THE TECHNOLOGY ACCEPTANCE MODEL: A REVIEW OF THEORIES AND MODELS

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Abstract

Tam was introduced in 1986 was the widely applied model in the field of information technology adoption. Evolution of TAM over a period of timeexplained the phenomenon of technology adoption in a better ways. This process of evolution has principally been determined by rapid change in technology scenario and has also led to introduction of new variables to the theory. Thus in this study an over view of technology adoption theories, various model and evolution stages, extended tam variables and limitation of the Tam based on the previous study are highlighted.

KEY WORDS: Technology Adoption Theories, Model, Evolution Stages, Extended Tam Variables and Limitation

INTRODUCTION

Technology adoption model is one of the oldest domine of IS research.TAM model was adopted from the Theory of Reasoned action (Ajzen and Fishbein 1980) and was originally proposed by Davis 1986. Former research on TAMmodel proved that individual's information system acceptance is determined by two major variables, perceived usefulness (PU) and Perceived ease of use (PEOU). With rapid strides being made in technology innovations in every conceivable domain, the issues related to technology adoption have gained increasing prominence in recent times, particularly in the technology based self-services adoption in banking sector.According, Sultan, Abdulrazza (2017), TAM models was the most well-known and accepted model being used to provide a comprehensive understanding of their impacts toward the adoption of banking technology.

Previous studies have exposed that technology adoption is not related to the aspects of technology alone but has evolved as a much more complex process involving dimensions of user attitude and personality (Venkatesh et al. 2012), social influence (Ajzen and Fishbein 1975), trust (Gefen et al. 2003) and numerous facilitating conditions (Thompson et al. 1991). It is necessary to understand the evolution of this research area in Information Systems and look at future research opportunities. But still there exists a hesitation among the people regarding the safety and security of the technology and its usage. These must be

overcome in order to achieve the usage of technology to the fullest extent Huge investments are made by organizations and governments for introducing new technologies that have the potential of bringing a paradigm shift in the life-style of the users.

In this study, the evolution of research in the area of technology adoption over the years by means of a review of the existing literature on the subject being highlighted. The study also illuminates on various TAM model and its stages, new variables add to existing Technology was also overviewed based on previous research, and limitation of the TAM was also focused.

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EVOLUTION OF TECHNOLOGY ADOPTION THEORIES

Year	Theory	Developed by	Determinants of adoption
1960	Diffusion of Innovation Theory .	Everett Roger	The innovation, communication channels, time and social system.
1975	Theory of Reasoned Action	Ajzen and Fishbein	Behavioral intention, Attitude (A), and Subjective Norm
1985	Theory of Planned Behavior	Ajzen	Behavioral intention, Attitude (A), and Subjective Norm, Perceived BehaviouralControl.
1986	Social Cognitive Theory	Bandura	Affect, anxiety.
1989	Technical Adoption	Fred D Davis	Perceived usefulness and perceived ease of use.
1991	The Model of PC Utilization	Thompson et al.	Job-fit, Complexity, Long-term consequences, Affect Towards Use, Social Factors, Facilitating Conditions.
1992	The Motivation Model.	Davis et al	Extrinsic motivation (such as perceived usefulness, perceived ease of use, and subjective norm) and intrinsic motivation (such as perceptions of pleasure and satisfaction).
2000	Extended TAM2 model	Venkatesh and Davis	Social influence processes (subjective norm, voluntariness and image) and cognitive instrumental processes (job relevance, output

			Quality, result demonstrability and perceived ease of use).
2003	Unified Theory of. Acceptance and Use of. Technology (UTAUT)	Venkatesh et al	Performance expectancy, effort expectancy social influence and facilitating conditions
2009	Model of Acceptance with Peer Support(MAPS)	Sykes et al.	Behavioral intention, System use, Facilitating conditions, Network density, Network centrality, Valued network centrality, Valued network density

