A COMPREHENSIVE FRAMEWORK FOR ADOPTION OF MOBILE BROADBAND SERVICES IN INDIAN CITIES

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Abstract

3G mobile broadband services have not yet picked up in India, while newer 4G technologies like Long Term Evolution are already in pipeline. Mobile network operators in India need to understand the drivers of adoption of new technologies as they have to make large investments. This research developed a comprehensive conceptual framework of mobile technology adoption in India based on literature, which was empirically tested among 276 the early adopters in India. The fit of empirical data the hypothesized model was analyzed using structural equation modeling. The results showed that the impact of social influence on individual's perception of usefulness and the impact of price on individual's behavioral intention to adopt was significant, while the impact of perceived risk in use and social influence construct on the individual attitude was not significant.

Keywords: Adoption of mobile broadband, Mobile broadband in India, adoption by early adopters, framework for mobile adoption

1. INTRODUCTION

Information and Communication Technology (ICT) industry worldwide had seen significant development of newer and better technologies in last two decades. India had also witnessed unprecedented growth in this sector in last 15 years after the GSM technology was licensed by Indian government for operating commercial mobile networks. In August 2013, there were more than 674 Million GSM mobile subscribers in India (COAI, 2013), with voice related services being the main growth driver.

After the auction of 3G commercial licenses by Indian government in 2010, data services were introduced growth. With the advent of technologically advanced smart phones and rapid development of mobile application ecosystem, there was a significant potential of growth for next generation mobile broadband technologies like LTE[1]. LTE could provide a truly wireless broadband experience to subscribers with the available data rates of 200-300 Mbps per mobile base station, more than a ten-fold increase over the capacity of currently deployed 3G networks in India. LTE was already deployed in most of the developed countries across the world. There had been a few LTE deployments India so far, and it presented potential growth area in near future.

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[1]LTE, an acronym for Long Term Evolution, commonly marketed as 4G LTE, is a standard for wireless communication of high-speed data for mobile phones and data terminals.

The Indian wireless telecom industry was going through a difficult time after phase of a phenomenal growth in the last decade. The reasons were many: lack of clarity on government regulations, severe competition, increasing costs, decreasing average revenue per users, and lack of new revenue generating products and services (PwC & COAI, 2011). In such a condition, any significant investments made by telecom operators in launching new services needed to be carefully researched to ensure acceptable return on investments.

Thus, there was a need to know about the variables which influenced the decision of the potential users about adoption of high speed mobile data services. Answers would help mobile network operators to assess the readiness of market as well as in planning marketing initiatives to increase for adopting high speed mobile data networks like LTE. This was important especially because large investments were to be deployed for such services in different regions within India. The current study aims to answers those questions by developing a conceptual framework and validating the same empirically.

2. LITERATURE REVIEW

Based on the study of human behavior, Theory of Reasoned Action (TRA) posits that behavioral intention was dependent on Attitude towards that behavior and Subjective Norm (Fishbein & Ajzen, 1975). Attitude towards behavior was defined as an individual's positive or negative feelings about performing a certain target behavior. Subjective Norm was defined as a person's perception about whether people, who were important to him, thought that he should or should not perform a certain behavior. In other words, it was a person's perception of the social pressure to perform the behavior in question.

In the context of information systems and information technology adoption, Technology Acceptance Model (TAM) had been widely used in studying the adoption of diverse range of technologies and user types. TAM defined 'Perceived Usefulness' and 'Perceived Ease-of-Use' as the driver of adoption behavior (Davis, 1989). Perceived usefulness was defined as person's degree of belief that using a system would enhance his job performance. Perceived ease-of-use was defined as his belief that using the system would be free of effort. Subjective Norm was later added as additional construct in TAM2, which extended original TAM model (Venkatesh & Davis, 2000).

Both these theories were mainly based on constructs of behavioral intention as the primary driver for the actual usage by an individual. However, Ajzen (1991) argued that apart from the intention, the actual behavior also depended to a certain extent on some non-motivational factors like availability of opportunity, money, skills, etc. For example, individuals might use technology in order to comply with commands of superiors or peers, rather than due to their own feelings and beliefs about using the system (Davis *et al.,* 1989). These factors and constraints collectively defined a person's actual control over the behavior. Theory of Planned Behavior (TPB) defined this construct as 'Perceived Behavioral Control' and conceptualized it as the perceived ease or difficulty of performing a certain behavior (Ajzen, 1991). Thus, perceived behavioral control might affect behavioral intentions to use a certain technology such as high speed mobile data services.

Thompson *et al.* (1991) defined the Model of PC Utilization (MPCU), which was useful for predicting individual acceptance of technology across a range of information technologies. The core constructs defined in this model were Job-fit, Complexity, Long-term Consequences, Social Factors, Affect towards Use and Facilitating Conditions. Some constructs in this model were similar to core constructs defined in some of the other models of technology adoption. For example, job-fit mapped well with the perceived usefulness and complexity mapped well with perceived ease-of-use construct of the TAM. Similarly, Social Factors were included in Subjective Norms construct and Facilitating Conditions could be mapped largely with the Perceived Behavioral Control construct defined in the TPB.

