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Adoption of Cloud Computing Amongst Indian SMBs: An Extension of TAM Framework

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Abstract

Cloud computing has been gaining recognition amongst enterprises due to its wide range of applications. Its adoption is found to be driven by factors like industry, geography, size of organisation, and nature of business etc. Gradually researchers started exploring adoption of cloud computing from user's perspective particularly behavioural factors driving the same. The present study intends to explore different behavioural predictor of intention to use cloud computing, by adopting the recent Technology Acceptance Model (TAM) 3 developed by Venkatesh & Bala (2008). A total of 100 users who are involved in purchasing computing solutions or are key stakeholders/ decision-makers of Indian Small and Medium Businesses (SMBs) constituted the sample for this study. Data collection was done through online survey. The findings suggest that perceived ease of use has significant effect on attitude towards usage which subsequently affects intention to use cloud computing. The findings are consistent with the previous researches on technology adoption factors. At the end, the theoretical and managerial implications of the study are discussed.

Keyword: Cloud Computing, TAM, SMBs, India

Introduction

Cloud computing is no more a technology fad and has been defined as an emerging IT development, deployment and delivery model, enabling real-time delivery of products, services and solutions over the Internet (Fowler & Worthen, 2009). It has become one of the major technological advances made in the computing history which refers to both the applications delivered as services over the Internet and the enabling hardware and systems software in the datacenters (Armbrust *et al.*, 2010). It enables access of files, data, programs and third party services from a Web browser via the Internet that are hosted by a third party provider and paying only for the computing resources and services used (Kim, 2009). As per the report by Gartner Inc. (2012), worldwide the amount of money spent on cloud computing was $7.6 billion in 2011 and is projected to be $35.5 billion in 2016. Cloud computing provides an open environment which enables distance online collaboration as well as sharing repository amongst the users (Aljabre, 2012).

It is pertinent to say that cloud computing has been gaining recognition amongst enterprises due to its wide range of applications. Its adoption is found to be initially driven by factors like industry, geography, size of organisation, and nature of business etc. The earlier researches were directed towards defining and categorising cloud computing and identifying challenges and issues related to its adoption (Leavitt, 2009; Chebrolu, 2011; Carroll *et al.*, 2011; Wood & Anderson 2011; Fortis *et al.*, 2012; Phaphoom *et al.*, 2012). Gradually researchers started exploring adoption of cloud computing from user's perspective particularly behavioural factors driving the same.

The present study intends to explore different behavioural predictor of intention to use cloud computing, by adopting and extending the most recent Technology Acceptance Model (TAM) 3 developed by Venkatesh & Bala (2008). The premise for this study is Indian Small and Medium Businesses (SMBs) and unit of analysis for the same is users/stakeholders/decision makers from these business units. It has been found that SMBs are inherently different

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from large enterprises in terms of various differentiating characteristics like limited resources, low revenue generating ability, dependency on third parties, simpler organisation structure thus more rapid decision-making processes (Street & Meister, 2004). Aljabre (2012) opined that due to cloud computing's ability to enhance firms' capabilities with no extra costs; this technological platform may hold several opportunities for SMBs.

A total of 100 users who are involved in purchasing computing solutions or are key stakeholders/ decision makers of Indian Small and Medium Businesses (SMBs) constituted the sample for this study. The sample was drawn using purposive sampling. Data collection was done through online survey. Questionnaire was designed incorporating constructs suggested in TAM 3 along with some descriptive questions. At the end, the theoretical and managerial implications of the study are discussed.

Literature Review

The literature on user acceptance, adoption, and usage behaviour provides a gainful insight and suggests that various models have been employed to study the same. The list includes the theory of reasoned action (TRA) (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), the theory of planned behaviour (TBA) (Ajzen, 1991; Mathieson, 1991), the technology acceptance model (TAM) (Davis, 1989; Davis, 1993; Venkatesh & Davis, 2000; Venkatesh *et al.* 2003, Venkatesh & Bala, 2008), and the decomposed theory of planned behaviour (Taylor & Todd, 1995). However it is TAM which is still capturing the attention of information systems community (Chuttur, 2009). It has received empirical support for being robust in predicting technology adoption in various contexts and with a variety of technologies (Sugar *et al.*, 2004; Gao, 2005; McKinnon & Igonor, 2008; Park, 2009; Teo, 2009).

