



## PERSONAL DIGITAL ASSISTANT AS MOBILE COMMERCE: AN INTEGRATED THEORY MODEL

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### Abstract—

M-commerce is the purchase and sale of products and services using hand-held wireless devices such as mobile phones and personal digital assistants (PDAs). In India mobile and mobile internet subscribers are increasing the ubiquity, accessibility, mobility and flexibility of the M-commerce network. The Indian Mobile Commerce Market's potential and development rates point to an exciting future. By 2020, India's smartphone users were 220 million, rising 23% by 2020. This study presents a detailed examination of mobile devices and of their usage in connection with the comparison with China. India is currently projected to overcome the largest smart phone market, China, by 2025. Study also examines the elements that impact user adoption for M-commerce based on the technology acceptance (TAM) model and the task-technological fit (TTF) theory. The theoretical model demonstrates that fitness perceived has a favorable influence on perceived utility and security and that value perceived is connected to M-commerce purpose.

**Keywords--**M-commerce, E-commerce, Growth, Smartphone, Subscribers.

### I. INTRODUCTION

Mobile computing and commercial (M-commerce) is the 21st century recognized with the creation and wide use of Wireless and portable equipment. For commercial and non-commercial activities carried out through an open network based on wireless technologies and mobile devices, M-commerce varies from e-commerce. Because of its innovation, portability, fast response and high potential uses, M-commerce has already drawn significant business attention and has been widely utilized, and its usage demonstrates a trend of rapid wide and deep expansion. By the end of June 2011, according to the recent study by the Chinese Internet Network Information Centre (CNNIC), Chinese Internet users were 485 million whereas India was 251 million. China's Internet users were 485 million. Also in other nations, M-commerce

applications are highly popular. 25% of Internet users in Europe utilize mobile e-mails, while 20% are habituated to mobile internet usage is not unlikely. Albeit M-commerce apps are becoming a trend, the internal mechanism and behavioral logic of researchers and business users are unclear: why are people adopting M-commerce?

Others have utilized Task-Technology Fit Theory (TTF), as a theoretical basis to evaluate the link between personal employment performance by individuals utilizing M-commerce and prior academics and practitioners use TAMs as analytical frameworks. Although TAM research is commonly used for IT research, it does not take into account the technological job appropriate for the action to be taken by the user and does not take into account the features of the purpose of the company. The TTF model takes into account technical characteristics and task elements but misses the impact of the technical task on the psychological and behavioral aspects. This article builds and uses this integrated model as a comprehensive analytical instrument to make a link between the technical fitness and technology usage to combine TAM and the TTF model. The article also uses the integrated model. Section 2 provides a theoretical framework that identifies these determinants and impacts on M-commerce adoption.

## II. THEORETICAL BACKGROUND

### A. Technology Acceptance Model

Researchers generally use behavior theory (such as TRA and TPB) as the theoretical foundations for studying the behavior of people in IT use, which is the most famous model for accepting technology (TAM). A TAM (Figure 1) model demonstrates that a user's attitudes have an effect from perceived utility and perceived ease of use (*Pedersen et al., 2002*). Numerous researches show that perceived utility and perceived convenience substantially impacts users' behavior and willingness to use, and perceived convenience also influences perceived utility in conventional information systems (*Pedersen, 2005*).