Rogers (1995) studied a variety of innovations across the industries to come up with Innovation Diffusion Theory (IDT), which had its roots in sociology. The IDT conceptualization was further refined to study individual acceptance. The constructs defined were Relative Advantage, Ease of use, Image, Visibility, Results Demonstrability, Voluntariness of use, and Compatibility. Relative Advantage was defined as "the degree to which an innovation was perceived as being better than its precursor" (Moore & Benbasat, 1991). Similarly, Image defined the status in social system which was largely an adaptation of Subjective Norm construct of TRA. Visibility measured the extent of the system in question being visible to others while Compatibility defined the degree to which an innovation was perceived as being consistent with the existing values and past experiences of its potential users (Moore & Benbasat, 1991). Results Demonstrability was linked to tangibility of results of usage, including observability and communicability. Voluntariness of Use measured the degree to which the use of innovation was perceived as voluntary and not forced in any way.

Consumers generally considered the possible purchase outcomes and unfavorable results associated with making a wrong decision quantitatively. However, there existed an uncertainty in the specific outcome; the quantitative value of the same has been defined as perceived risk. For example, in business-to-consumer business, E-commerce success was determined to an extent by whether consumers trusted the sellers and the products they are buying (Lee & Turban, 2001). This was because the consumer could not touch or see the product and they had no prior experience either.

Theory of risk taking in consumer behavior had been developed using some key concepts and their interrelationships. Taylor (1974) defined two types of risks involved in any decision process. One of them pertained to uncertainty in the outcome of a decision and the other pertained to uncertainty in the consequences of making a mistake or importance of the possible loss.

Perceived Risk was studied as a moderating factor in technology adoption models (Featherman & Fuller, 2002), where a significant moderating role of perceived risk was found in the relationships between perceived ease-of-use, perceived usefulness and intention to use constructs. Similarly, the impact of varying level of usage-risk on technology adoption and usage had been studied, which confirmed the moderating role of perceived risk-in-use in new technology adoption by an individual (Lam *et al.,* 2008). This concept could be generalized into a perception of risk while adopting any new technology by an individual and was a determinant in the adoption decision.

In a comprehensive model of new product adoption, all the constructs and factors discussed in various technology adoption models were expected to be present and were likely to be significant in explaining the behavioral intention and actual adoption by an individual. However, there were certain overlaps in constructs, which were defined quite similarly in various models. Thus there was a scope to rationalize the variables and yet come out with a comprehensive model.

3. DERIVATION OF CORE CONSTRUCTS AND HYPOTHESES

There were many constructs which were uncovered in the literature review, which could influence the new product adoption. There were considerable overlaps in many cases. Thus, each of the constructs derived from the literature review, needed to be further evaluated to determine if they were significantly distinct from each other so as to be specifically included in adoption model for the current study. The idea was to arrive at a model which was comprehensive and yet parsimonious. The core constructs used across the models were reviewed and consolidated along with their relationship with each other to arrive at the overall model and hypotheses for the current study.

3.1. Constructs included in research problem

3.1.1. Perceived usefulness
Usefulness of a technology as perceived by the consumer was one of the key variable which influenced the adoption decision. Thus, measure of usefulness had been included in most of the technology adoption models studied. In TAM, it was called perceived usefulness (Davis, 1989). In

MPCU, job-fit construct has been found to be quite similar to usefulness (Thompson *et al.,* 1991). Similarly, in the innovation diffusion theory (Rogers, 1995), the similarity between usefulness and relative advantage has been acknowledged in literature (Davis *et al.,* 1989; Moore & Benbasat, 1991; Plouffe *et al.,* 2001). Therefore, a single construct 'Perceived Usefulness' was used to cover the generic concept of usefulness, to study its impact on individual's attitude towards use of high speed mobile data services.

H1.   Perceived usefulness has a positive impact on an individual's attitude towards high speed data services on mobile.

3.1.2. Perceived ease-of-use

Similar to perceived usefulness, the ease-of-use (as perceived by consumer) was included in most common technology adoption models with slight variations in its definition. While, TAM/TAM2 talked about perceived ease-of-use, MPCU defined it as complexity, and IDT defined as ease-of-use. The similarities between these constructs had also been noted in prior researches (Davis *et al.,* 1989; Moore & Benbasat, 1991; Plouffe *et al.,* 2001; Thompson *et al.,* 1991). Due to its wide acceptance across models, the construct 'Perceived Ease-of-Use' was included in the current research to study its impact on the individual's attitude towards use of high speed mobile data services. The following hypotheses could be framed based on the literature:

H2.   Perceived ease-of-use has a positive impact on an individual's attitude towards high speed data services on mobile.

Further, Davis (1989) suggested that, from a causal perspective, ease of use may be an antecedent to usefulness. This also made sense conceptually, since an easier to use system required lesser effort to operate as compared to a difficult to use system, thereby increasing the perception of usefulness. A positive impact of perceived ease of use of a system on the perceived usefulness could be expected. Therefore, the relationship between these two constructs was also added into the model.

