the developed ones like US and Europe [7]. The scope of this systematic review is to highlight the state of growth in mobile commerce adoption studies based on technology adoption frameworks.

The current study explicitly focuses on the growth of mobile commerce adoption literature. Although, various mobile commerce studies found in the review process were based on various theories except technology adoption frameworks in the literature. To the best of the knowledge, very few studies investigated the state of art in this area specifically based on technology adoption frameworks in the last 5 years. Ngai reviewed mobile commerce and its applications in his study and found 65 studies based on technology adoption theory [8]. This study also intends to explore the frequency of construct usage in the literature of mobile commerce adoption. This study also focusses on the technology adoption theories widely used across the globe. Another purpose of this study is to highlight the type of studies in this area providing insights regarding various sample sizes chosen, theories applied in the respective studies. The present study has employed a systematic approach to explicate the synthesis of mobile commerce adoption and gaps in the literature. This paper is structured as follows: Section 1: Introduction, Section 2: Background of the technology adoption theories, Section 3: Research Methodology, Section 4: Data Scrutiny and Collection, Section 5: Results of the literature Review, Section 6: Conclusion

2. Background of Technology Adoption Frameworks

Technology adoption frameworks have been used and investigated in various areas. In some of the studies, the process approach was attempted to examine the insights of the processes [9- 10-11], while in others, the main focus was on the association between the technology adoption and the governing variables [12-13-14-15]. The dominant theories in the field of information system of technology adoption include: The Theory of Reasoned Action (TRA) [16], The Technology Acceptance Model (TAM) [17], Theory of Planned Behavior [18], Innovation of Diffusion Theory/ Diffusion of Innovations (IDT/DOI) [19] and Unified Theory of Acceptance and Use of Technology (UTAUT) [20].

The Theory of Reasoned Action postulates that beliefs influence attitudes toward a behavior as well as dependent on perceived subjective norms [16]. Further, Ajzen reassessed the theory and added another construct called perceived behavioral control [18]. It defines the individuals perceived level of difficulty or ease in performing a behavioural intention. Davis explains how user accepts a specific technology with the help of two imperative determinants, perceived usefulness and perceived ease of use [17]. Roger, defined innovation into five attributes that influence the behavior intention of a user viz., relative advantage, complexity, compatibility, trialability and observability [19]. Lastly, Venkatesh introduced four constructs combining eight technology adoption theories. Where *performance expectancy* posits benefits to a user of using a technology, *effort expectancy* posits the ease to use the technology by a user, *social influence* posits the significance of people (friends and relatives) who are important to a user while using a technology and *facilitating conditions* posits the

enablers and support system available to a user using a technology.

3. **Methodology**

3.1. Research Objectives

In order to identify to what extent the technology adoption frameworks been used for prediction of user attitude, intention and actual usage, this paper investigates the following research objectives:
(1) Highlighting the growth of mobile commerce adoption based on
    a. mobile commerce applications studies grounded technology adoption framework
    b. type of study (empirical and non-empirical studies) and mobile commerce applications
(2) Reviewing geographical analysis of the mobile commerce adoption studies
(3) Reviewing the technology adoption frameworks that have been widely used in mobile commerce research studies
    a. to analyze country wise distribution of technology adoption theory in mobile commerce applications
    b. to analyze the most employed constructs in mobile commerce adoption

3.2. Search Strategy and Search String

The online digital libraries were referred during the initial search process. In order to maintain the authenticity and quality of published research, only peer-reviewed journals, Scopus indexed or ABDC (Australian Business Dean Council) were considered for this study. In the first phase, only the studies based on technology frameworks focusing on mobile commerce applications were shortlisted. The published research articles such as conference proceedings, experimental studies, and qualitative studies were extracted. The search string used in this review was based on AND/OR boolean operator. The keywords used in this review were "mobile commerce" and "technology adoption". Similarly, another search strings were used interchangeably with other keywords "M-Commerce" OR "Mobile e-Commerce" AND "technology adoption theories". The search period was limited to the research articles published between January 2008 and December 2016.

