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4G Adoption in India : An Extended TAM Model

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***Abstract:** The research focuses on 4G adoption scenario and revealing the important determinants that influence consumer's decision regarding adopting 4G services in India. The determinants used in this research are Perceived Cos(PC), Perceived ease of use(PEOU), Social influence(SI), Self-efficacy(SE) and Perceived usefulness(PU). The study extended the TAM model by considering the other variables .371 respondents was chosen for the study using 4G telecom services in India. Hypothesis were tested using Structural Equation modeling (SEM). PUand SE are the significant determinants of 4G adoption. Many countries are formulating their marketing strategy regarding technology adoption and the model tested in the research plays has a practical implication in helping the stakeholders in the present revolution in the telecom sector.*

***Keywords:** 4G, TAM, SEM, Telecommunication.*

I. INTRODUCTION

The various revolutions in the digital technologies worldwide have enabled the consumers to access lot many data within a fraction of seconds from any corner of the world that is connected via the internet. This has led to the importance and requirement of fast, reliable and stable internet technologies like 4G, which enables achieving success in the concepts of Internet of Things, VoLTE, etc. Again, the rapid development and availability of a vast compatible hardware ecosystem like smart phones, smart watches, smart TV etc. has also boosted the requirement of faster adoption of the 4G technology by the consumers. The various other research studies till date have used various theories in their studies, which have their own limitations. Therefore, the current research article is an attempt to carry out the research using the extended version of the traditional TAM, which tries to focus upon the gap in existing studies and to give a new dimension towards the solution.

II. LITERATURE REVIEW

Park & Joon (2013) , their research developed a model for knowing about the adoption level of the 4G services through the thorough verification of the latent cause-effect linkages between the main human psychology-oriented factors & consumer readiness to avail the offerings. "satisfaction" is the main contributor towards consumers' interest to use 4G services. "perceived usefulness", "adaptivity", "processing speed" & "system & service quality" were concluded to be the main factors controlling the consumers' "attitude" for availing the 4G services. Pagani & Fine (2008) , the research prioritizes upon the various controlling factors impacting the consumer acceptance towards "3G services", like that of the "customer dynamics", "competitive dynamics", & "technology dynamics". Chong et al. (2012) in their cross-cultural research work have stated that how the developments in the mobile networks have led to the growth in the population of cellular network users as well as it has led to the accelerated acceptance of the mobile-commerce services by the consumers. Factors like trust, cost, social influence are taken into the consideration Pagani (2006) in the research work has focussed upon a set of determinants that influence the acceptance of "wireless High-Speed Data Services" from a commercial perspective. They had combined the two model TAM and TF in their study. Kim et al. (2011) in the research work has emphasized upon the fact that how the knowledge about customers' "decision making process" is advantageous to the firms in getting a better idea about the determinants influencing consumers' acceptance towards newly introduced services as well as that of the further innovations in the same. Lin & Kim (2016) in their research work have stated about the various pros & cons regarding the inclusion of "sponsored advertising" in social media. As per the researchers even though the inclusion of the paid ads adds up to the monetary benefit of the social media platforms still, they are anticipated as threats to that of the customers' sensitive data. Shin (2012) in the research work has focused upon the importance of the various explanatory factors responsible towards the customers' adoption of the various development and advancements in the field of cellular network services like that of the "mobile voice over internet protocol (mVoIP)", which is very important to the marketers' strategic decision making and formulation of various policies. Kim et al. (2015) in their research article have mainly focused upon the comparative as well as the contrasting aspects of the cellular service consumers vs that of the non-adopters. As per the study, though theoretically "perceived usefulness" is one of the major factors behind the failure of various technology oriented firms, still statistical facts have shown that in Korea, many consumers avoid adopting to cellular based innovations irrespective of knowing their utilitarian importance, due to various factors like "perceived risks, financial barriers, cost effectiveness & perceived non attractiveness of other service providers".