H3.   Perceived ease of use has a positive impact on an individual's perception of usefulness of high speed data services on mobile.

3.1.3. Subjective norm / social influence

Just like any other behavior, consumer behavior also could be influenced by the norms of the social group (Ackerman & Tellis, 2001). The subjective norm had been classified into two; social influence and societal norm. Social influence reflected the degree of influence the opinions from family and peers (essentially a small circle of influence) had on a person by. Societal norm reflected the degree of influence of the larger societal fashion, and had large circle of social influence (Pavlou & Chai, 2002). Subjective norms were influenced through social pressure of whether the behavior was accepted, encouraged, and promoted by the circle of influence (Ajzen, 1991). The significant impact of peer pressure on the subjective norm was found (Kim *et al.,* 2010). The influence of whether others approved or disapproved of a particular behavior generated different behavioral intentions.

Thus, many research works supported the effect of social influence or subjective norm on behavioral intentions in the adoption of technology. Presence of strong social influence was found, irrespective of age and degree of exposure to a system. Individuals' intention to perform a certain action had thus been proven to be a function of their perception of what important others thought that they ought to do (Chiasson & Lovato, 2001; Morris & Venkatesh, 2000; Karahanna *et al.,* 1999).

Collectivism and Power Distance, as defined by Hofstede (1980), played a significant role in Indian cultural values (Singh *et al.,* 2006). It was natural that there was significant impact of social influence on most decision making processes, including adopting and using new technologies like high speed mobile data services. The various labels used for this construct in different models were subjective norm in TRA, social factors in MPCU, and image in IDT. Even though the names used were different, the inherent notion of individual's behavior being influenced by, how they perceived

that others would view them, remained same either explicitly or implicitly. The impact of social influence on attitude towards a product/service had been studied and found to be significant (Lopez-Nicolas *et al.,* 2008). Similarly, the impact of social influence on behavioral intention was studied and confirmed (Lu *et al.*, 2005). Therefore, social influence was taken as a core construct to study its impact on individual's attitude and behavioral intention to adopt high speed mobile data services.

Further, social influence was found to impact an individual's perception of usefulness and ease of use (Lu *et al.,* 2005), which could also be the case in mobile data services. The impact of social influence on perceived usefulness and ease of use were further confirmed (Lopez-Nicolas *et al.,* 2008). It was reasonable to argue that, if people in social circle believed that a particular technology was useful and made them more productive, the individuals in that social circle also got influenced by other's opinion and perceived the technology as useful. Same could hold true for ease of use but to a lesser extent since ease of using a technology could vary significantly from person to person and was personal experience driven. Therefore, the impact of social influence on an individual's perceived usefulness was studied in current research.

H4.   Social influences have a positive impact on an individual's attitude towards high speed data services on mobile.
H5.   Social influences have a positive impact on an individual's perception of usefulness of high speed data services on mobile.
H6.   Social influences have a positive impact on an individual's behavioral intention to use high speed data services on mobile.

3.1.4. Perceived risk
Developed markets and Emerging Markets (EM's) exhibit different characteristics. EM's tend to be complex and diverse as compared to developed markets (Bloom & Quelch, 1996). Some differentiating characteristics common across emerging markets were the lack of marketing infrastructure in terms of reliable market data, distribution systems, communication channels and effective institutional regulatory framework (Arnold & Quelch, 1998). In such a context, risk assumed very important and possibly direct role in attitude formation towards adopting new product or service.

Within the Indian context, the risk avoidance was found as a significant factor for adoption of new technologies like internet banking (Kesharwani & Bisht, 2011) and has been studied as a main construct instead of a moderating variable. Therefore, it could be argued that including perceived risk as a core construct in an existing technology adoption model could improve the overall explanatory strength of the model within the Indian context. Thus, perceived risk was added as a core construct to study its impact on the individual's attitude towards use of high speed mobile data services.

H7.   Perceived risk has a negative impact on an individual's attitude towards high speed data services on mobile.

3.1.5. Attitude towards use
This construct worked at a psychological level and formed the foundation for formation of behavioral intention of an individual not just for technology adoption but across diverse set of decision making process. It was therefore considered as a core construct to first verify the impact of previous constructs on itself, and further to verify its own impact on the individual's behavioral intention to use high speed mobile data services.

H8.   Attitude towards high speed data services on mobile has a positive impact on an individual's behavioral intention to use such services.

3.1.6. Price

The circumstance in which an individual operated varied significantly and there were numerous and diverse external sub-factors, which together impacted overall perceived behavioral control for an individual. Similar was the case for voluntariness of use construct of MPCU, where the degree of free will was used as a factor for adoption. However, price was important exogenous variable which could impact behavioral intention to buy from an affordability standpoint. If the consumers thought that the mobile data services were priced high, the adoption would slow down. India has traditionally been a price sensitive market (Bhate, 2001) and therefore, impact of price on the behavioral intention to buy was expected and hence, price was included as a core construct.