3.3. Study selection criteria (Inclusion/ Exclusion)

The inclusion and exclusion criteria have been considered in many review studies so far irrespective of research fields [21]. The intent of present study was to evaluate the technology adoption theories to study the behavior attitude, intention and actual usage of mobile users. The research articles were extracted from available electronic databases such as Elsevier Science Direct, Emerald Insight, ACM Digital Library, INDERSCIENCE Publishers, Wiley Online Library, Springer Link, JSTOR, IEEE Xplore Digital Library, ProQuest Direct and EBSCO Business Source Premier.

The inclusion criteria considered the articles published in the period 2008-2016. Only full text reading articles of mobile commerce studies based on technology adoption framework were a part of inclusion criteria. Research articles published only in peer reviewed journal were considered (Scopus Indexed, ABDC listed or SCImago journal). Studies published in English language were only taken into account. Case studies, periodicals, newspaper articles, reports, text chapters, masters and doctoral thesis, unpublished research articles, duplicate and inaccessible articles were not taken into account. Studies that does not include technology adoption frameworks and conference proceedings which are not published in ABDC or Scopus listed journal were also not considered in this review.

4. **Data Scrutiny & Data Collection**

More than 1000 articles from digital libraries were shortlisted after examining the abstracts. Out of these, around 514 were found relevant considering the area and the keywords searched. Further, based on technology adoption framework, 234 research articles were shortlisted. Finally, considering the relevance of the schematic review, 201 articles made it through. The research articles extraction was processed through Google scholar. It included various publications such as Wiley, Routledge, Elsevier, Taylor and Francis and Emerald Insight and so on. The literature was stored and managed with the help of a variety of software such as Mendeley and Microsoft Office Excel.

5. **Results of Review**

5.1. Growth of Mobile Commerce studies based on TA frameworks

The primary objective of this study was to explore the motivations which significantly influence the attitude, and intention of the users towards mobile commerce. The figure below shows the rapid growth of articles every year, from 2008 to 2016. It was found that there is a dip in the number of publications in 2011. However, there is a gradual increase from 2012 through 2014. In 2015, again, the number fell down to just 10 articles. The major reason is, many research articles were not given full access to or were unavailable for the subsequent year's publications. Nevertheless, the number is expected to increase at a steady pace in the coming year.
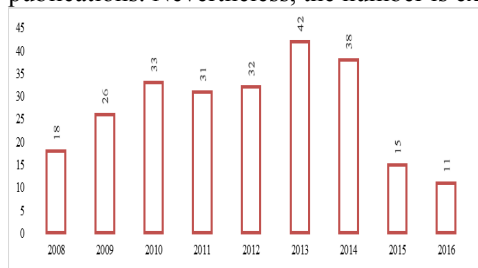

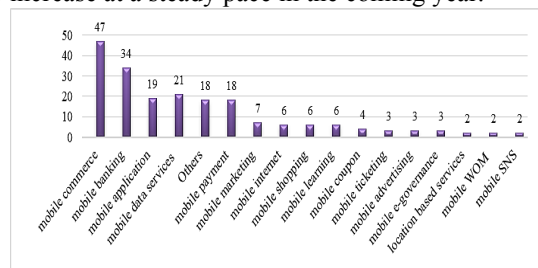Fig. 1. (a) Articles published in mobile commerce adoption

Fig. 2. (b)Frequency of mobile commerce application articles

5.2. Type of study and Mobile Commerce Applications

It is evident from the observation that methodologies adopted in these studies were different in terms of approach, likewise survey method, mix-method approach as well as experiments. It was found out that the average mean of a sample size was 365 respondents. Out of the 201 studies, quantitative method was used for 182 (91%) studies. Apart from this, qualitative methods were applied in five studies, and two studies were such wherein both qualitative and quantitative methodology, alias mix-method approach, was used. Of the 9 studies were literature review articles from January 2008 till 2016. Figure 2, explains the frequency of mobile commerce applications investigated between January 2008 and December 2016. 47 studies were based on the exploration of mobile commerce adoption. Other mobile commerce applications like mobile banking, mobile application, mobile data services and mobile payment are also gaining attention of researchers and academicians due to the rise in internet technology development.