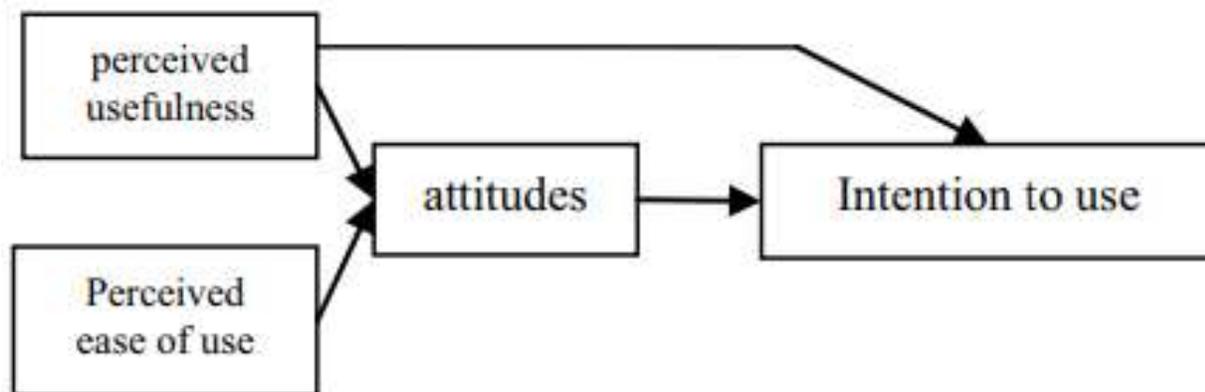


Figure1. Technology acceptance model.

(Source: Pedersen, 2005)

### B. Task – Technology Fit Theory

The Goodhue and Thompson's first suggested task - technology fit hypothesis (Figure 2). It has currently been extensively recognized and implemented in the IS area after expansion by Zigurs and Blackland (*Malhotra and Segar, 2005; Webster and Watson, 2002*). This idea demonstrates the logical connection between information technology which supports and improves job performance of specific activities. If IT can increase the performance of people, users need to accept it and better fit between their supporting duties. The technology mentioned here is the tools used to carry out the tasks (*Cheong and Park, 2005*).

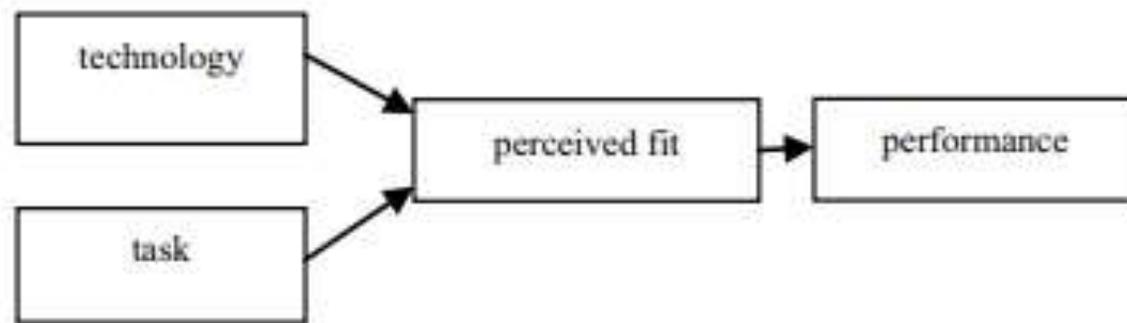


Figure 2. Task-Technology Fit.

(Source: Malhotra and Segars, 2005)

### C. Model Development

Although the TAM and TTF models were recognized by researchers, they had several shortcomings as well. Since TAM lacks attention to its mission, the key characteristic of the IT system to help people carry out the activities may be overlooked; thus, TTF limits its applicability to its width and depth as a consequence of the failure to build a bridge between technological tasks and IT behaviour. Given the two shortcomings, researchers can use one model to increase explanatory skills (Yang et al., 2004). As per Dickinger et al., 2006; Harris et al., 2005; Knutsen et al., 2005 and Nysveen et al., 2005 numerous researchers have tried to explore e-commerce and e-government IS adoption, but no application has been made for M-commerce. In addition, IT is now a necessary infrastructure and an important part of the individual companies with the increasing popularity of data technology, reciprocal maturity, and the ability of individuals, coupled with the interconnection and interoperability of IT products, to improve their use gradually. Reducing the complexity and difficulty of IT goods shows that easy IT usage no longer represents an essential component that affects customers, because the perceived usability only analyses the use by technology. The influence of perceived usability on those who use the IS in connection to the perceived value (Barnes and Huff, 2003; Haque, 2004) is not substantial and significant. At the same time, popularization and use of IT goods plainly makes information security vital, and this problem cannot be avoided by consumers.