H9.   Prices have a negative impact on an individual's behavioral intention to use high speed data services on mobile.

3.1.7. Behavioral intention

This construct was the dependent variable in the current research and is therefore, included as the core construct. It was expected to get driven primarily from Attitude towards use, as well as from social influence and price constructs. Therefore, this construct was included in the current study for verifying the various hypotheses and the research model.

3.2. Constructs not included in research problem

3.2.1. Perceived behavioral control

As per the literature review, the factors impacting the perceived behavioral control for an individual varied significantly and could be diverse in nature. Similarly, voluntariness of use construct of MPCU, where the degree of free will was used as a factor for adoption, was similar in its inherent meaning with perceived behavioral control. Moreover, there was an element of individual perception (comprising of internal factor) about how easily one could adapt to a particular technology use. This element could be captured in the perceived ease-of-use construct. Therefore, it was possible that the construct of Perceived Behavioral Control was likely to get covered by the Perceived Ease of Use. To avoid redundancy in the research and to keep the research model parsimonious, the sub-factors within the ambit of perceived behavioral control were not taken up separately as part of the current research problem.

3.2.2. Facilitating conditions

Facilitating condition had been conceptualized as environmental factors that could make an observer agree about ease of accomplishing a task (Thompson et al., 1991). This could be in terms of support provided for the service being used or the ease of handling required customization. Such factors can be operationalized in the perceived ease-of-use construct since most of these factors would already be playing a role in an individual's mind regarding the facilitating conditions existing in the services being provided already by mobile operators. Taylor and Todd (1995) acknowledged the theoretical overlap by modeling facilitating conditions as a core component of perceived behavioral control in TPB. Therefore, this construct was not included separately in the model worked out for current research.

3.2.3. Image

Moore and Benbasat (1991) defined the construct as "the degree to which use of an innovation is perceived to enhance one's image or status in one's social system". This was an important element especially in a high power distance society (Singh et al., 2006) that was prevalent in India. However, this aspect could be adequately covered in the social influence construct and is therefore, was not considered separately in the current model.

3.2.4. Long term consequences

Long term consequences had been defined as "outcomes that have a pay-off in the future" (Thompson et al., 1991) in the MPCU. This could be a useful construct for study in areas where completely new technology was being launched and there were no historical evidence available to

assess the long term effects of the technology usage. In specific case of mobile related technologies, this was not considered to be a significant factor since similar technologies were already prevailing in the Indian market and consumer was expected to be quite aware of the long-term consequences of using such technologies.

3.2.5. Affect towards use
Affect towards use had been defined as "feelings of joy, elation, or pleasure, or depression, disgust, displeasure, or hate associated by an individual with a particular act" (Thompson *et al.,* 1991) in MPCU. This overall emotional response to the technology use could be captured by the 'attitude towards using technology' construct in an effective way. Therefore, this was not specified as a separate construct in the current model.

3.2.6. Visibility
The extent to which one could see someone else using the system (Moore & Benbasat, 1991) had been defined as visibility construct as part of the MPCU model. It was expected that when an individual watched someone else using the system, he got more confident of being able to use the system himself. It would eventually improve the perceived ease-of-use in that individual's mind. Since latter was already included in the model, there was no need to further consider visibility as a separate construct for the current research.

3.2.7. Compatibility
The construct was defined by Moore and Benbasat (1991) as "the degree to which an innovation was perceived as being consistent with the existing values, needs, and past experiences of potential adopters". This construct would be more applicable to systems where a perception of incompatibility could exist with the existing systems or technologies being used or where a radical new technology was being deployed, as the case had been for PCs. For high speed mobile data services, this was not essentially true since mobile data services were already prevalent in the Indian environment and consumers were already quite familiar with the degree of compatibility it provided. Therefore, this construct was not considered necessary for the current model.

4. RESEARCH PROBLEM

The following sets of hypotheses were formulated related to the adoption of high speed mobile data services in the Indian context:

H1.   Perceived usefulness has a positive impact on an individual's attitude towards high speed data services on mobile.
H2.   Perceived ease-of-use has a positive impact on an individual's attitude towards high speed data services on mobile.
H3.   Perceived ease of use has a positive impact on an individual's perception of usefulness of high speed data services on mobile.
H4.   Social influences have a positive impact on an individual's attitude towards high speed data services on mobile.
H5.   Social influences have a positive impact on an individual's perception of usefulness of high speed data services on mobile.
H6.   Social influences have a positive impact on an individual's behavioral intention to use high speed data services on mobile.
H7.   Perceived risk has a negative impact on an individual's attitude towards high speed data services on mobile.
H8.   Attitude towards high speed data services on mobile has a positive impact on an individual's behavioral intention to use such services.
H9.   Lower prices have a positive impact on an individual's behavioral intention to use high speed data services on mobile.

The conceptual model was derived by consolidating the hypotheses in a pictorial form, given in Figure 1.