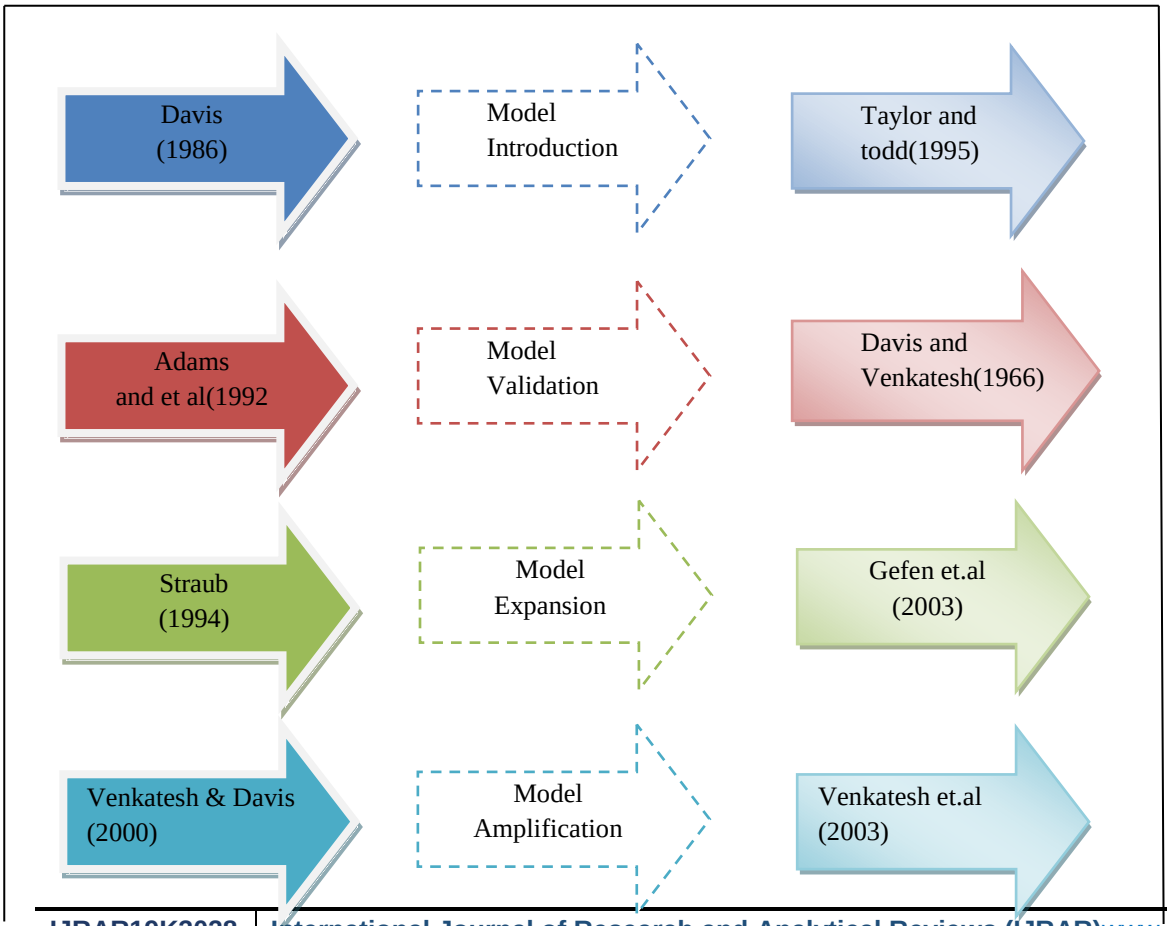
OBJECTIVE OF THE STUDY

- To study the evolution of tam theories
- To illuminate on various tam model and stages
- To study the limitation of tam model over the period of time

RESEARCH METHODOLOGY

Literature survey methodology is used for the study. Research papers technology adoption, technology adoption theory, technology adoption model etc.were referred from online databases like EBSCO, Google Scholar, Proquest, INFORMS etc. Details of evolution of TAM model, model stages, extended variable of TAM and limitation of TAM was highlighted with the reference of previous study.

