

ADOPTION OF 4G MOBILE SERVICES IN INDIA: AN EXPLANATION THROUGH DECOMPOSED THEORY OF PLANNED BEHAVIOUR

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Abstract — *The main aim of this paper is to explain the adoption intention of 4G mobile services through the decomposed theory of planned behaviour. The collection of data comprises of 233 mobile phone users in India through a self-administered questionnaire. The data was analysed using AMOS software and the findings indicated that Attitude, Subjective Norms and Perceived Behavioural Control have a significant impact on consumer's decision to adopt 4G mobile services. The findings indicate that Attitude was found to be an important variable influencing 4G mobile usage. Subjective norms and Perceived Behavioural Control also positively influence behavioural intention. This study represents a careful and systematic effort to examine DTPB on 4G mobile services usage. The model was examined in the workplace and personal settings where usage is more likely to be mandatory. As many telecom operators are starting to embrace 4G technology, this study helps the mobile service providers to formulate appropriate business strategies to increase and retain their customer base.*

Key words—4G mobile services, technology adoption, decomposed theory of planned behaviour

I. INTRODUCTION

Mobile services are becoming increasingly important for firms and consumers because of its ubiquitous, universal and unison access to information and services, and the possibility for unique and personalized exchange of information [1]. Due to the convergence of internet, media, information technology and advancement in telecommunications, the future of mobile communications rely on mobile services. Mobile services are referred as digital services which are added to mobile phone networks or integrated to the mobile devices other than traditional voice services with highly diversified benefits [2]. According to a survey, there are 4.77 billion mobile users in the worlds and is expected to grow to 5.07 billion by 2019 [3].

Mobile telephony was discovered in AT & T Bell's Lab in 1970's. The First generation - 1G was launched in 1980's with advanced mobile service cellular networks. The Second generation - 2G was widespread for two decades from 1990's with voice calling and text messaging services. The Third Generation - 3G enabled with speedy data transmission, larger network capacity, advanced services such as video call, multimedia services, mobile internet, mobile TV, etc. signifies with the rate of information transfer which is faster compared to 2G technology [4,5]. By 2005, almost 40 percent of mobile phone users around the world used the 3G network, making 2G technology obsolete. The marketers play a vital role in identifying the services, designing them to suit the customer needs and pricing them appropriately [4]. 3G data cards help users to browse the Internet via laptop or a mobile device. However, users do not use the internet similarly from mobile terminals or computers. The Fourth Generation - 4G mobile technology is progressing steadily with 30 times faster data transfer and internet access compared to 3G.

4G mobile technology provides a wider horizon of its mobile users a "virtual presence" i.e. always-on connections to keep people connected through Video Conferencing and Virtual navigation which is a remote database containing the graphical representation of streets, buildings, roads and physical characteristics of a large metropolis around the world. The mobile telecommunication industry expects the mobile services to render a massive source of revenue growth. 4G services are iconised by wider bandwidth services such as communication, browsing the web and location-specific information using GPS, online shopping, etc. The success of 4G lies in its ability to serve both mobile users and others who wish to have internet access with data cards plugged in their laptops. Another interesting factor that draws the attention of 4G mobile users is faster data connection speed and the availability of reasonably priced yet trendy handsets. It is currently estimated that the telecom subscriber base was 1198 million in India [6]. ASSOCHAM-KPMG report states that high speed 4G connections would account for 17 per cent of the total user base by 2020 [7]. As a part of financial inclusion, 4G can support Indian government to facilitate its social sector schemes in a faster and more secured manner. In lieu with the migration from 3G to 4G, this research on the adoption intention of 4G mobile services is considerably significant. The main objective of this research lies in conceptualizing and empirically validating the Decomposed Theory of Planned Behaviour (DTPB) in the context of intention to adopt 4G mobile services by Indian consumers.

II. LITERATURE REVIEW

Most of the theories and models available in the technology adoption literature are tested in different contexts. Many of the empirically researched models are adopted from Social Psychology and Sociology, while a few apply technology adoption theories. Each theory attempts to explain adoption behavior and intention to usage as the key dependent variables since behavioural intentions are inducing factors that hold how people try to perform a behavior.

