

Revised Technology Acceptance Model Framework for M-Commerce Adoption

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Abstract—Following the E-Commerce era, M-Commerce is the next big phase in the technology involvement and advancement. This paper intends to explore how Indian consumers are influenced to adopt the M-commerce. In this paper, the revised Technology Acceptance Model (TAM) has been presented on the basis of the most dominant factors that affect the adoption of M-Commerce in Indian scenario. Furthermore, an analytical questionnaire approach was carried out to collect data from Indian consumers. These collected data were further used for the validation of the presented model. Findings indicate that customization, convenience, instant connectivity, compatibility, security, download speed in M-Commerce affect the adoption behavior. Furthermore, the findings suggest that perceived usefulness and attitude towards M-Commerce are positively influenced by number of M-Commerce drivers (i.e. download speed, compatibility, convenience, security, customization, connectivity, and input mechanism).

Keywords—M-Commerce, perceived usefulness, technology acceptance model, perceived ease of use.

I. INTRODUCTION

THE convergence of the two fastest growing industries, the internet and the mobile communication, has led to the creation of an emerging market for mobile commerce (M-Commerce). Although the M-Commerce market is relatively young, mobile online shopping is rapidly reaching a critical mass of businesses and individual users in near future [19]. “Projections by Cisco put the number of smartphone users in India at 651 million by 2019, a near five-fold jump from 140 million by end-2014” [25]. “A study noted a 54 percent surge in the number of smartphone users in 2014 as the average price of handsets fell to around \$150 last year and as smartphone penetration increases in rural India” [25]. With the recent emergence of the wireless and mobile networks, a new platform for business to trade their product which is known as M-Commerce begins to gather attentions from businesses [23].

Angsana emphasizes on three elements of M-Commerce; namely, a range of activities, devices, and network types [3]. “With the relatively new emergence of M-Commerce from the simple service of SMS to mobile payment service vendors are cautious in introducing more complex transactions in providing alternative payment services so as not to oversell its potential” [19]. It has also been noticed that some vendors

have rolled out such services to the market on a very small scale and within a somewhat restricted environment [19].

M-Commerce is a technology where mobile devices are connected wirelessly in a mobile environment as compared to E-Commerce where connectivity is through wired internet. In developing countries, it has been found that M-Commerce has much potential, since the small sized companies can use them to reach the potential customers. M-Commerce offers more mobility and ubiquity to the consumers as compared to E-Commerce. M-Commerce is conducted with the help of mobile devices that are small in size and light in weight, which makes it very convenient for users to carry. Moreover, as mobile devices are usually not shared between users, so more customized services can be delivered to the users in M-Commerce.

II. LITERATURE REVIEW

M-Commerce is all together a new concept/philosophy, and there exist multiple definitions of it. It is really difficult to be defined since it can be interpreted in multiple ways. M-Commerce can be defined as “all activities related to a (potential) commercial transaction through communications networks that interface with mobile devices” [20]. It provides unique business opportunities for both existing Electronic Commerce (E-Commerce) companies and new ventures focusing solely on M-Commerce [13]. Another definition of M-Commerce as given by Shuster is “the use of wireless device to communicate, interact, and transact via high speed communication to the internet” [29]. M-Commerce is an evolving area of E-Commerce, where users can interact with the service providers through a mobile and wireless network, using mobile devices for information retrieval and transaction processing [4].