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Tan et al. (2014) in their research article have focused upon the factors that influence consumers' decision making regarding accepting the "mobile learning" as well as that of the various innovations in information & communication technology. The research methodology used in the article includes "Structural Equation Modelling- Artificial Neural Networks method, Root Mean Square of Errors method & Sensitivity Analysis". Kim (2012) in the research work has tried to focus upon the various explanatory factors related to the behavioural adoption of "mobile data services and applications (MDSA)" by the consumers which further acts as a catalyst in fast advancements in the innovations related to the afore said field. The findings also showed that the factors like "user satisfaction, perceived monetary value, and variety of use", better explain the "MDSA habit" of the consumers. Morosan (2014) new conceptual model developed based upon the "Technology Acceptance Model" which has various factors like "perceived usefulness, perceived ease of use, trust, privacy, security, innovativeness & personalization". The statistical methods like "confirmatory factor analysis & structural equations modelling" were used. Aharony (2013) The researcher has implemented the "Technology Acceptance Model, having 4 core variables like perceived ease of use, usefulness, personal innovativeness & smartphone usage", for the research purpose. The results of the research supported the TAM model validity in the given context. Tarhini et al. (2017) in their research paper have focused upon the "Mobile banking or M-banking" utility of the mobile network-based service advancements in recent days. The researchers have used the concept of the "Technology Acceptance Model" in order to test the research model developed for the concerned study "from a developing country point of view". staged regression analysis the "perceived ease of use & demographic variables" were not statistically significant where as contradictorily they were relatively of much higher importance as per the "neural network" model. The rest of the factors were found out to be significantly important as per both the methods. Tseng & Lo (2011) The statistical analysis results however state that in this context the "Technology Acceptance Model" did not satisfy the goodness of fit criteria. Even if the consumers know that the future innovations in mobile products and services industry would be easier and better to use than the existing versions, still they continue to use the same age old phone simply because they are satisfied with what they have. When users were satisfied with their current model, they were not willing to upgrade to a newer generation model. Roberts & Pick (2005) The research model developed has been formulated by the merging between "TAM and innovation adoption/diffusion models, adding the factors of security, cost, reliability, digital standards/regulatory environment, technology product suitability, and future Web connectivity". Kitchen et al. (2015) The researchers had used the standardised "technology acceptance mode" with some context-based modifications for the study. As per the results of the research work, "Consumer Attitude" was found out to be the most crucial factor that influences the consumers' decision regarding 4G adoption. Yang (2012) in their research paper has been focused upon the various apps that could utilise the full potential of the LTE services & that could be run on small cellular gadgets. The study yields the results that came out with a "2x3" model with 6 groups of categorical factors like that of the "augmented reality, mobile social networking & m-health", which gives an idea about the various attributes of prevailing LTE cellular apps & that of the evolving futuristic versions of those apps. Park et al. (2016) As per the research work the 3G services being saturated now the consumers have been using LTE services and are looking forward to the various innovations in the 4G and $4G^+$ services. The research work is focused upon the explanatory factors that are responsible for the acceptance of the various innovations in the 4G services, by the consumers in South Korea. The research work had taken into consideration the various aspects like that of the functional ones comprising of "cost, speed, and security", the social ones like that of "social influence" & the personal ones like that of "personal innovativeness and self-efficacy", in order to know their impact on the consumers' behaviour towards acceptance of the innovations in the 4G services.

III. FRAMEWORK OF THE RESEARCH

Perceived Ease of Use (PEOU): -

PEOU is the concept which states the degree of effortlessness at which a person thinks that he/she can use any application or system. This factor is a vital determinant of the new technology adoption by the people. In this research work, PEOU is taken as the level to which the adoption of 4G telecom services is anticipated to be simple and effortless. For this article, we hypothesize that:

H1: PEOU has a significant positive relation with the consumers' readiness towards the adoption of 4G.

Perceived Usefulness (PU): -

PU is the concept which states the anticipated utility-oriented value that the user can gain by using any particular product or service. In case of 4G adoption, PU plays a vital role to influence the consumers' decision regarding the adoption or non-adoption of the 4G services taking into consideration the value proposition that they will get by using the 4G services.. For this research work, we hypothesize that:

H2: PU has a significant positive relation with the consumers' intention towards the adoption of 4G.

Perceived Cost (PC): -

PC is the concept which deals with the anticipated cost bearing involved in the process of availing the offerings of various products or services. In the current research article, the PC plays a vital role since it is related to the 'Benefit vs Cost' calculations of the consumers. The process of 4G technology adoption by the consumers is influenced to a greater extent taking into consideration the various anticipated costs that one would incur by virtue of the prices of the devices as well as that of the service charges. Therefore, here it is hypothesized that:

H3: PC has a significant positive relation with consumers' intention towards the adoption of 4G.

Social Influence (SI): -

SI deals with the concept which states that consumers get much influenced by the social environment surrounding them, while taking any decision regarding adoption of any new technology. The family members, the friends, colleagues etc. influence the perception of the customers towards any product or service to a great extent. Likewise, it is obvious that the consumers' intention towards the adoption of the 4G technology is also influenced by the society surrounding them. Hence, it is hypothesized that:

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H4: SI has a significant positive relation with consumers' intention towards the adoption of 4G.