In particular, IS behavior depends on reducing security threats to information, increasing information security expertise, and establishing trust mechanisms in the context of the network (Kim et al., 2005). Perceived security is typically used to measure users' understanding about the security and reliability of the system in relation to zero (riskless) people assume following the use of a certain system. Prior study reveals that security is considered as an essential issue in the use of IT (Frank, 2001; Hung et al., 2003 and Pagani, 2004). Finally, perceived value is the net amount of the deducting expenditure (monetary or non-monetary benefit), derived from the revenues of the items purchased (Yang, 2005). The value perceived emphasizes the balance between advantages and expenses and is a major component for predicting consumers' decision to buy something or their intention to utilize IS. And other research have also shown that perceived value might affect consumers' desire or intention to purchase something (Khalifa, 2002 and Wang et al., 2006). For M-commerce, the impact of the value on the purpose of the user is more obvious, as M-commerce has a great characteristics not demonstrated by traditional e-commerce companies that raise awareness of M-commerce value. In short, since TAM and TTF are weak in themselves, the two models must be integrated in one model, in order to increase their analytical capabilities; secondly, by including a number of new variables in the model, including perceived security and perceived value. We must expand the scope of model development.

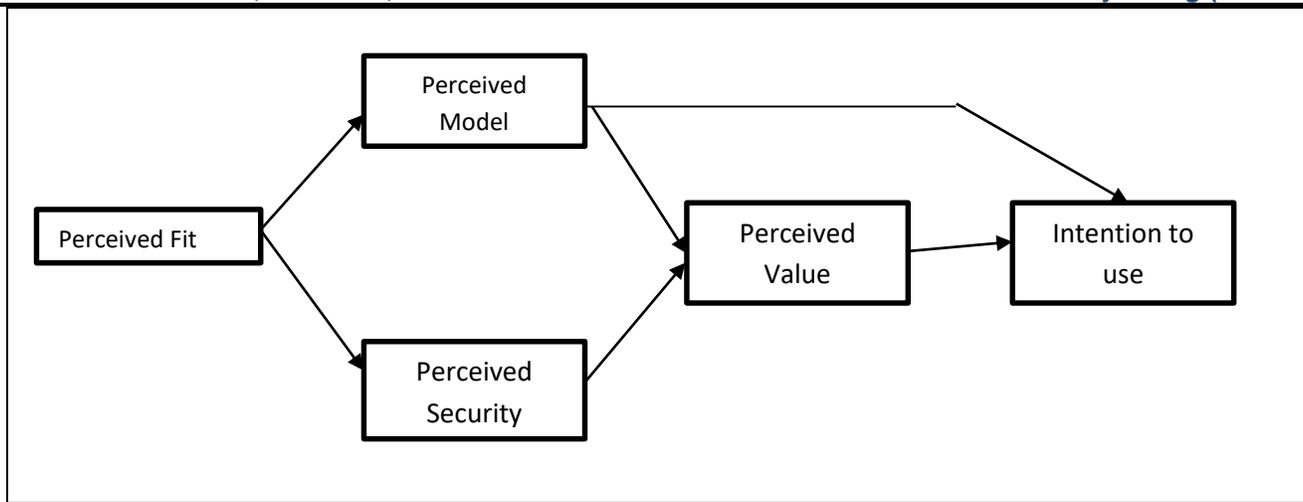


Figure 3. Research model.

Study thus substitute the sensitive usability in our investigation with the perceived safety in the TAM model. Based on the integration of the TAM and TTF model, the perceived value is seen as mediating perceived utility and security in the intentional application of the Research Model Figure 3. Then in the following phase, we will discuss different assumptions in the model.

### III. HYPOTHESIS

#### ***A. Perceived Fit and Perceived Usefulness***

Compared to traditional e-commerce products, M-commerce has these unique characteristics, such as mobility, location and time criticality (Nysveen et al., 2005), so that M-commerce offers obvious advantages to assist people to perform certain special tasks, such as mobile meetings, notification, distribution of tasks or move-on tracking in real time. If these technological elements are well related to the respective tasks, they will have a favorable effect on the user's job, so that the user can view M-commerce better. So study represents initial hypothesis:

Hypothesis 1: Perceived fit has positive effect on perceived usefulness.