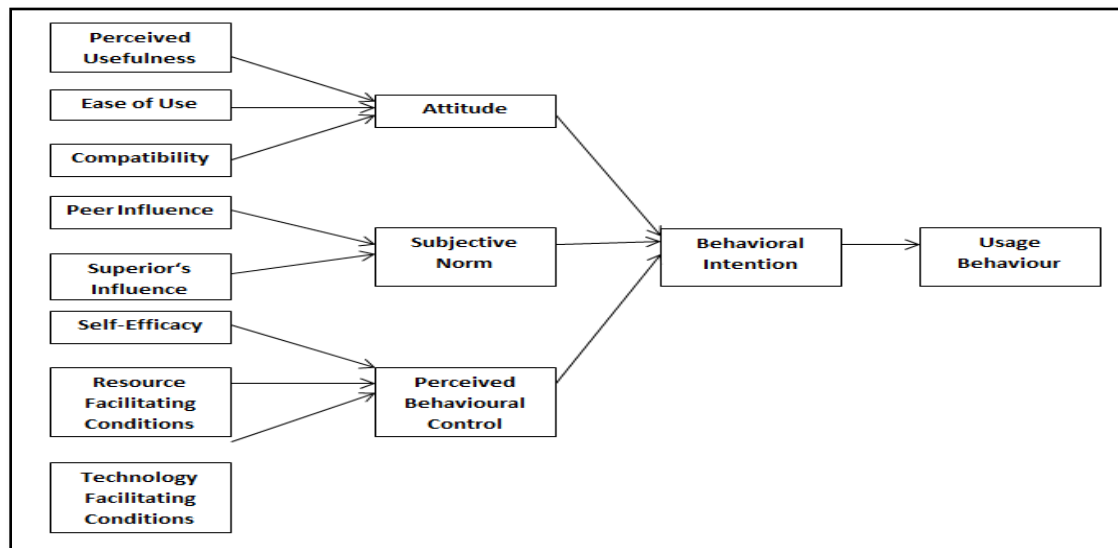
The Theory of Reasoned Action (TRA) demonstrated by Fishbein and Ajzen (1975) is a general theory which explains the behavior beyond technology adoption extensively [8]. This model proposes that individual's actual behavior is influenced by the person's intention to perform the behavior and this intention is influenced by the individual's attitude and subjective norm. The Theory of Planned Behavior (TPB), introduced by Ajzen (1985) encompasses the TRA and extends it. It denotes an individual's intention to involve in behaviour at a specific time and place [9]. TPB is different from TRA as it includes a new construct Perceived Behavioural Control (PBC) which accounts for conditions where the individuals have no control over their behaviour. The Technology Acceptance Model (TAM) was introduced by

Davis (1986) with constructs and relationships adapted from TRA and TPB [10]. This theory has been considered the most effective and useful in predicting the usage of technology.

To examine the factors affecting the adoption process of mobile services, DTPB has been most widely cited in the literature. DTPB was developed by Taylor and Todd (1995) based on the traditional TPB combined with TRA and TAM. DTPB aimed at decomposing the structure of Attitude, Subjective Norm and Perceived Behavioural Control. According to DTPB, the Behaviour is determined by *Intention to Use*, which is determined by the Attitude toward behaviour, Subjective Norm and Perceived Behavioural Control [11,12,13]. DTPB decomposes attitudinal, normative and a control belief into multi-dimensional belief constructs [14].

DTPB has been used in the adoption study of Mobile coupons [15], Online shopping [16], Mobile internet [17], Mobile data services [18], Electronic service continuance [19], Mobile banking [20,21], Internet banking [22,23,24,25], Web 2.0 technologies [26], E-textbook adoption [27], Online Tourism booking [28], IT acceptance [29], etc.

RESEARCH MODEL



Source: Taylor, S. and Todd, P.A. (1995b)

Fig. 1: Decomposed Theory of Planned Behaviour

Figure 1 represents the model of DTPB framework. The comparison of TPB and Decomposed TPB by Taylor and Todd revealed that there is an added value as a result of the decomposition, in terms of increased explanatory power and a better, more precise, understanding of the antecedents of behaviour. DTPB is more relevant to determine the specific factors that lead to adoption and use of technology [30]. DTPB offers a comprehensive approach to understand the factors that affect an individual's decision to use technology information while TPB simply explains the relationship between the structure of beliefs and intention [31]. The current research aims to understand the explanation of the Decomposed TPB model in explaining the adoption behaviour of 4G mobile usage in India.

III. RESEARCH METHODOLOGY

Sample Description

This study was conducted among the intending 4G users in India using questionnaires and interviews. 233 usable responses collected through convenience sampling were analysed using SPSS and AMOS v.20.0. Among the respondents, 47% were male and 53% were female. The demographic information such as age group, professional level and monthly income, duration of 4G mobile usage, average usage per day and the purpose of using 4G mobile services were collected. Those in the age group of 26-35 years old comprised the largest group, with 99 respondents, accounting for 42.5 per cent.