Self-Efficacy (SE): -

SE can be defined as the confidence or belief that one has upon himself/herself regarding the self-learning-oriented usage of any new technology. When it comes to the topic of the adoption of 4G technologies by the consumers, SE plays a really crucial role for the decision making by the consumers regarding the fact that whether they are capable of learning and adapting to the usage of the 4G technologies or not. Therefore, it is hypothesized that:

H5: SE has a significant positive relation with consumers' intention towards the adoption of 4G.

This research work will focus upon the individual association between each of the factors discussed above, with that of the consumers' decision towards 4G adoption.

IV. DATA ANALYSIS

371 respondents were sampled for the data collection and those customers selected were having experience of using 4G services. The questionnaire was based on the TAM model using the constructs from TAM and it was extended with other variable like Social influence an perceived cost and self efficacy. Structural Equation model alone with Confirmatory analysis i.e. CFA was used for analysis . 5 point Likert scale was used ranging from 1 Strongly agree to 5 Strongly disagree.

Table-1 Reliability and Validity of the Scale

Reliability and Validity				
Latent Constructs	**Indicator**	**Standardized Loading**	**AVE**	**Reliability α**
Perceived Usefulness	**PU1** **PU2** **PU3** **PU4**	**.875** **.897** **.786** **.679**	**.603**	**.873**
Perceived Ease of Use	**PEOU1** **PEOU2** **PEOU3**	**.876** **.878** **.784**	**.509**	**.786**
Perceived Cost	**PC1** **PC2** **PC3**	**.789** **.875** **.862**	**.623**	**.872**
Self Efficacy	**SE1** **SE2**	**.878** **.832**	**.507**	**.774**
Social Influence	**SI1** **SI2** **SI3**	**.765** **.763** **.734**	**.507**	**.872**

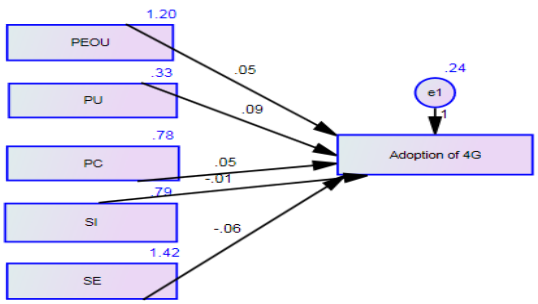

Fig-1 Path Analysis Model

SEM was used to analyze the research model hypothesized. 310 samples was used for the analysis and 5 point Likert scale was used ranging from 1 to 5 (Strongly agree top strongly disagree) The Cronbach Alpha was ranged from .7 to .8 which are al accepted threshold value i.e. .7 and all are statistically significant at p<0.001

Table-2 Hypothesis Testing Results

Hypothesis	Path	Path Coefficient	p-value	Supported / Not supported
H1	**PEOU->AD**	**0.082**	**0.176**	**Not Supported**
H2	**PU->AD**	**0.243**	**0.015**	**Supported**
H3	**PC->AD**	**0.045**	**0.572**	**Not Supported**
H4	**SI>AD**	**0.065**	**0.331**	**Not Supported**
H5	**SE->AD**	**0.265**	**0.001**	**Supported**

PEOU, PU, PC, SI, SE are the five construct examined in the study regarding 4g adoption . The model was extended with TAM in adoption of 4g.

GFI,AGFI,CFI and NFI value are greater .8 which represents a good fit of the model and RMSEA value is less .08 which is perfect fit and the model is a god fit for analysis .

Model Fit Summary of SEM

Indices	Value	Recommended Values
Chi Square value	10.614	
P Value	0.065	>.05 (Hair e al, 1980)
Goodness of Fit Index(GFI)	0.984	>.90(Hair et al 2006)
AGFI(Adjusted Goodness of Fit Index)	0.987	>.90(Hair et al 2006)
NFI(Normated fit Index)	0.967	>.90(Hair et al 2006)
CFI(Compratabv fit index)	0.979	>.90(Hair et al 2006)
RMSEA(root Mean square error of approximation)	0.041	<0.08(Hair et al)

V. CONCLUSION

Perceived usefulness and self efficacy are the predicting variables for the adoption of 4G.The intervening variables are the perceived ease of use, and perceived cost which are not directly significant to the adoption of 4G.The output of the hypothesis tested support the extended TAM through the structural analysis . The TAM model was extended with the additional construct social influence , self efficacy and perceived cost .The PU and the self efficacy was found to be significant and others are not. The findings are very help ful for the stakeholders for designing appropriate marketing strategies in marketing 4G services as well future service to come.

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