TABLE 1 SEQUENTIAL PROGRESS OF TAM



The Tam model adoption based on the previous studies is classified into four major category Model introduction, model validation, model expansion, model amplification...as shown in fig. 1 above.

- **MODEL INTRODUCTION**

This stage of TAM illuminates us on evolution of TAM from Ajzen and Fishbein's [1980] Theory of Reasoned Action (TRA) .the theory explains us the determinants of computer acceptance among users and user behavior across a broad range of end-user computing technologies, while at the same time it also provides us both parsimonious and theoretically justification" [Davis et al. 1989, p. 985]. After the introduction of model, researchers in this Stage performed several TAM studies and explained two main important aspect

- Replication of TAM model
- , Comparison of TAM and its origin(TRA Model)

- ✓ **Replication Studies**.

Several replication studies appeared in this Stage. Adams et al. [1992] examined TAM in 5 different applications—word processors, graphics, spreadsheets, e-mail, and v-mail—and found that, in general, TAM maintained its consistency and validity in explaining users' IS acceptance behavior. Davis [1993] replicated his previous study [Davis et al., 1989] using e-mail and a text editor with 112 knowledge workers, and found that TAM successfully explained the adoption of both technologies (R2 =0.36). Sambamurthy and Chin [1994] applied TAM to study group attitudes toward GDSS use, and found that the ratio PU/PEOU successfully predicted group attitude to GDSS use. Finally, Subramanian [1994] performed the replication of the original TAM with two mailing systems' acceptance, and found that TAM variables showed results consistent with previous studies.

- ✓ **Relationshipof TAM andTRA**.

Davis et al. [1989] compared TRA and TAM on MBA student's relative facility with a word processor across two time Stages, immediately after introducing the system and 14 weeks later. They found that TAM (R2 = 0.47 at time 1, R2 = 0.51 at time 2) explained the acceptance intention of the users better than TRA (R2 = 0.32 at time 1,R2 = 0.26 at time 2). Another study carried out by Hubona and Cheney [1994] compared both TAM and the Theory of Planned Behavior (TPB) model and found that TAM offers a slight empirical advantage and is a much simpler, easier to use, and more powerful model to explain users' technology acceptance.

Thus, it was found that TAM could successfully predict ISacceptance behavior under different technologies and different situations. In addition, it was also found that TAM was a much simpler, easier to use, and more powerful model of the determinant .The user acceptance of computer technology than TRA [Igbaria et al. 1997, p. 281]**.**

- **Model Validation Stage**

After the introduction stage theresearcher insisted that most IS instruments are in the premature stage of development and thus require a rigorous validation .thus this stage explains us the validation of the TAM's original instruments. Bejar's [1980] suggested that robust instruments greatly enhanced the value of research. The researchersalsoconfirmed that TAM truly uses an accurate measurement of the user's acceptancebehavior under different technologies, situations, and tasks.Adams et al. [1992] replicated and extended the Davis 1989 study and foundthat both validity andreliability of measurement for both PU and PEOU across different settings and differentinformation system to be valid and reliable. Hendrickson et al. [1993, 1996] examined the test-retest reliability of the PUand PEOU scales and found the TAM instrument to be reliable and valid in terms of test-retestanalysis.Segars and Grover [1993] found throughconfirmatory factor analysis, they found that instead of the two-factor model (PU and PEOU), athree-factor model, including effectiveness as a new TAM variable, is more salient. However, Segars and Grover's study was disproved by Chin and Todd [1995] Afterperforming a structural equation modeling (SEM) analysis, it was found that a single factor PUmeasure has reasonable psychometric properties, thus there is no substantive rationale toseparate PU into two dimensions (PU and effectiveness). Davisand Venkatesh [1996] concluded that original grouped items could be used forpredicting IS acceptance.