5.3. Distribution of articles across the Globe

The classification of the countries in the current study is based on the United Nations. The exponential growth

of studies occurred in China. Of 201 studies, 53 come from China alone. It can be observed that there is an enormous development of mobile commerce studies in East Asia. Additionally, South East Asia including Korea (19), Malaysia (18) and Singapore (2) had around 18 studies including (1) cross country (China and Malaysia) study as well. In South Asia; India (10) is followed by Bangladesh (1), Iran (1) and Pakistan (1). From West Asia there was (1) from Turkey, and lastly (7) studies were from Africa (South Africa and Zimbabwe).

Moreover, it was found that the number of studies in developed nations is lesser than that of the developing nations. For instance, (34) studies were from USA and (31) from Europe. However, cross-country study is gaining more and more impetus gradually. There were (7) articles found in this study which were done jointly by scholars from USA and Europe. The total number of journals referred to in this review was 44. Of the 201 cases, (22) articles were published in Computer in Human Behaviour, (7) were published in Industrial Management & Data Systems and (6) in Information and Management. Despite the fact that MIS quarterly ranked 3rd in the information system journals, only (1) article was found in the current study. Supporting the analysis, Information and Management and Decision Support Systems were found in top 10 list of journals that has published the technology acceptance models articles [22]. There was an increased attention of scholars and academicians towards behaviour intention due to the increase in the number of studies of mobile banking and mobile payment technology.
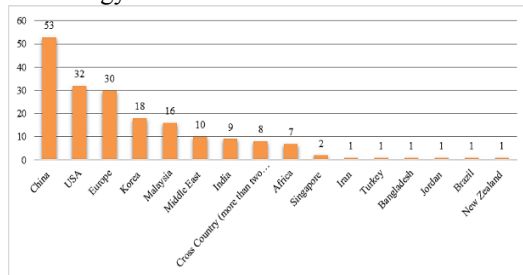

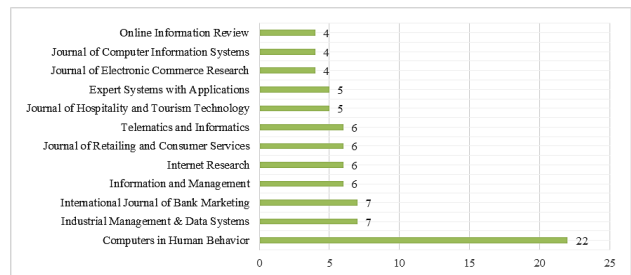
Fig. 3. Geographical distribution of m-commerce articles

Fig. 4. Top 12 Journals

5.4. Technology Adoption Frameworks in Mobile Commerce

Out of the 201 studies, in 138 studies TAM was predominantly used. Since TAM does not include any external variables and demographic it has its own limitation to explain behavior intention [23]. Many studies attempted to overcome the limitation of TAM by contributing new constructs and not varying the basic variables of TAM. Some of the constructs are perceived risk [24], perceived enjoyment [25], compatibility [26], perceived cost [27] and trust [28]. Beside this, few studies had foundation which was different from technology adoption theories. These studies were not significant in numbers, but are seemingly drawing attention of academicians and research scholars. Likewise, there were other integrated studies based on integration of TAM with Flow theory, Expectancy Theory Model and so on [29-35]. However, the number of such integrated studies has increased rapidly in the last 5 years.