In terms of professional distribution, there were more private sector employees, with a total of 146 respondents, accounting for 62.7 per cent. The educational background of the respondents was mostly Graduates, a total of 151 respondents, accounting for 64.8 per cent. The monthly income of the respondents falls as 32.6 % earn between Rs.40001 – 50000 followed by 31.3% of those who earn between Rs.30001 – 40000. The purpose of using 4G mobile services by the respondents are enlisted as downloading apps, Social networking, Watching online videos, Mobile banking, Mobile gaming, Share location, Taking pictures, Playing music, Navigating highways, Group Call/ Chat, Sharing official reports/ documents and so on. Table 1 shows the 4G usage pattern of mobile services by the respondents.

Table 1 Usage pattern of the respondents

Description	Option	% of respondents
Duration of 4G mobile usage	Less than 6 months	7.3
	6 months to 1 year	17.6
	1 - 2 years	53.2
	More than 2 years	21.9
4G mobile usage per day other than voice services	Less than 30 minutes	8.2
	30 minutes to 1 hour	11.6
	1 – 2 hours	21.0
	2 – 3 hours	28.8
	More than 3 hours	30.5

Instrument Design

The items used in this survey were adapted from previous studies [32, 33, 34, 35, 36, 37, 38, 9, 13, 39]. The instruments were initially examined to establish the reliability of scales. This study measures 12 constructs including Perceived Usefulness(PU), Perceived Ease of Use(PEU), Compatibility(COM), Peer influence(PI), Superior influence(SI), Efficacy(EFF), Facilitating Conditions-Technology(FCT), Facilitating Conditions-Resource(FCR), Attitude(ATT), Subjective Norms(SN), Perceived Behavioural Control(PBC) and Behavioural Intention(BI) with 53 items. Since this study used borrowed scale for each of the constructs, it is important to first establish the validity and reliability of the scale.

IV. DATA ANALYSIS AND RESULTS

Reliability and Validity

Cronbach’s alpha was calculated in order to measure the reliability of these constructs which ranged from 0.715 to 0.925 that exceed the recommended value of 0.70 [40]. These values show good reliability and internal consistency among scales employed for the present study. To establish the face validity, a group of 10 experts was identified who were exposed to the objectives of the research, overall scope, definition of each construct and items under each construct.

After incorporating the feedback/suggestions of experts, the final instrument had a brief summary on the purpose of the study as well as explicit statement of assurance about confidentiality of their responses. This was followed by two sections of questions – first section had items for beliefs and intention related constructs and second section had items related to demographic and usage patterns. Respondents were also asked if they were aware about 4G mobile services in India. All the beliefs and intention related items were rated on a scale of 1-5 (strongly disagree to neutral to strongly agree). In this study, all the twelve criteria proved significant at 0.05 significance level and thus confirming construct validity.

Table – 2 Fit Indices of the SEM measures of the model used in the study

Goodness of Fit statistics	Acceptable Levels	Threshold	Result (Study Values)	Description
Chi square (χ^2)	-	-	3035.881	Acceptable. Good model fit
df	-	-	1314	Acceptable. Good model fit
GFI	> 0.90	-	0.681	Mediocre fit
RMSEA	< 0.07	-	0.07	Acceptable. Good model fit
RMR	< 0.10	-	0.127	Mediocre fit
PNFI	> 0.50	-	0.664	Good model fit
AGFI	> 0.90	-	0.652	Mediocre fit
PGFI	> 0.50	-	0.625	Good model fit
Relative χ^2 (χ^2/df)	< 5	-	2.310	Acceptable. Good model fit

Degree of fit

The Structural model was assessed by Structural Equation Modelling (SEM) using AMOS v.20.0. As shown in Table 2, all the model-fit indices almost meet the respective threshold limit suggested by previous research, thus demonstrating the model exhibited a fairly good fit with the data collected. The relative/ normed chi square (CMIN/df) of the model has a value of 2.310, which follows the threshold limit and proves an acceptable ration resulting in a good model fit. RMSEA value is 0.08 which represents good model fit. The GFI value of the tested model is 0.681 and the AGFI is 0.652, which is within the acceptable limit of 0 to 1. However, it is not above the threshold cut-off values resulting in an excellent model fit. These measures are affected by sample size and hence, the current consensus is not to use these measures [41, 42].

The tested model holds RMR value of 0.127 with a somewhat good fit. A value less than 0.10 is generally considered a good fit [43]. The PGFI value of the tested model is 0.625 and PNFI is 0.664, which is greater than the cut-off threshold value of 0.50 representing the model as good fit model. All the three fit indices in this study related to measures developed for 4G mobile services adoption intention were closer to the accepted threshold levels and hence accepted to prove that the overall model is fit with relevant indices.