Thus, thestudy in this Stage extensively investigated whether TAM instruments were,
Dependable, reliable, and valid.Various researches on TAM validation declared that *no* instruments hasabsolute measurement of Technology adoption though used in a different context, according to Segars and Grover 1993, stated that Measurement models must be rigorously assessedand, if necessary, it must be reframed.

- **Model Expansionstage**

After validation stage the need for expansion of TAM variable arrived.New variables postulating diversified relationships between PE and PEOU with external variable was highlighted. Agarwaland Prasad [1999] extended TAM with five kinds of individual difference variables as the externalvariables of PU and PEOU. They found that the relationship between participation in training andPU, between prior experiences,

role with regard to technology, tenure in workplace, level ofeducation, and prior experience and PEOU, were predicted successfully. Igbaria et al. [1995]investigated the effects of organizational factors and found that user training, computing support,and managerial support significantly affect both PU/PEOU and microcomputer usage. Karahannaand Limayem [2000] conducted a study with two technologies, e-mail and voice-mail, and foundthat the determinants of the system usage and those of PU and PEOU are different among thetechnologies. PU did not influence e-mail usage but social influence did, and the result wasreversed in the case of voice-mail.

According to Straub [1994] the TAM model in two countries with different cultures, and found that culture played an importantrole in the attitude toward and choice of communication media. He also investigated the effect of gender difference on ISacceptance, and determined that gender significantly moderates the effects of PU, PEOU, andsocial presence. They found that men are more affected by PU, while women are more affectedby PEOU and Subjective Norm. Moon and Kim [2001] appliedTAM in the Internet context, differentiating tasks into entertainment and work–related task. Theyfound that the significant factors affecting Internet usage depend on the task type. Perceivedplayfulness was most pivotal for an entertainment task and PU for a work-related task on theInternet.

The previous studies during this stage has made tremendous paceto explain the relationship between antecedents variable with PU and PEOU and also highlighted on various external included in the previous model.it can be concluded from the study that various external variable affect the TAM variable developed earlier.

- **Model AmplificationStage**

This Stagedescribes the elaboration of TAM. This stage illuminates on two significant issues: to develop the nextgeneration TAM that synthesizes the previous effects and to resolve the limitations raised byprevious studies. Venkatesh and Davis [2000] and Venkatesh [2000] introduced TAM II, a newmillennium version of original TAM. TAM II synthesized the previous efforts. It clearly defines the external variables of PU andPEOU.Venkatesh and Davis [2000] define the external variables of PU, such as social influence(subjective norms) and cognitive instruments (job relevance, image, quality, and resultdemonstrability). Venkatesh [2000] provides the external variables of PEOU, such as (computer self-efficacy, perceptions of external control, computer anxiety, and computerplayfulness) and adjustments (perceived enjoyment and objective usability). Through both efforts,the explained variance increases to 60% of PEOU and 40% of PU.

Second, studies were performed to resolve several problems in TAM. Venkatesh [2000] performed a TAM study considering both voluntary and mandatory situations with four different subject groups and information systems. Thislongitudinal study, including Subjective Norm excluded by

Davis [1989], used employees in aworking environment and measured actual usage instead of self-reported usage. ThisStage described uncovered determinants of PEOU and PU, andthus advanced TAM as a salient theory, laying the foundation for further research.