The present research is centralized upon the most recent TAM 3 by Venkatesh & Bala (2008). It states that the success of a system can be determined by user acceptance of the system, measured by three factors: perceived usefulness (PU), perceived ease of use (PEOU), and attitudes towards usage (ATU) of the system (Davis, 1989). The model specifies three belief factors that are salient in the context of information technology usage and acceptance: perceived usefulness (PU), perceived ease of use (PEOU), and attitude towards usage (ATU) (Ajzen & Fishbein, 2000; Davis, 1989).

Perceived usefulness (PU) is defined as "the degree to which a person believes that using a particular system would enhance his or her performance" (Davis, 1989) while Perceived ease of use (PEOU) refers to "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989). Perceived usefulness and perceived ease of use can be considered as cognitive factors.

Attitude towards usage (ATU) refers to the "the degree to which an individual evaluates and associates the target system with his or her job" (Davis, 1993). Attitude towards usage has been identified as a factor that guides future behaviour or the cause of intention that ultimately leads to a particular behaviour. In TAM, attitude towards usage is referred to as the evaluative effect of positive or negative feeling of individuals in performing a particular behaviour (Ajzen & Fishbein, 2000).

With cloud computing as point of reference, following hypotheses are formulated on the basis of behavioural predictors suggested in framework of TAM 3 (Table 1).

Table 1: Hypotheses

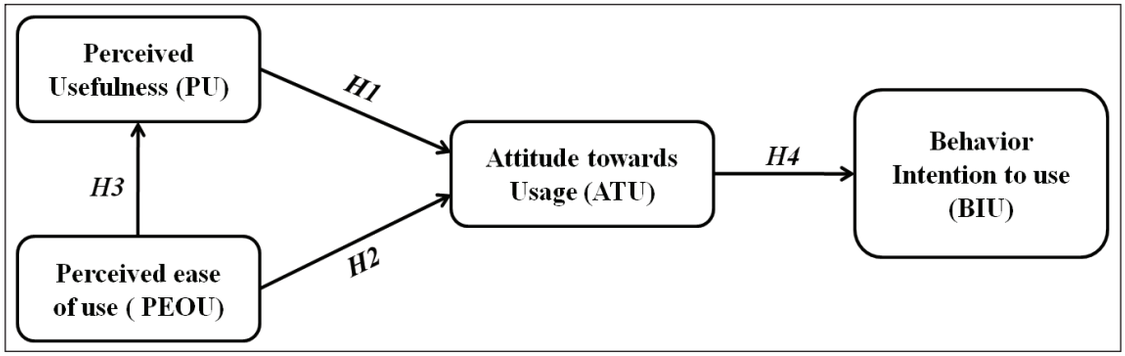
Hypothesis	
H1	Perceived Usefulness → Attitude toward Usage
H2	Perceived Ease of Use → Attitude toward Usage
H3	Perceived Ease of Use → Perceived Usefulness
H4	Attitude toward Usage → Behavioural Intention to Use

Thus, the objective of this study is to explore and examine the relationship of users' behavioural intention to use (BIU) the cloud based software with select factors of perceived usefulness (PU), perceived ease of use (PEOU), and attitude towards usage (ATU), and develop a general model of cloud based software acceptance. Based on these hypotheses following framework has been conceptualized (Figure 1).

Methodology

A questionnaire based survey was planned. The unit of analysis for the study is Indian Small and Medium Businesses (SMBs) wherein individuals who are involved in deciding/ purchasing cloud solutions or are key stakeholders/ decision makers in cloud based software

Figure 1: Research Framework



adoption in Indian organisations constituted the pool of respondents. The sample was drawn using purposive sampling which ensures that key research themes are addressed and that diversity in each category is explored (Silverman, 2005).

The questionnaire was designed which consists of two sections. The first section was designed to generate profile of the respondents and it includes questions on educational qualification, usage frequency and level of experience with IT technology. The questions in Section two were based on prior studies on technology adoption with modifications to fit with the reference point of cloud based software and subsequently adapted and incorporated TAM scales, developed by Davis *et al.* (1989) and Venkatesh *et al.* (2003). All the items were measured with seven point likert scale ranging from strongly disagree to strongly agree.

Data collection was done through online survey and a total of 100 valid questionnaires were received.