Many industry and technology leaders are discussing these problems, and thus, M-Commerce has a great potential as the era of wireless and mobility becomes a trend in the 21st century. In July 2014, there were about 15 percent of transactions coming from mobile, and in a year, it has increased 70 percent [25]. The number of mobile Internet users in India is expected to grow to 314 million by the end of 2017 with a CAGR (compounded annual growth rate) of around 28% for the period 2013- 2017, and this impressive growth would drive India to become one of the leading Internet markets in the world with more than 50% of Internet user base being mobile-only Internet users [10]. “The growth will be led by the government’s Digital India initiative, collaboration among mobile Internet ecosystem stakeholders and innovative content and service offerings from mobile-

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based services players” [18]. Digital India is an umbrella programme that encompasses providing Internet access to all by creating infrastructure, delivering government services on the Web and mobile phone, promoting digital literacy, and increasing electronic manufacturing capability [18]. Furthermore, since M-Commerce is a new technology, therefore there exist a number of challenges to it, and the main challenges are the security concerns and also the software and the interface that vary among various partners. The biggest challenge that has been observed in M-Commerce is that the screens of the mobile phone are somewhat small [27].

Many of the earlier studies attempted to find out the factors that influence adoption of M-Commerce but they were based on traditional models such as Theory of Planned Behavior (TPB), Diffusion Innovation Theory (DOI), and Theory of Reasoned Action (TRA); however, except for few recent studies [7], [17], there has been a lack of strong empirical work to create the establishment of models to find out the factors that affect the adoption of M-Commerce.

The TAM was adapted from TRA which was proposed by Fishbein and Ajzens in 1975 [31] and that was specially used in the field of management of information system. TAM conceptualizes the technology characteristics as perceived usefulness and perceived ease of use. TAM has been applied to various disciplines to study information communication technologies (ICTs). The various disciplines that have considered the adoption process of new ICTs include economics, consumer behavior, and sociology [5], [14]. TAM is one of the parsimonious, yet robust models for explaining ICT characteristics and their effects on consumer adoption/use of new ICTs. TAM is one of salient models, which is validated by many other researchers in variety of academic disciplines. Studies have shown that TAM consistently accounts for 40% of variance in usage intentions and helps to examine why user beliefs and attitudes affect their acceptance and rejection of ICTs [14]. Due to the popularity of Internet and other emerging ICTs, TAM is being widely used in adoption studies, such as the World Wide Web, E-Commerce, and online shopping [2]. It has further been argued that M-Commerce can be considered as a subset of E-Commerce [8].

Pavlou has integrated trust and risk with TAM in an uncertain E-Commerce environment to understand the consumer attitude owing to the fact that the practical utility of TAM stems from the fact that E-Commerce is technology-driven [21]. As TAM has been applied to examine E-Commerce usage, it is justified to further extend the model for the study of M-Commerce technology as both the technologies are closely related with each other. TAM is a theoretically justified model which intended to explain Information Technology (IT) adoption. TAM proposed that Perceived usefulness (PU) which is defined as “the degree to which a person believes using a particular system would enhance his or her job performance” and Perceived ease of use (PEOU), which is defined as “the degree of to which a person believes that using a particular system would be free of effort” are the two critical beliefs that helps in determining user’s adoption intention and actual usage of IT [6]. Other key components in

the model are “attitude toward using”, “behavioral intention to use” (BI), and “actual system use” (AU) [16]. Attitude toward use, PU and PEOU are the main determinants in IT usage [1]. According to TAM, these two determinants PU and PEOU serve as the basis for attitudes towards using a particular system, which in turn determines the intention to use, and then generates the actual usage behavior. The present study uses a revised version of the original TAM model which conceptualizes that consumer actively wants to evaluate the usefulness and ease-of-use of M-Commerce technology in their decision-making process [9]. The present study aims to explore the future adoption of M-Commerce applications, rather than the present usage behavior. The M-Commerce application is still in its early stage in India, and actual consumers of the technology are limited. Therefore, the AU is not a valid measure for this study. Similarly, as any financial consequences or perceived risk are not involved (compared to actual adoption decision), behavioral intention to use is not of any importance in this study

III. RESEARCH MODEL AND HYPOTHESIS

Based on the external factors affecting M-Commerce and consumer attitude towards the use of M-Commerce, the proposed research model is as shown in Fig. 1. The various attributes related to the proposed model are discussed below:

- A. Customization- It is defined as the “degree of offering or recommending tailored content and the transactional environment to individual customers” [11].
- B. Input mechanism of Mobile devices- It is very critical in developing consumer attitude towards the use of M-Commerce, as in the M-Commerce environment input mechanisms are generally poor [24]. As wireless devices usually employ small keypads, they have limited input facilities in comparison with equipment on a wired network, but with the evolution of the smart phones, the input mechanism is improving, as the touch screen smart phones have bigger screens, and keypad size is increasing.
- C. Convenience- It allows users to do things that they never thought possible without being tethered to a home or office computer, from comparing store prices and searching for restaurant reviews to checking into a hotel and social networking at anytime and anywhere [26].
- D. Instant connectivity- One great thing about M-Commerce is its availability on an easy connection, and as long as the network signal is available, it is easy that for the mobile devices to get connected to internet. It does not need to look for modem and Wi-Fi connection anymore.
- E. Compatibility- It is an important aspect of innovation that can be defined as the extent to which a new service is consistent with the users’ existing values, beliefs, previous experiences, and habits [15].
- F. Security- It is defined as the degree of resistance/protection against any harm. In terms of M-Commerce, security and privacy are the main concerns of the user.
- G. Download speed in M-Commerce- It is defined as the rate of data transfer and with the advent of latest technologies

ike 4G, 3G, and WiMax, the download speed in M-Commerce is definitely going to increase.

Based on the model following hypothesis are proposed:

- H1: PU positively influences attitude toward using M-Commerce.
- H2: PEOU positively influences attitude toward using M-Commerce.
- H3: PU positively influences PEOU of M-Commerce.
- H4: Customization positively influences PU.
- H5: Input mechanism of mobile devices influences PU.
- H6: Convenience positively influences PU.
- H7: Instant connectivity positively influences PU.
- H8: Compatibility positively influences (PU).
- H9: Security positively influences PU.
- H10: Download speed in M-Commerce positively influences PU.
- H11: Customization positively influences PEOU.
- H12: Input mechanism of mobile devices influences PEOU.
- H13: Convenience positively influences PEOU.
- H14: Instant connectivity positively influences PEOU.
- H15: Compatibility positively influences PEOU.
- H16: Security positively influences PEOU.
- H17: Download speed in M-Commerce positively influences PEOU.