#### ***B. Perceived Fit and Perceived Security***

The exterior aspects, their perceived usefulness and their perceived ease of use are strongly connected in the technological acceptance model. The TTF and TAM model, used to substitute the external elements judged to be fit for the TAM model, were part of the study. The failure to ensure adequate safeguards to protect privacy has become important obstacles to online trade and has a negative impact on M-commerce applications (Hung et al., 2003). When people understand that the technology can make them better, they want M-commerce to be adopted. With customers constantly improving their understanding of M-commerce and dependence on M-commerce, they raise awareness for the safety of the system. Therefore, the second hypothesis is:

Hypothesis 2: Perceived fit has positive effect on perceived security

#### ***C. Perceived Usefulness and Perceived Value***

The perceived utility of the TAM model significantly impacts consumers' inclination for use (Pedersen et al., 2002). M-commerce offers advantages such as mobility, comfort, location, strong connectivity, customization etc. in a moving world. Therefore, M-commerce benefits from its strengths to provide timely, convenient, personalized information, which meets its users' multi-level information needs, improves customers' efficiency and completes tasks that in conventional information environments cannot be carried out, thereby enhancing the value of M-commerce. The number

of farmers is vast, and the degree of literal growth must be improved, the commercial applications passionately welcomed by farming friends, particularly under the Chinese backdrop, due to the unprecedented regional development and social diversification structures in China. The mobile company also allows users to run their business and to go beyond their typical dependence on a desk and workplace that helps enhance the user's M-commerce value impression (Laurin and Lin, 2005). Therefore, third hypothesis is:

Hypothesis 3: Perceived usefulness has positive effect on perceived value.

#### ***D. Perceived security and Perceived Value***

The degree to which a user considers the use of a certain programme to be safe is characterized as perceived security (Kim et al., 2005). In the field of M-commerce, the perceived security represents users' knowledge that M-commerce services are reliable and privately protected. It is an essential element that affects the trust of users in service providers and IT and leads to behaviors (Aarnio et al., 2002). The previous studies shows that if consumer information technology use does not violate their own personal privacy or are financially or otherwise impacted, customers are more aware of the perceived advantage of M-commerce. That is why study assumes:

Hypothesis 4: Perceived security has positive effect on perceived value.

#### ***E. Perceived Value and Intention to Use***

The perceived value refers to an overview of service or product by customer after comparison of profit and costs (Scarborough, 2000) and significant structural factors for the projections of present and developing consumer use behavior in M-commerce (Okazaki, 2005). It may lead to the perceived value variations within the same product or service, due to variances in human requirements, tastes, values and the particular status of system usage. The Moreover, multiple aspects of system usage such as compulsory, voluntary, informed, and uninformed, are effective and inefficient, making it difficult for researchers to assess the system precisely. DeLone and McLean highlighted that, in some situations, usage intent is more significant than net income. Research has also revealed that the perceived value is a valid predictor to predict the use of individuals. So, fifth assumption is:

Hypothesis 5: Perceived Value has positive effect on intention to use.

### **IV. RESULTS**

<i>Hypothesis</i>	<i>Perceived Value</i>	<i>Conclusion From Hypothesis</i>
Hypothesis 5	The perceived value is a valid predictor to predict the use of individuals	It is achieved via service or product by customer after comparison of profit and costs
Hypothesis 4	The perceived value has an effect over security.	Consumer information technology use does not violate their own personal privacy or are financially or otherwise impacted
Hypothesis 3	A typical dependence has been noticed in this hypothesis.	The degree of literal growth must be improved, the commercial applications passionately welcomed by farming friends
Hypothesis 2	Perceived securities are positive correlation.	The TTF and TAM model, used to substitute the external elements judged to be fit for the TAM model, were part of the study.
Hypothesis 1	Perceived security.	Unique characteristics have been shown as perceived securities are positive correlation.