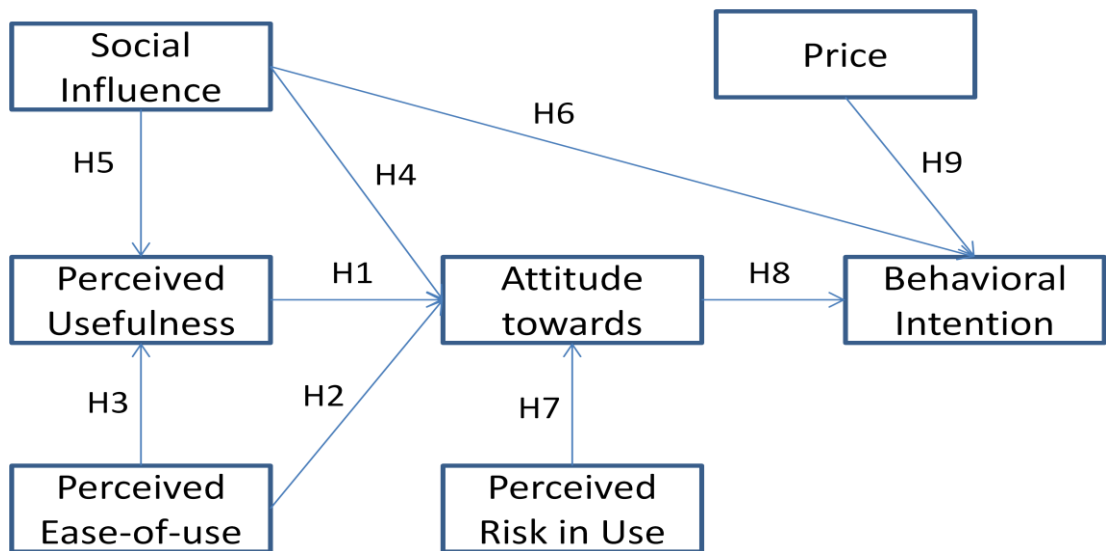A Comprehensive Framework for Adoption of Mobile Broadband Services in Indian Cities

Figure 1: Research Model for adoption of high speed mobile data services

5. RESEARCH METHODOLOGY

The research was about consumers' adoption of the broadband mobile data services. Hence the respondents were essentially the target market of such services. A large number of consumers were thus the population, from which the sample had to be collected. Thus the method selected was survey based, which provided the possibility of statistical data analysis and inferences.

Since the objective of the research was to conduct a hypothesis testing and model fit exercise, there was an option to use regression as well as structural equation modeling. Since the use of structural equation modeling allowed the possibility of using interrelated variables, which was expected from the literature review, structural equation modeling was preferred. Also, the model to be tested had latent constructs for which structural equation modeling was an appropriate tool. AMOS 4 software package was used for the data analysis.

5.1. Sampling plan
Convenience sampling was adopted. The respondents included individuals who were already using some kind of mobile data services or at least were aware of the existence and availability of mobile data services in India. This was the primary target population for the adoption of the LTE mobile data services in India since they were using the lower speed versions and some who were not current users but had the potential to use. Thus the respondents were primarily urban, middle/upper-middle class, and well educated. Since structural equation modeling software was to be used for analysis, and the model had seven constructs measured with the help of 28 observed variables, a sample size of around 280 responses were set as the target for the survey.

5.2. Instrument
A survey questionnaire was prepared, by adapting the scales already available in literature. Refer to exhibit 1 for the details of the constructs and their literature references. Each of the constructs was

measured using four items, each of them measured on a 5-point likert scale. In addition to that, three questions related to demographics (age group, current usage of mobile data services and income group) were included to check if the sample represented the population. The survey was planned to be conducted online on Google drive (http://www.drive.google.com) and offline by way of responses on printed A4 size sheets.

Exhibit 1: Reference of scale items and their adaptation

Construct (Measurement)	Reference Item	Adapted scale Item
Perceived Usefulness: #489 Usefulness of Technology to Assist Shopping (Bruner *et al.,* 2005)	Technology assisted shopping would improve my shopping productivity.	Access to high speed data service on mobile would improve my overall productivity
	Technology assisted shopping would enhance my effectiveness in shopping.	Access to high speed data service on mobile would help me save time
	Technology assisted shopping would improve my shopping ability.	High speed internet access on my mobile would help me get right information as and when I need it
	NA	Access to high speed data service on my mobile would help me lead a better life
Perceived Ease-of-Use: #158 Ease of Use - Technology Assisted Shopping (Bruner *et al.,* 2005)	Technology assisted shopping would be clear and understandable.	It would be easy for me to adopt high speed data service on my mobile
	Technology assisted shopping would not require a lot of mental effort.	Using high speed data service on mobile would require no additional mental effort
	Technology assisted shopping would be easy to use.	It would be easy for me to use applications using high speed data service on my mobile
	NA	I would be comfortable using different applications and services that require high speed internet access on mobile
Social Influence: Consumer Susceptibility to Interpersonal Influence (Bearden *et al.,* 1989)	I often consult other people to help choose the best alternative available from a product class.	I often consult people to help choose the best product available in the market
	It is important that others like the products and brands I buy.	It is important that others like the brands, products and services that I use
	To make sure I buy the right product or brand, I often observe what others are buying and using.	To make sure I buy the right product or brand, I often observe what others are buying and using
	I often identify with other people by purchasing the same products and brands they purchase.	I often identify with other people by purchasing the same products and brands they purchase
Perceived Risk in Use: #384 Risk – General (Bruner *et al.,* 2005)	Getting a _____ is risky.	Using Internet on mobile phone is risky
	____ can lead to bad results.	Financial transactions on mobile phone using data service can lead to losses