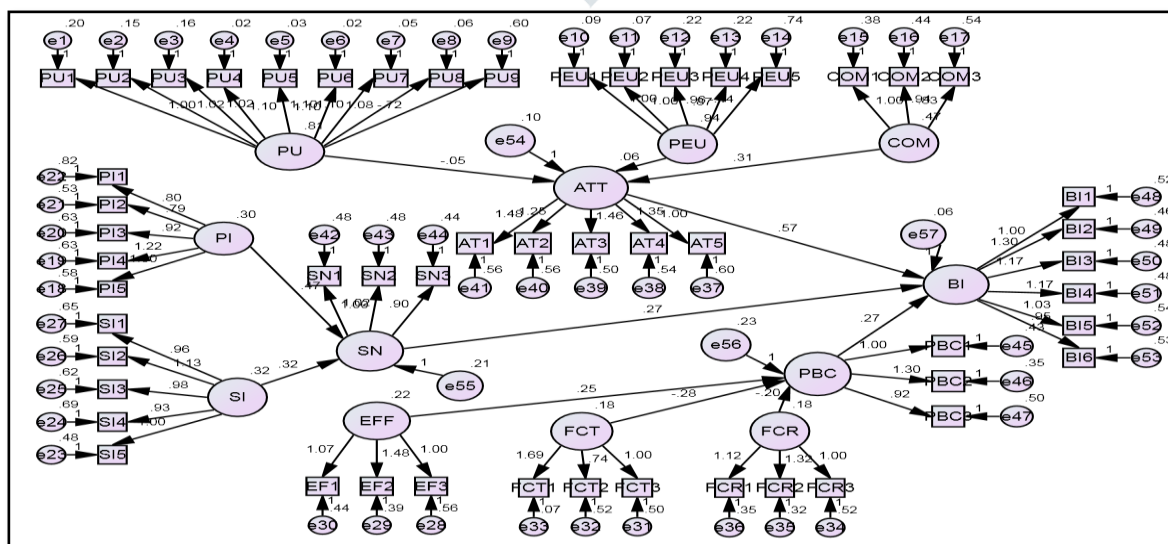


Fig.2: Structural Model

As depicted in Figure 2, the model provided comparable fit to the data based on the measures. The findings indicate that Compatibility ($\beta=0.31$) has positive significant influence on Attitude. Attitude ($\beta=0.57$) was found to be an important variable influencing 4G mobile usage. Peer Influence ($\beta=0.47$) and Superior Influence ($\beta=0.32$) have significant positive influence on Subjective Norms. Efficacy ($\beta=0.25$) has positive significant influence on Perceived Behavioural Control. Subjective Norms ($\beta=0.27$) and Perceived Behavioural Control ($\beta=0.27$) also positively influence behavioural intention. These finding is consistent with the results from Taylor and Todd's (1995b) investigation of the role prior experience in the assessment of IT usage [13]. The findings of the study show that Perceived Usefulness have no influence and Perceived Ease of Use has less influence on mobile consumer's 4G adoption decision. Facilitating Conditions-Resource ($\beta=-0.28$) and Facilitating Conditions-Technology ($\beta=-0.20$) have negative significant influence on Perceived Behavioural Control. Though this is in contrast with previous studies [34], the results reveal that Indians in general already have a solid knowledge that 4G mobile services are easy to use. The majority of the respondents are relatively young and the latest mobile technology is not something new to them. Hence, the 4G mobile services are not something that the respondents perceive as difficult to use.

V. IMPLICATIONS AND CONCLUSION

The current research points out that mobile service is becoming increasingly important and hence more studies on mobile services innovation, acceptance and adoption should be carried out. This study represents a careful and systematic effort to examine DTPB on 4G mobile services usage. The model was examined in the workplace and personal settings where usage is more likely to be mandatory. This may operate differently if options are available for usage and in other specific settings such as teaching-learning, healthcare, tourism, etc. As many telecom operators are starting to embrace 4G technology, this study helps the mobile service providers to formulate appropriate business strategies to retain and increase the customer base. Also, the constructs in the model cannot provide sufficient validation to researchers and practitioners, if other factors such as context of use, cultural differences or individual perception are not be taken closely into consideration. The survey included respondents who use 4G mobile services for multipurpose. Hence, Gender and Age differences leading to 4G mobile services acceptance can be explored further. A longitudinal survey also can be undertaken to study the level of acceptance by late adopters.

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