**Table 1: Comparative perspectives over various studies.**

Factor(s)	Example studies	Perspectives/roles			Comments
		tech	Net	Cons	
Usefulness, performance expectancies	Cheong and Park, 2005; Knutsen et al., 2005; Pedersen and Nysveen, 2002 and Yu et al., 2003	*			Direct/indirect effect on Intentions was found
Enjoyment, playfulness	Dickinger et al., 2006; Kim et al., 2005; Nysveen et al., 2005 and Pedersen and Nysveen, 2002	*			Direct/indirect effect on Intentions was found
Expressiveness, image, lifestyle enhancement	Harris et al., 2005; Nysveen et al., 2005 and Pedersen and Nysveen, 2002	*	*		Direct/indirect effect on Intentions was found
User satisfaction (with using the service itself)	Harris et al., 2005; Haque, 2004 and Julius and Khasawneh 2002	*			Direct/indirect effect on Intentions was found
Relative advantage and perceived value	Barnes et al., 2003 and Kim et al., 2005	*	*	*	Direct/indirect effect on Intentions was found
Technical Issues such as connection speed, service speed, bandwidth, device limitations, etc	Haque, 2004; Hung et al., 2003; Kim et al., 2005 and Pagani, 2004	*			Direct/indirect effect on Intentions was found
Contents and functions availability and quality	Cheong and Park, 2005; Dickinger et al., 2006; Haque, 2004; Julius and Khasawneh 2002 and Pagani, 2004	*			Direct/indirect effect on Intentions was found
Personal innovativeness	Frank, 2001; Hung et al., 2003; Yang, 2005 and Yu et al., 2003	*			Direct/indirect effect on Intentions was found
Behavioural Control (self-efficacy, facilitating conditions, etc)	Hung et al., 2003; Khalifa and Sammi, 2002; Nysveen et al., 2005; Pedersen and Nysveen, 2002; Wang et al., 2006 and Yu et al., 2003	*			Mixed results were found
Compatibility, prior experience, relevant past knowledge	Barnes et al., 2003; Cheong and Park, 2005; Knutsen et al., 2005; Wu et al., 2005 and Yang, 2005	*	*		Mixed results were found
Ease of use, complexity, effort expectancies	Barnes et al., 2003; Cheong and Park, 2005; Dickinger et al., 2006; Hung et al., 2003; Knutsen et al., 2005; Lurn and Lin, 2006; Pagani, 2004; Pedersen and Nysveen, 2002; Wu et al., 2005 and Yang, 2005	*			Mixed results were found
Service cost, price, fee, perceived financial cost, perceived financial resources	Aarnio, 2002; Harris et al., 2005; Haque, 2004 and Julius and Khasawneh 2002; Kim et al., 2005; Lurn and Lin, 2005; Wang et al., 2006 and Wu et al., 2005	*		*	Mixed results were found
Trust, Risk, Security, perceived credibility, privacy issues associated with using a service	Haque, 2004; Julius and Khasawneh 2002; Lurn and Lin, 2005; Wang et al., 2006; Wu et al., 2005 and Yu et al., 2003	*		*	Mixed results were found
Subjective norm (peer influence, external influences, normative beliefs, others recommendations)	Barnes et al., 2003; Harris et al., 2005; Hung et al., 2003; Julius and Khasawneh 2002; Khalifa and Sammi, 2002; Lurn and Lin, 2005; Nysveen et al., 2005; Pedersen and Nysveen, 2002; Pederson 2005 and Yu et al., 2003		*		Mixed results were found”
Triability, exposure to service through marketing	Barnes et al., 2003; Harris et al., 2005; Khalifa and Sammi, 2002; Knutsen et al., 2005 and Pagani, 2004	*	*	*	Mixed results were found

## V. DISCUSSION

The issues taken for discussion is to assess the performance of e-commerce institutions in India and the factors influencing the consumers to depend on the e-commerce institutions across the Globe. In this respect, the results are analyzed under the following heads and are discussed separately for drawing a meaningful conclusion. They are: Profile of e-commerce leaders– General characteristics of cross border e-commerce institutions– Performance of M-commerce institutions– Factors influencing the consumers to depend on the e-commerce institutions for their various needs– Governmental intervention to stabilize e-commerce– Strategies to promote the e-commerce trade.

Profile of e-commerce leaders: Cross border e-commerce is getting great popularity and attraction among the youths of cities across the world. While discussing the e-commerce, one should discuss the profile of leaders leading the world in e-commerce. China is one of the leaders in leading the e-commerce trade across the world and other countries are tracing the path of Chinese model of adoption of e-commerce. In this situation, the country profile of India and China becomes important and hence, these details are analyzed and the results are presented in Table 2. The population of India and China is almost equal. A difference of only 08 crores of population is high in the case of China (Table 2).