	___ have uncertain outcomes.	Frequent use of high speed data services on mobile phone can have unknown problems
	Getting a ____ would cause me to worry.	One has to be very cautious of security related problems when using data service on mobile
Price: #314 Price – Product (Bruner et al., 2005)	The price of ___ is high.	Subscription to high speed data service on mobile is inexpensive
	The price of ___ is low. (r.)	Subscription cost of high speed data service on mobile is low
	___ is expensive.	Subscription to high speed data service on mobile is expensive
	NA	The price of high speed data service on mobile is justified by the benefits it provides
Attitude towards product/service: #58 Attitude Toward the Product - High Tech (Bruner et al., 2005)	like / dislike	I like high speed mobile data services
	useful / not useful	High speed data service on mobile is useful
	practical / impractical	High speed data service on mobile is practical
	dependable / not dependable	High speed data service on mobile is dependable
Behavioral Intention: #92 Behavioral Intention (Bruner et al., 2005)	unlikely / likely	I am likely to subscribe high speed data service on mobile
	improbable / probable	It is probable that I will subscribe to high speed data service on mobile
	definitely would not use / definitely would use	I would definitely recommend use of high speed data service on mobile
	not at all / very frequent	Use of high speed data service on my mobile would be very frequent

5.3. Pilot test

A pilot test was first conducted with 60 respondents. Around 40% of the potential respondents were contacted though online channel while the remaining respondents were contacted though offline channel using printed questionnaire for capturing their responses. Using the initial 60 responses, the reliability of the scale items was verified by calculating the Cronbach's alpha in SPSS 18. Since most of the figures were near the threshold of 0.70, and the figures were expected to improve with increase in the sample size, the complete responses were collected without making any modification to the data collection instrument.

5.4. Data collection

After testing of reliability scores of the constructs were found acceptable in pilot test, additional data was collected from 251 additional participants to reach a total of 311 responses for complete analysis of the data. Out of the 311 respondents, 35 responses were found to be containing incomplete data and were, thus, removed. Thus, 276 responses were used for final analysis.

The data had 148 respondents in the age group of 20 years less than 30 years, 115 of 30 years less than 40 years and 23 of above 40 years. There were 68 respondents with annual household income less than 0.9 million rupees, 104 from 0.9 million to less than 1.8 million, 63 from 1.8 million to less

than 2.7 million and 41 above 2.7 million rupees. Thus the sample was quite representative of the metropolitan consumers in India, the prime target market for high speed mobile data services.

6. RESULTS AND CONCLUSIONS

The collected data was analyzed in two steps. In the first step, reliability of each construct was calculated using SPSS18 to confirm if they were in acceptable range for conducting further analysis. Subsequently, a two phase structural equation modeling analysis using AMOS 4 software was conducted to test the hypotheses and the model fit.

6.1. Validity and reliability of the scale

All the constructs had four measurement items. Each of the measurement items were derived from validated scales given in literature, and hence the construct validity was based on literature. However, since the reference scales had been adapted for the current research, the reliability analysis was conducted to confirm the reliability of the constructs. The Cronbach's alpha score of each measurement was calculated to confirm the reliability. Some of the scale items had to be deleted to get the scale reliability to a score of above 0.7. The Chronbach's alpha scores for the constructs have been reported in Table1 given below.

Table 1: Chronbach's alpha scores of the constructs

Construct	Reliability (Cronbach's alpha)
Perceived Usefulness	0.838
Perceived Ease-of-Use	0.765
Social Influence	0.701
Perceived Risk in Use	0.700
Price	0.719
Attitude towards use of service	0.746
Behavioral Intention	0.852

6.2. Confirmatory factor analysis

Confirmatory factor analysis of the measurement model was conducted using the AMOS4 software. According to Hair *et al.*(2007) one incremental fit index (CFI) , one goodness of fit index (GFI) , one absolute fit index (AGFI) and one bad-ness of fit index (RMR), with chi-square statistic should be used to assess a model's goodness of fit. Results of all the different types of indices were in the acceptable range, given in Table 2.

Table 2: Model fit indices for measurement model

Statistic	Recommended value	Obtained value
χ^2		411.438
Df		254
χ^2/df	< 3.00	1.620
GFI	> 0.90	0.900
AGFI	> 0.80	0.872
RMR	< 0.08	0.042
CFI	> 0.80	0.951

6.3. Result of hypotheses testing

The regression results of the AMOS 4 output of the structural model were studied and the hypotheses H3, H4 and H5 were not supported by the data (p-value being more than the threshold of .05 or below 95% confidence interval). The tabulated results are given in Table 3.