TABLE 2 EXTENDED TAM VARIABLES

Variable	Definition	Origin	Reference
Voluntariness	The degree to which use of the innovation is perceived as being voluntary or free	Moor and benbasat(1991)	Barki and Hartwick [1994];Venkatesh and Davis [2000]
Relative Advantage	The degree to which an innovation is perceived as being better than its precursor	Rogers [1983]	Moore and Benbasat [1991]; Premkumar and Potter [1995]
Compatibility	The degree to which an innovation is perceived as being consistent with the existing values, needs, and past experiences of potential adopters	Rogers [1983]	Chin and Gopal [1995]; Xia and Lee [2000]
Complexity	The degree to which an innovation is perceived as being difficult to use	Rogers(1983)	Premkumar and potter(1995)Igbaria et al(1996)
Observability	The degree to which the result of an innovation are observable to other	Rogers(1983)	Moore and Benbasat1991
Trial ability	The degree to which an innovation may be experimented with before adoption	Rogers(1983)	Moore and Benbasat 1991 and Karahanna et al(1999)
Image	The degree to which use of an innovation is perceived to enhance one's image or statusin one's social system	Rogers [1983]	Karahanna et al. [1999]; Venkatesh & Davis [2000]
Self Efficacy	The belief that one has the capability to perform a particular behavior	Bandura[1977]	Fenech [1998]; Venkatesh
End User Support	High levels of support that promotes morefavorable beliefs about the	Igbaria et al. [1995]	Igbaria et al. [1996]; Karahanna and

	system amongusers as well as MIS staffs		Limayem [2000]
Personal Innovativeness	An individual trait reflecting a willingness totry out any new technology	Agarwal and Karahanna [2000]	Agarwal and Prasad [1998]; Agarwal and Karahanna [2000]
Perceived Playfulness	The degree of cognitive spontaneity in microcomputer interactions	Webster and Martocchio [1992]	Moon and Kim [2001]; Agarwal and Karahanna [2000]
Social Influence	The degree to which a medium permits usersto experience others as beingpsychologically present	Fulk et al. 1987	Karahanna and Straub [1999]; Karahanna and Limayem [2000]
Attitude	The degree to which a person likes or dislikes the object	Ajzen and Fishbein[1980]	Chau [2001]
Anxiety	An individual's apprehension, or even fear,when she/he is faced with the possibility ofusing computers	Simonson et al. [1987]	Montazemi et al. [1996]; Gopal et al. [1994]
Perceived Enjoyment	The extent to which the activity of using aspecific system is perceived to be enjoyablein its own right, aside from any performanceresulting from system usage	Davis et al. [1992]	Chin and Gopal [1995]; Teo et al. [1999]
System Quality	The perception how well the system performs tasks that match with job goals	Venkatesh and Davis [2000]	Lucas and Spitler [2000]; Lederer et al. [2000
Facilitating Condition	The control beliefs relating to resource factors such as time and money and IT compatibility issues that may constrain usage	Taylor and Todd [1995b]	Taylor and Todd [1995b

TABLE 3 LIMITATION OF TAM

LIMITATIONS	EXPLANATION	EXAMPLES
Self-reported Usage	Did not measure the actual usage	Venkatesh and Davis[2000]
Single IS	Use only a single information system for theresearch	Venkatesh[1999]
Student Samples (or UniversityEnvironment)	Inappropriate to reflect the real workingenvironment	Agarwal and Karahanna [2000]
Single Subject (or Restricted subjects	Only one organization, one department, MBAstudents	Karahanna and Straub [1999]
One Time Cross Sectional Study	Mainly performed based on cross-sectionalstudy	Karahanna et al.[1999]
Measurement Problems	Low validity of newly developed measure, usesingle item scales	Agarwal and Prasad [1998]
Single Task	Did not granulize the task and test them with the target IS	Mathieson [1991]
Low Variance Scores	Did not adequately explain the causation ofthe model	Igbaria et al. [1997]
Mandatory Situations	Did not classify mandatory and voluntarysituation, or assume voluntary situation	Jackson et al.[1997]

CONCLUSION

This study found that TAM has evolved continually and was validated, elaborated and amplified by the researchers by resolving its limitations, integrating other theoretical models by introducing new external variables to the existing model. This study acknowledged theevolution theories and model of TAM over the period of time and its limitations TAM has come a long way. While there are still contradictory views on TAM .thus it was found from the previous research that further research has to continue in this domain in order to identify the new construct of adoption of TAM.

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