Most of the theories like risk perception, five factor model of personality traits, uses and gratifications theory and task-technology fit were found to be the recent most employed consumer behavior theories in this area. The above discussed observations provided some guidance in understanding the concept of adoption mobile technology, taking place in developed and developing markets. Marketers need to focus uniquely on addressing the perception of the consumers, as there are many factors which do not affect all the consumers but rather only a specific segment or an individual [36]. A study established a consumer typology based on drivers and their impediments towards mobile shopping which gave an insight on how managers can focus on their potential m-shoppers [3]. The research on mobile commerce adoption in developing nations requires more attention, as it can be used to improve the infrastructure of mobile technology [37].
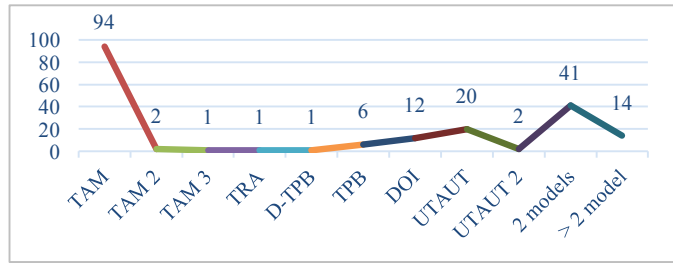
Fig. 5. Frequency of technology adoption theories in m-commerce
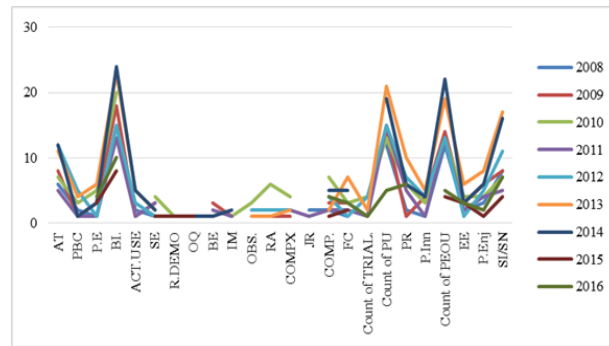
5.5. *Overview of Constructs*

Fig. 6. Frequency of Technology Adoption frameworks constructs in Mobile Commerce

Notes: BI: Behaviour Intention; PU: Perceived Usefulness; PEOU: Perceived ease of use; SI/SN: Social Influence/Subjective Norm; ATT: Attitude P.ENJ: Perceived enjoyment; EE: Effort Expectancy; COMP: Compatibility; PE: Performance Expectancy; FC: Facilitating Conditions; INN: Innovativeness; AU: Actual Use; RA: Relative Advantage; TRL: Trialability; CPX: Complexity; B: Behaviour; OB: Observability; JR: Job Relevance; IM: Image; OQ: Output Quality

Figure 6 describes the variation in constructs dispersed in mobile commerce literature. The highest frequency of construct used for investigation of mobile commerce adoption studies is Behaviour intention (146) Perceived Usefulness (119) followed by PEOU (115), ATT (63), PR(43), Enjoyment (39), compatibility (30), innovativeness (22), self-efficacy (20) actual usage (17). The increase in frequency of PE (27), EE (27), FC (27) and SI/SN (83) reflects the usage of UTAUT theory to predict the user behavioural intention. It was found that, studies conducted in the developing nations and in emerging markets of mobile users that social influence, culture, income and education are strong factors that influence mobile users [39]. The increase in the usage of risk perception is due to the uncertainties and risk associated with the advancement in technologies [38].

6. **Discussion and Implications**

The aim of the study is to classify the accumulated literature on technology adoption frameworks in mobile commerce. It can be deemed as an extension to the [8] study of review on mobile commerce and its applications. Review of mobile commerce adoption was found in another study [40]. There was an investigation of the review of mobile commerce applications and not a complete focus on technology adoption frameworks in these studies. A selection of data from 44 scrutinized journals has been done in the current study. These journals have the highest frequency of mobile commerce adoption articles. Following this, 201 articles including empirical

methods, conceptual papers, literature review and mix-method approaches have been evaluated. In this review, the dominant mobile commerce studies, based on technology adoption theories, from the last 9 years, were investigated. The study shows a phenomenal growth in the number of research studies in mobile commerce adoption since the year 2008. Recently, the rise in the number of studies has taken place predominantly in the developing nations like China and India. It has been found out that empirical studies were the most prevalent while qualitative and mixed-method approaches are in their nascent stage.