Shortly India will outperform in enhancing the population unless it takes some control measures. The gross domestic product of India and China is also almost equal. Only the marginal difference in growth is in favor of China. In actual terms, China is a giant and India has to go a long way to reach that level. But the growth is expected to decrease in both the nations according to some macroeconomic estimates. One of the estimates done by international monetary fund predicted that the GDP growth in respect of China will reach to the level of 5.60% and the India's GDP will touch to the level of 7.70% during the year 2023. According to UNCTAD, the B2C e-commerce Index estimates, India is ranked in 83 out of 144 countries. Whereas, China is ranked in 65 out of the 144 nations. From that one could understand that the China is growing fast in respect of e-commerce applications between the Businesses to Consumer process. In respect of International Telecommunication Union's ICT development Index, India is in 134th position out of 176 nations. Whereas, China is occupying 80th position in respect of ICT development index out of 176 nations. The internet users in China are also almost double when compared to India. Such strong nations in respect of GDP and other indices, its growth through Cross border e-commerce and its status assessment is drawn with a view of comparing with its counterpart, China. General characteristics of cross border e-commerce institutions: Internet penetration in India and China: Before availing discussions on the general characteristics of e-commerce institutions, it is important to analyze the causative factor which facilitated the trade to huge extent is of paramount importance. The causative factor for the success is the spread and extent of usage of Internet by the stakeholder institutions through the communication satellite which has made the world into a small village by which one can communicate fast and access the resource needs across the world. The internet removes geographical boundaries, eliminates travel time and provides instant access to products available anywhere in the world (Ratchford et al., 2001). In this respect, one would be interested in analyzing the details of rate of internet penetration in India and hence these details are analyzed and the results are presented in Table 3. China is found to be the leader in internet penetration and India is the follower (Table 3). Though India is slowly progressing in respect of internet penetration when compared to China, India is growing very fast in number of users of Internet. During the year 2017, the number of internet users in China is found to be 771.98 million (Figure.4). Whereas, India had only 331.77 million. When one could compare these figures during the year 2006, 137 million in China and India had only 32.60 million users of internet. In a decade of time, the percentage change

<b>Table 2: Profile of E-Commerce Leaders (2017)</b>			
Sr. No.	Particulars	India	China
1	Population in million	1324.2	1403.5
2	GDP in million US \$	2259642	11218281
3	Merchandise trade in millions US \$	624177	3685557
4	Internet users in millions	391.3	746.7
5	GDP growth in percentage	7.1	7.3
6	Rank in UNCTAD B2C E-commerce Index	83/144	65/144
7	Rank in ITU ICT development Index	134/176	80/176

Source: www.unctadstat.unctad.org

In the internet users in India is arrived at 613.48 per cent. But, China could realize only 267.61 per cent increase in internet users over a period of ten years. It is understood that the internet users' growth is alarming in respect of India which is growing at the rate of 24.40 per cent while the China is growing at the rate of 14.90 per cent. If this trend continues, India could out beat China in another decade of time. What is needed here is the facilitating services for the growth and spread of internet services by the respective Governments. Mobile phone internet users in India: Mobile phone has played a greater role in the communication process in the current decade and also played a vital role in facilitating the e-commerce transactions using internet and the growth of business too.