Table 3: Result of Hypotheses testing

Hypotheses	p-value	Conclusion
H1. Perceived usefulness has a positive impact on an individual's attitude towards high speed data services on mobile.	0.000	H1 supported by the empirical data
H2. Perceived ease-of-use has a positive impact on an individual's attitude towards high speed data services on mobile.	0.029	H2 supported by the empirical data
H3. Perceived ease of use has a positive impact on an individual's perception of usefulness of high speed data services on mobile.	.000	H3 is supported by the empirical data
H4. Social influences have a positive impact on an individual's attitude towards high speed data services on mobile.	0.817	H4 not supported by the empirical data
H5. Social influences have a positive impact on an individual's perception of usefulness of high speed data services on mobile.	0.023	H5 is supported by the empirical data
H6. Social influences have a positive impact on an individual's behavioral intention to use high speed data services on mobile.	0.105	H6 not supported by the empirical data
H7. Perceived risk has a negative impact on an individual's attitude towards high speed data services on mobile.	0.064	H7 not supported by the empirical data
H8. Attitude towards high speed data services on mobile has a positive impact on an individual's behavioral intention to use such services.	0.000	H8 supported by the empirical data
H9. Lower prices have a positive impact on an individual's behavioral intention to use high speed data services on mobile.	0.007	H9 supported by the empirical data

6.4. Fit measures of structural model

Fit measures of data with the structural model were conducted using the AMOS4 software. Results showed that the fit indices were in the acceptable range, given in Table 4.

Table 4: Model fit indices for Structural Model

Statistic	Recommended value	Obtained value
χ^2		406.431
Df		261
χ^2/df	< 3.00	1.557
GFI	> 0.90	0.902
AGFI	> 0.80	0.878
RMR	< 0.08	0.051
CFI	> 0.80	0.955

However, the results also indicated that social influence was not found to have significant impact on the behavioral intention or the attitude but found significant impact on perceived usefulness. Hence, we removed social influence from the model and arrived at the modified alternate model, given in figure 2.
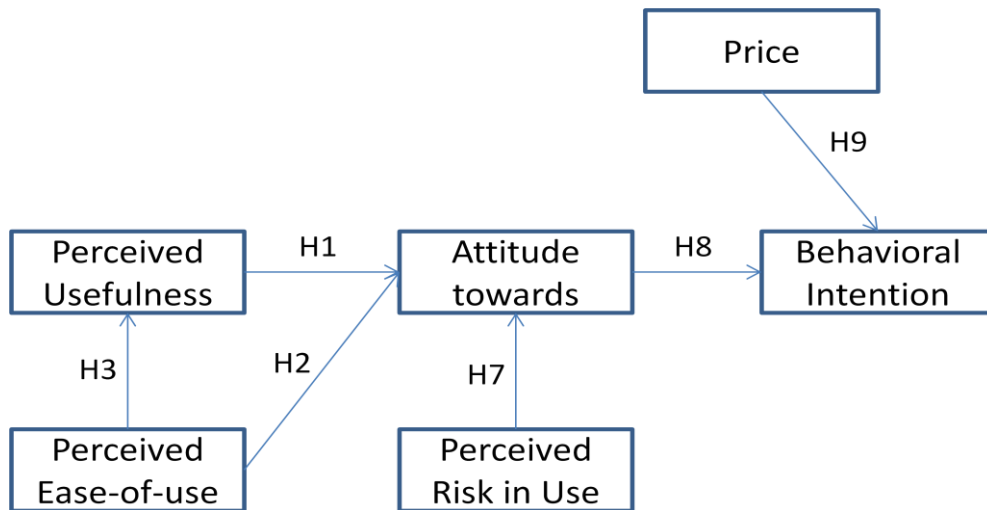
Figure 2: Modified Alternate Model for adoption of high speed mobile data services

Fit measures of data with the revised model showed that the fit indices were in the acceptable range, given in Table 5.

Table 5: Model fit indices for Revised Model

Statistic	Recommended value	Obtained value
χ^2		318.965
Df		181
χ^2/df	< 3.00	1.762
GFI	> 0.90	0.907
AGFI	> 0.80	0.882
RMR	< 0.08	0.051
CFI	> 0.80	0.955

However, comparison of the fit figures of the proposed model with the fit measures of the modified alternate model (given in table 3 and 4 respectively) revealed that the revised model did not improve the fit measures significantly. Thus, it was not possible to conclude that this modified alternate model was a significantly better fit with the data as compared to the structural model derived from the literature. Hence, it was considered prudent to accept the more detailed structural model proposed on the basis of literature as a comprehensive model. The modified alternate model was thus rejected.

7. DISCUSSION

The model developed and tested in our research used TAM as the base and superimposed additional constructs to arrive at a more comprehensive model for Indian context. The impact of price, perceived risk in use and social influence had not been considered together in technology adoption models developed by previous researchers. This is one of the key contributions of this research.