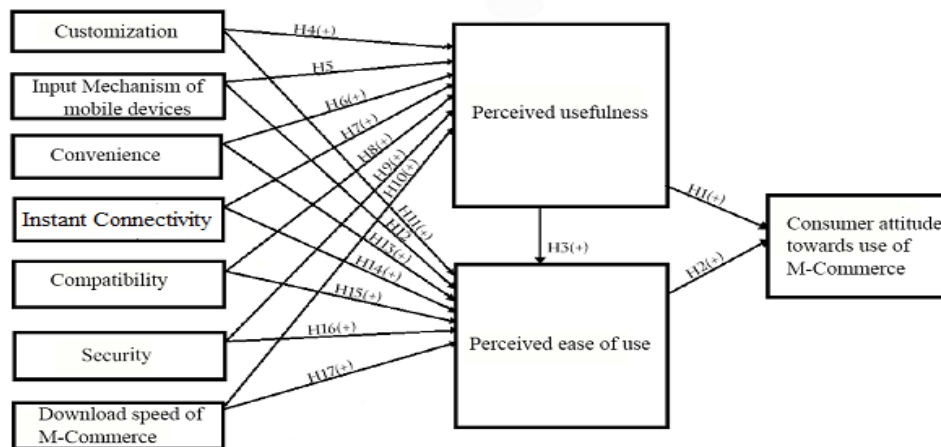


Fig. 1 Presented Framework (Revised TAM) for M-Commerce adoption

IV. RESEARCH METHODOLOGY

A. Sample

For the purpose of this survey, a structured questionnaire was framed to collect responses. These questions were framed on a five-point Likert-scale. A total of 500 questionnaires were mailed to different respondents throughout the country. This survey was carried out during July-Dec, 2015. Out of the 500 questionnaires mailed to the chief executives/senior managers, 24 questionnaires returned undelivered, and eight organizations refused to participate in the survey as they considered the information asked for as classified. A total of 112 responses were collected. However, out of the 112 responses received, four responses were incomplete and were excluded from the analysis. Thus, 108 complete responses were collected, which gives an effective response rate of 21.6%. The respondents were based mainly in Allahabad, Pune, Faridabad, Bangalore, and Delhi.

B. Variables Measurement

Previous research was reviewed to ensure that a comprehensive list of measures was included. Those for PU, PEOU, consumer attitude towards use of M-Commerce (AT), customization (CUS), input mechanism of mobile devices (INP), convenience (CON), instant connectivity (INST), compatibility (COMP), security (SEC), and download speed

of M-Commerce (DSMC) were adapted in our model from previous studies on technology adoption and technology diffusion [11], [13], [16], [28]. Data were collected using a five point Likert-type scale.

C. Reliability Analysis

Reliability analysis was done for each of the independent and dependent variable; there were five subvariables for each construct to define that construct and to get the correct view of consumers on that variable. The internal consistency of the subvariables is calculated with the help of Cronbach Coefficient alpha (α). If the value of α is 0.70 or above it, then it signifies that the data are reliable and there does not exist any inconsistency among the data. The results shown in the Table I indicate that all the measures adopted are reliable.

V. DATA ANALYSIS AND RESULTS

The revised TAM framework model for adoption of M-Commerce was investigated by four regression analyses; first PU and PEOU was made the predictor variable, and AT was independent variable. The results in Table II suggest that PU is positively associated with AT, while PEOU is negatively associated with consumer AT.

TABLE I
RESULT OF RELIABILITY ANALYSIS

Variable Name	Mean	Std.dev.	Cronbach's alpha
CUS	3.534	1.021	0.701
INP	3.742	1.002	0.775
CON	3.716	0.901	0.803
INST	3.00	1.216	0.938
COMP	3.96	0.936	0.803
SEC	3.66	0.998	0.814
DSMC	3.35	1.023	0.817
PU	3.672	0.875	0.911
PEOU	3.812	0.825	0.763
AT	3.596	1.178	0.851

TABLE II
RESULTS OF REGRESSION ANALYSES AMONG AT, PU AND PEOU

Predictor Variable	R2	Std. Error of the Estimate	Standardized Coefficients	t	Sig.
PU	0.058	0.153	0.278	2.273	0.025
PEOU	0.014	0.195	(-0.058)	(-0.473)	0.637

TABLE III
RESULT OF REGRESSION ANALYSIS BETWEEN PEOU AND PU

Predictor Variable	R2	Std. Error of the Estimate	Standardized Coefficients	t	Sig.
PU	0.400	0.059	0.633	8.415	0.000

In the second regression analysis, PU is predictor variable, and PEOU is kept dependent variable. The results in Table III suggest that PU is highly positively related to PEOU. The third regression analysis was conducted by keeping the M-Commerce drivers as dependent variable. The results in Table IV suggest that all the variables (M-Commerce drivers) are positively related to PU.

The fourth regression analysis was conducted by keeping M-Commerce drivers as predictor variable and PEOU as dependent variable. The results in Table IV suggest that some of the drivers are positively related to PEOU, while input mechanism of mobile devices, instant connectivity, and security are negatively related to the PEOU.