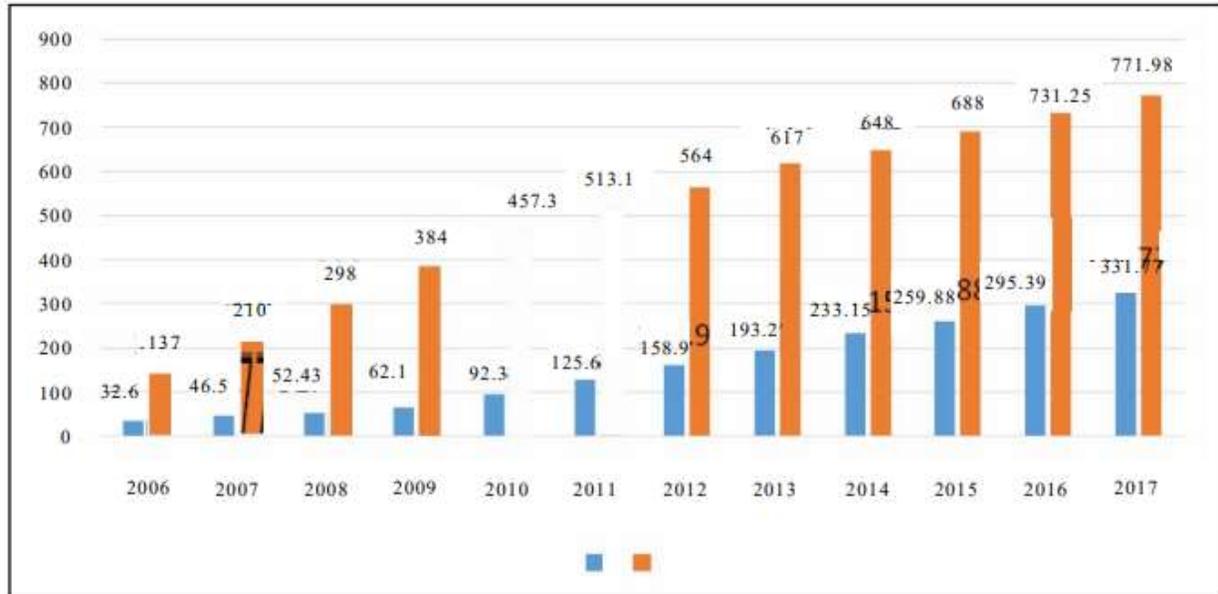


Figure 4 : Internet users (Millions)

Table 3: Internet Penetration in India and China.

Internet penetration in India and China				
Sr. No.	Year	Number of internet users in millions		Percentage increase in China over India
		India	China	
1.	2006	32.60	137.00	320.25
2.	2007	46.50	210.00	351.61
3.	2008	52.43	298.00	468.38
4.	2009	62.10	384.00	518.36
5.	2010	92.30	457.30	395.45
6.	2011	125.60	513.10	308.52
7.	2012	158.90	564.00	254.94
8.	2013	193.20	617.00	219.36
9.	2014	233.15	648.00	177.93
10.	2015	259.88	688.00	164.74
11.	2016	295.39	731.25	147.55
12.	2017	331.77	771.98	132.69
Percentage change in a decade of time		613.48	267.61	
Compound growth rate (%)		24.40	14.90	

Source: [www.statista.com](http://www.statista.com)

In this respect, one would be interested in learning the extent of penetration of mobile phone internet users in India and China is of much importance and hence these details are analyzed and the results are documented in Table 4.

Considering the importance of mobile phone internet usage in the e-commerce transactions, the extent of increase has been forecasted to 2022. During the year of 2022, the mobile phone internet user's strength is accrued to 493 million. The same was arrived at 243 million during the year 2015. When one could compare the percentage change between the eight-year duration, around 103 per cent increase (Figure 5) in the mobile phone internet users will be visualized during the year 2022 over the year 2015. This has resulted in a growth rate of 10.53 per cent indicating that the percentage will be increasing in the years to come (Table 4). When one could compare the above figures with that of China, the percentage change in the mobile phone internet users' population was found to be 142 per cent increase during the year 2015. But the same increase is not visualized during the year 2022 in respect of China because of poor growth in the mobile phone internet users. This is visible through the data presented in the Table 4.