The results showed that the impact of social influence on individual's perception of usefulness and the impact of price on individual's behavioral intention to adopt was significant, while the impact of perceived risk in use and social influence construct on the individual attitude was not significant.

Social Influence was found to have a significant impact on perceived usefulness confirming the earlier theories. The network theory (Lubloy, 2012) brought out the direct impact of an individual's social network on his/her choice of network operator and network services. There were confirmation

of impact of social influence on attitude and behavioral intention apart from perceived usefulness (Schepers & Wetzels, 2007). Also, the difference between the factors impacting adoption for early adopters versus the majority has been observed (Park & Yoon, 2005). Therefore, from a product life cycle point of view, the impact of social influence on adoption could be different for early adopters (which formed a large proportion of the samples for current research) as compared to the majority. As the fit measures with the model having social influence were good, it was considered prudent to retain the social influence construct in the final model as well.

Mick and Fournier (2008) suggested that within the various phases of innovation diffusion model, the consumer perception varied significantly in terms of coping with uncertainty related to adopting and using technology. Late majority and laggards are found to be significantly more cautious in adoption as compared to the innovators, early adopters and early majority. The respondents in the current study were mostly innovators and early adopters (a high percentage were already using mobile data services), therefore, a subdued impact of perceived risk was found in this sample. However, this did not reduce the importance perceived risk as an important factor for the overall population of potential adopters.

The impact of Price on behavioral intention to buy indicated another important aspect of the research outcome. The significance of price indicates that even for innovators and early adopters, the price of high speed mobile data services was an important factor and was expected to become even more important for the majority. Overall, perceived risk-in-use and price were the two additional variables that were found to be important in the Indian context. The extent of impact of these variables is expected to be different in the different stages of diffusion cycle.

8. RECOMMENDATION

The model developed and tested by us has significant marketing implications. The constructs like perceived usefulness and perceived ease-of-use were key determinants of the individual's attitude formation towards adoption of high speed data service on mobile. The perceived risk-in-use and social influence, while not found to be playing a significant role in explaining the individual's attitude towards mobile data service adoption, were expected to be important for adoption by majority population later in the diffusion curve.

Using this insight, telecom network operators as well as mobile application and content development companies could position their service/products as user friendly, easy to use (and manage). They could also invest on projecting distinct functional advantages that it offered over products/services of competition. Further, the campaigns could be targeted for the innovators and early adopters in the beginning of the new product introduction, for whom social influence may not be an important factor. However, the social influence that innovators and early adopters could exert on the early majority and late majority could be used effectively. The perceived risk-in-use of late adopters could also be addressed by effective communication strategies, though it may again not be important initially.

For explaining the behavioral intention to adopt service, Price was found to be significant apart from Attitude towards the service. It indicates that, at least for the Indian mobile data service market, an individual's negative attitude could be compensated for in his behavioral intention towards adoption of the high speed mobile data service using attractive pricing strategy.

9. LIMITATIONS OF THE STUDY

The sample primarily consisted of the professionals working in a major metropolitan market of India. There were a very high percentage of respondents who were already using mobile data services and, therefore, there was a higher likelihood for their positive attitude and behavioral intention towards use of high speed mobile data services. Also, there was no representation from the age group below 20 years; they would include the student population, which could emerge as an

important segment of mobile data service users in India. If the primary data were collected from more diverse set of respondents including samples with age less than 20 years, it was possible that a different set of factors may be found significant than the ones found in current research (Morris & Venkatesh, 2000).

Impact of perceived behavioral control, which was an important construct in the theory of planned behavior, was not included in the model which was tested. This could be done to gain deeper insights into the extent to which an individual's decision to adopt was dependent of the circumstance and environment in which they operated. Due to existence of these environmental conditions, the actual adoption could actually be different from what the current model. The limitation of current model was that it studied only the individual perceptions and the associated variables, whereas environmental factor has been left unexplored.

Social Influence construct covered the impact of an individual's small circle of influence, which was from the small group of people that an individual interacted with on a regular basis. The large circle of an individual's influence (called as the societal influence) was, however, left outside the scope of the current research problem. The societal influence or large circle of influence was also an important factor could increase the explanatory power of the research model thus developed.

10. SCOPE FOR FUTURE WORK

In future, the following areas could be explored:
The sample selection could be extended to a wider set of respondents demographically and thereby increase the relevance of the results obtained. A possible way forward could be to have a stratified random sampling to gain insights on different segments of consumers.

Instead of perceived risk in use, the perceived behavioral control construct could be used in the future model to ascertain the impact of the external or environmental conditions for an individual's adoption decision. Similarly, impact of societal influence on the attitude as well as behavioral intention could be studied further.

Group adoption could be quite important for mobile broadband services marketers as there are large numbers of institutional buyers in India. They could be studied for gaining insights into the business segment or organizational adoption scenario. However, the factors concerning group adoption could be different, necessitating development of a different model.

The current research had only covered the aspects important for individual adoption while the important variables for group adoption (by corporate, public enterprises or government organizations) have been left unstudied. For a more comprehensive view of how the overall adoption would take place, the group adoption factors needed to be incorporated.

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