The wide implementation of technology adoption theory in this area was also addressed in the present study. It indicated that TAM has been widely explored due its robustness and explanatory power followed by hybrid models. These hybrid models comprise technology adoption theory as well as non-technology adoption frameworks or constructs. It can be inferred from the results of the current study that UTAUT is gaining more attention of the researchers in the recent years. The most investigated constructs and the relationship among them were also probed in this study. As stated above, TAM has been the most popular and widely used framework in most of the studies. The constructs of TAM, perceived ease of use (PEOU) and perceived usefulness (PU) were found to be predominantly investigated by researchers. Moreover, other constructs like perceived risk, perceived enjoyment, personal innovativeness, self-efficacy, trust, security and perceived cost have been increasingly investigated. The phenomenal rise in the usage of mobile applications is one of the main reasons behind this. Users are now more concerned about their privacy and security while performing transactions on their mobile devices. This was one of the key findings in this study, which contribute and provide insight to the significant factors influencing behavioural intention of a mobile user.

The limitation of this study is due to limited database and inaccessible articles, which perhaps will not give an in-depth analysis of this area. The chosen classification of review in this study is deemed for an improvisation. Another research direction could be to extend and conduct a meta-analysis. Such reviews tend to pose questions and suggestions by academicians and practitioners to work on similar areas. However, it can be concluded that mobile commerce applications and usage of technology adoption framework is still in nascent stage, particularly in respect to usage pattern of the user and not just intention to use the technology.

References

[1] Tam C, Oliveira T. Understanding the impact of m-banking on individual performance: DeLone & McLean and TTF perspective. Computers in Human Behavior. 2016;61:233-44.
[2] Cheng YH, Huang TY. High speed rail passengers' mobile ticketing adoption. *Transportation Research Part C: Emerging Technologies*. 2013;30:143-60.
[3] San-Martin S, López-Catalán B. How can a mobile vendor get satisfied customers?. *Industrial Management & Data Systems*. 2013;113(2):156-70.
[4] Zhou T. The impact of privacy concern on user adoption of location-based services. *Industrial Management & Data Systems*. 2011;111(2):212-26.
[5] Thakur R, Srivastava M. Customer usage intention of mobile commerce in India: An empirical study. *Journal of Indian Business Research*. 2013;5(1):52-72.
[6] Chong AY. Mobile commerce usage activities: The roles of demographic and motivation variables. *Technological Forecasting and Social Change*. 2013;80(7):1350-9.
[7] Zhang L, Zhu J, Liu Q. A meta-analysis of mobile commerce adoption and the moderating effect of culture. *Computers in human behavior*. 2012;28(5):1902-11.
[8] Ngai EW, Gunasekaran A. A review for mobile commerce research and applications. *Decision support systems*. 2007;43(1):3-15.
[9] Kim J, Kizildag M. M-learning: Next generation hotel training system. *Journal of Hospitality and Tourism Technology*. 2011;2(1):6-33.
[10] Tobbin P. Towards a model of adoption in mobile banking by the unbanked: A qualitative study. *Info*. 2012;14(5):74-88.
[11] Wang D, Xiang Z, Fesenmaier DR. Adapting to the mobile world: A model of smartphone use. *Annals of Tourism Research*. 2014;48:11-26.
[12] Oliveira T, Faria M, Thomas MA, Popovič A. Extending the understanding of mobile banking adoption: When UTAUT meets TTF and ITM. *International Journal of Information Management*. 2014;34(5):689-703.

[13] Trivedi JP, Kumar S. Determinants of mobile commerce acceptance amongst gen Y. *Journal of Marketing Management*. 2014;2(2):145-63.

[14] Arvidsson N. Consumer attitudes on mobile payment services–results from a proof of concept test. *International Journal of Bank Marketing*. 2014;32(2):150-70.

[15] Hsu CL, Lin JC. What drives purchase intention for paid mobile apps?–An expectation confirmation model with perceived value. *Electronic Commerce Research and Applications*. 2015;14(1):46-57.

[16] Ajzen I, Fishbein M. Belief, attitude, intention and behavior: An introduction to theory and research. Reading, MA: Addison-Wesley.

[17] Davis FD. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS quarterly*. 1989:319-40.