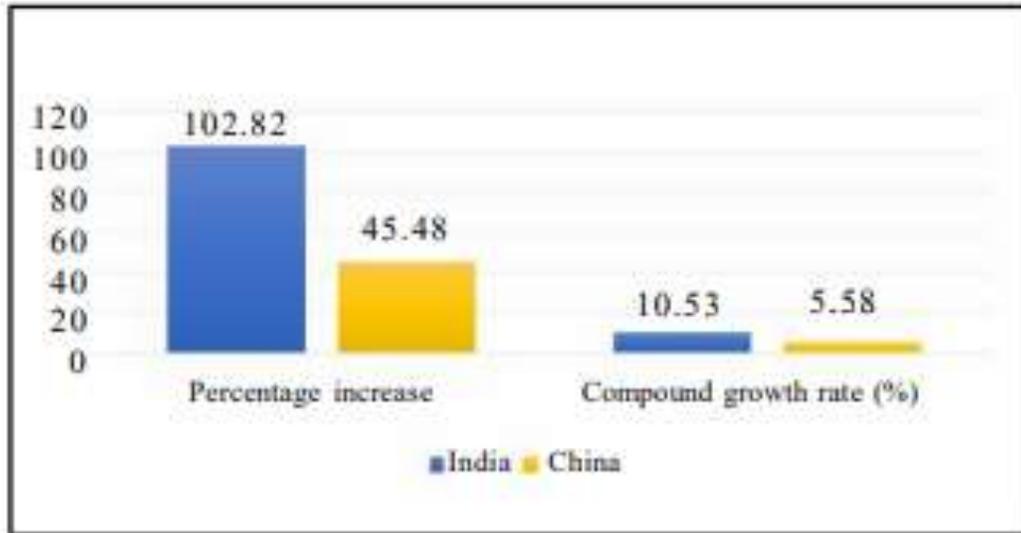


Figure 5: Growth of internet usage through mobile phone

Table 4: Mobile phone internet user

Mobile phone internet user penetration in India and China				
Sr. No.	Year	Number of mobile phone internet users in millions		Percentage increase in China over India
		India	China	
1.	2015	242.92	588.54	142.27
2.	2016	281.81	619.22	119.73
3.	2017	320.57	653.16	103.75
4.	2018	358.46	690.60	92.66
5.	2019*	394.99	730.90	85.04
6.	2020*	429.77	772.99	79.86
7.	2021*	462.77	815.45	76.21
8.	2022*	492.68	856.19	73.78
Percentage increase during 2022 over 2015		102.82	45.48	
Compound growth rate (%)		10.53	05.58	

Source: [www.statista.com](http://www.statista.com)

**Table 5: Details of E-commerce Institutions in India.**

Details of e-Commerce institutions operating in India				
Sr. No.	Name of the company	Number of employees	Revenue earned in B\$	Head quarters
1.	Amazon	268908	107.00	Seattle, USA
2.	Alibaba	26000	12.29	China
3.	E-Bay	34600	08.59	San Jose, USA
4.	Rakuten	12981	06.30	Tokyo, Japan
5.	Groupon	10000	03.10	Illinois, USA
6.	Flipkart	35000	01.50	Bangalore, India
7.	ASOS.com	07500	01.40	London, UK
8.	Zalando	10000	03.28	Berlin, Germany
9.	Net Ease	12919	03.63	China
Total		417908	147.09	

Source: <https://www.worldatlas.com/articles/the-25-largest-internet-companies-in-the-world.html>

Since Mobile phone is the handy instrument to most of the consumers, they do their purchase through electronic commerce platform operating agencies like Amazon, Alibaba, Flipkart and so on. In this respect, it is important to know the leading e-commerce institutions which are operating in India and other countries. Details of e-commerce institutions: So far, the discussion went on analyzing the extent of internet penetration and its users in India and China. When compared to the number of employees manned by the Indian e-commerce Institutions and the China e-commerce Institutions, the Indian e-commerce institutions could employ higher.

## VI. CONCLUSION

From the above finding in this paper, it can be clearly seen that m-commerce have a deep impact over various users in India (a comparative analysis with china) for the purpose of shopping, institutions, commercial etc. The perceived utility of the TAM model significantly impacts consumers' inclination for use. Since, M-Commerce offers advantages such as mobility, comfort, location, strong connectivity, customization etc. Therefore, m-commerce benefits from its strengths to provide timely, convenient, personalized information, which meets its users' multi-level information needs, improves customers' efficiency and completes tasks that in conventional information environments cannot be carried out, thereby enhancing the value of m-commerce. This has resulted in a growth rate of 10.53 per cent indicating that the percentage will be increasing in the years to come (Table 4). When one could compare the above figures with that of China, the percentage change in the mobile phone internet users' population was found to be 142 per cent increase during the year 2015. But the same increase is not visualized during the year 2022 in respect of China because of poor growth in the mobile phone internet users. This is visible through the data presented in the Table 4. However, India is progressing ahead in respect.

The research provides a fresh perspective for people to examine m-commerce which would play a leading role in the prediction of user behavior. The practical significance of the study is that it allows trade providers to sell their products and services theoretically by employing a highly concentrated marketing approach that encourages customers to utilize m-commerce actively.

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