The hypothesized relationship between various constructs is tested by using regression analysis. The M-Commerce drivers are defined as exogenous variables. PU, PEOU, and AT are defined as endogenous variables. The statistical significance is measured by using t-statistical values. More positive "t values" indicate a higher level of agreement with the variable. More negative "t values" indicate for higher level of disagreement with the variables. The coefficient of determination R2 for each structural path has been calculated. The coefficient of determination R2 measures the percentage variance of dependent variable explained by the set of independent variables. The following discussions of the study findings are divided into two sections. The first section discusses hypotheses (H1-H3) generated from core elements in the original TAM, consisting of PU, PEOU, and AT. The second section examines hypotheses (H4-H17) in the revised TAM, investigating the relationships between individual characteristics, PU, and PEOU.

TABLE IV
FINAL RESULTS OF REGRESSION ANALYSIS

Predictor Variable	R2	Std. Error of the Estimate	Standardized Coefficients	t	Sig.
ABOUT PU, CUS, INP, CON, INST, COMP, SEC, DSMC					
CUS	0.205	0.179	0.231	1.404	0.016
INP	0.166	0.205	(-0.267)	(-1.373)	0.017
CON	0.327	0.120	0.498	4.626	0.000
INST	0.001	0.067	0.327	3.354	0.001
COMP	0.089	0.166	0.011	0.072	0.054
SEC	0.121	0.140	0.310	2.174	0.032
DSMC	0.166	0.115	0.111	0.934	0.035
ABOUT PEOU, CUS, INP, CON, INST, COMP, SEC, DSMC					
CUS	0.086	0.160	0.221	1.177	0.042
INP	0.041	0.184	(-0.321)	(-1.448)	0.151
CON	0.210	0.108	0.490	3.989	0.000
INST	0.006	0.061	(-0.047)	(-0.424)	0.673
COMP	0.017	0.149	0.164	0.921	0.035
SEC	0.006	0.126	(-0.165)	(-1.016)	0.312
DSMC	0.069	0.103	0.073	0.541	0.059

VI. DISCUSSION AND CONCLUSION

"India has a huge opportunity for mobile commerce. This is the first time a majority of Indians are getting connected to the internet. They are discovering products at costs that are lower than they've never seen before, and they are getting products that were not available in their market before. So, it's a huge opportunity" [25]. M-Commerce is an emerging technology, and the success of this technology in Indian scenario still depends upon many other factors such as telecommunications infrastructure, government policies, marketing strategies of service providers, and the abilities to protect consumer privacy. The determinants of online shopping acceptance differ among product or service types and it has been found that personal innovativeness of information technology (PIIT), perceived Web security, personal privacy concerns, and product involvement can influence consumer acceptance of online shopping, but their influence varies according to product types [12]. According to a report released in April by market research firm Zinnov, India's mobile commerce market could balloon to \$19 billion by 2019, up 850 percent from its current size of \$2 billion. Surging smartphone sales in the world's second most populous country amid a tidal wave of low-cost handsets is the key driver, the report said [25].

This paper has investigated and provided insights into the relationships between PU, PEOU, AT, with the M-Commerce drivers. According to the previous TAM researches in the existing literature, PU is found to be good predictor of many ICT. PU is found to be a strong predictor of consumer adoption in this study, while PEOU is not a good measure to predict an emerging technology (M-Commerce) of which consumers have heard but do not have firsthand experience to use it. This can be justified by the fact that empirical values of input mechanism of mobile devices, instant connectivity, and security are coming negative or not significant with PEOU, which is against the hypothesis proposed for these variables. PU has direct effect on developing consumer attitude towards use of M-Commerce while PEOU has mediating effect. This

study supports TAM and helps researchers to understand the relationships between PU, PEOU, AT, and actual use of M-Commerce. The empirical data also confirm that there is strong positive relationship between PU and PEOU. Despite the empirically documented applicability of the TAM, further efforts are critical to validate the existing study findings in the TAM literature involving different technologies and settings [22]. The study aims to extend the model's empirical applicability and theoretical validity by examining factors influencing Indian's consumer adoption of M-Commerce and thus to make a theoretical and practical contribution to M-Commerce adoption/acceptance research by advancing the understanding of consumer technology acceptance/adoption behavior [30].

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