[18] Ajzen I. The theory of planned behavior. *Organizational behavior and human decision processes*. 1991;50(2):179-211.

[19] Rogers, E. M. (1995). Diffusion of innovations (4th ed.). New York: Free Press

[20] Venkatesh V, Morris MG, Davis GB, Davis FD. User acceptance of information technology: Toward a unified view. *MIS quarterly*. 2003:425-78.

[21] Chauhan S, Chauhan S, Agarwal N, Agarwal N, Kar AK, Kar AK. Addressing big data challenges in smart cities: A systematic literature review. *Info*. 2016;18(4):73-90.

[22] King WR, He J. A meta-analysis of the technology acceptance model. *Information & management*. 2006;43(6):740-55.

[23] Zarmpou T, Saprikis V, Markos A, Vlachopoulou M. Modeling users' acceptance of mobile services. *Electronic Commerce Research*. 2012;12(2):225-48.

[24] Chan FT, Yee-Loong Chong A. Analysis of the determinants of consumers'm-commerce usage activities. *Online Information Review*. 2013;37(3):443-61.

[25] Kim B, Choi M, Han I. User behaviors toward mobile data services: The role of perceived fee and prior experience. *Expert Systems with Applications*. 2009;36(4):8528-36.

[26] Chen C. Perceived risk, usage frequency of mobile banking services. *Managing Service Quality: An International Journal*. 2013;23(5):410-36.

[27] Goh TT, Sun S. Exploring gender differences in Islamic mobile banking acceptance. *Electronic Commerce Research*. 2014;14(4):435-58.

[28] Gu JC, Lee SC, Suh YH. Determinants of behavioral intention to mobile banking. *Expert Systems with Applications*. 2009 36(9):11605-16.

[29] Zhou T, Lu Y, Wang B. Integrating TTF and UTAUT to explain mobile banking user adoption. *Computers in human behavior*. 2010;26(4):760-7.

[30] Shin DH, Shin YJ, Choo H, Beom K. Smartphones as smart pedagogical tools: Implications for smartphones as u-learning devices. *Computers in Human Behavior*. 2011;27(6):2207-14.

[31] Zhou T, Lu Y. Examining mobile instant messaging user loyalty from the perspectives of network externalities and flow experience. *Computers in Human Behavior*. 2011;27(2):883-9.

[32] Joo J, Sang Y. Exploring Koreans' smartphone usage:An integrated model of the technology acceptance model and uses and gratifications theory. *Computers in Human Behavior*. 2013;29(6):2512-8.

[33] Barnett T, Pearson AW, Pearson R, Kellermanns FW. Five-factor model personality traits as predictors of perceived and actual usage of technology. *European Journal of Information Systems*. 2015;24(4):374-90.

[34] Lo HY. Quick Response codes around us: Personality traits, attitudes toward innovation, and acceptance. *Journal of Electronic Commerce Research*. 2014;15(1):25.

[35] Oliveira T, Faria M, Thomas MA, Popovič A. Extending the understanding of mobile banking adoption: When UTAUT meets TTF and ITM. *International Journal of Information Management*. 2014;34(5):689-703.

[36] Dasgupta SI, Paul RI, Fuloria SA. Factors affecting behavioral intentions towards mobile banking usage: Empirical evidence from India. *Romanian Journal of Marketing*. 2011;(1):6.

[37] Alkhunaizan A, Love S. What drives mobile commerce? An empirical evaluation of the revised UTAUT model. *International Journal of Management and Marketing Academy*. 2012;2(1):82-99.

[38] Xu H, Gupta S. The effects of privacy concerns and personal innovativeness on potential and experienced customers' adoption of location-based services. *Electronic Markets*. 2009;19(2-3):137-49.

[39] Zhang L, Zhu J, Liu Q. A meta-analysis of mobile commerce adoption and the moderating effect of culture. *Computers in human behavior*. 2012;28(5):1902-11.

[40] Hew JJ. Hall of fame for mobile commerce and its applications: a bibliometric evaluation of a decade and a half (2000–2015). *Telematics and Informatics*. 2017;34(1):43-66.