Analysis and Discussion

Sample Profile

As mentioned a total of 100 valid responses were obtained. The sample profile is shown in the Table 2. Majority of the respondents were professionally qualified even some of them had done Ph.D. As far as their usage frequency is concerned majority responded that they have never used IT tools however their experience with IT technology varies from novice, intermediate to advanced wherein majority suggested they fall in the category of advanced users. The descriptive profile suggests that even though most of them claim themselves being advanced users the usage frequency is not in sync with same which implies that behavioural adoption is an issue here in the context of SMBs.

Table 2: Sample Profile

Sample Characteristics		*Response (%)*
Educational Qualification	Graduate	15.0
	Post-graduate	27.0
	Professional	50.0
	PhD	8.0
Usage Frequency	Once in a week	9.0
	Once in a month	27.0
	Never	64.0
IT Experience	Novice	5.0
	Intermediate	39.0
	Advanced	56.0

Validity and Reliability Analysis

Section two of the questionnaire comprises various items related to predictors of behavioural intention to use and are measured with seven point likert scale. These items of different constructs were checked for reliability using Cronbach alpha and all the items were found reliable (Table 3). Construct validity was also assessed using confirmatory factor analysis (CFA) to test the fit of the data to the model. Table 3 presents the factor loadings for the constructs in the questionnaire for the sample of 100 respondents. The results of confirmatory factor analysis indicated that the constructs were not only reliable, but also valid.

Hypothesis Testing

Structure equation modeling (SEM) was used to test the

Table 3: Validity and Reliability Analysis

Construct	*Items*	*Factor Loading*	*Cronbach's α*
Perceived Usefulness (PU)	I have a generally favourable attitude towards using cloud based software	0.93	0.959
	Using cloud based software enhances my effectiveness on the job	0.94	
	I intend to use cloud based software	0.92	
	Learning to use cloud based software is easy for me	0.84	
	I believe it is a good idea to use cloud based software for my job	0.91	
Perceived Ease of Use (PEOU)	Using cloud based software improves my job performance	0.92	0.948
	My interactions with cloud based software is clear and understandable	0.93	
	Overall I found cloud based software easy to use	0.9	
	I intend to use cloud based software as often as possible	0.85	
	I like the idea of using cloud based software	0.86	
Attitude towards Usage (ATU)	Using cloud based software in my job increases my productivity	0.88	0.942
	Using the cloud based software is a enjoyable experience	0.9	
	I plan to use cloud based software in future	0.89	
	I find cloud based software to be useful in my job	0.83	
	I find it easy to get cloud based software do what I want it to do	0.9	
Behavioural Intention to Use (BIU)	I expect my use of cloud based software to continue in future	0.93	0.942
	I find cloud based software cumbersome to use	0.96	
	Cloud based software enables me to accomplish tasks more quickly	0.84	
	I intend to use cloud based software frequently for my job	0.72	
	Overall I enjoyed using the cloud based software	0.74	

hypothesis and explore relationship between/among four factors namely Perceived usefulness (PU), Perceived ease of use (PEOU), Attitude towards usage (ATU) and Behaviour intention to use (BIU). Figure 2 shows the path model. According to Gefen *et al.* (2003) and Hair *et al.* (2003), goodness of fit index (GFI), comparative fit index (CFI) and normed fit index (NFI) are best if above 0.90 and demonstrate marginal acceptance if above 0.80, adjusted goodness of fit index (AGFI) above 0.80 and root mean square residual (RMR) below 0.05. The results are very close to suggested values and hence indicate acceptable fit of model with the data collected.

Overall, three hypothesis were supported. Perceived ease of use (PEOU) had a significant effect on attitude toward usage (ATU), with path coefficient 0.99 and *p value = 0.001*. Perceived ease of use also had a significant effect on Perceived usefulness with path coefficient of 0.97 and *p value =.006*. Attitude towards usage (ATU) was positively related with Behaviour intention to use (BIU) with path coefficient of 0.96 and *p value= .001*. However Perceived usefulness (PU) didn't have any effect on Attitude towards usage (ATU) as shown by results (Table 4).

Conclusion and Implications

The study shows that perceived ease of use has significant effect on attitude towards using which in turn affects behavioural intention to use cloud based software. Software as service enabled by cloud computing is a new paradigm shift in the way software has been used consumed so far. Ease of use, has been a major driving factor in cloud based software adoption. Right from purchasing software on the cloud, to learning and start using it, to take support for issues etc are part of user experience, basis which a customer makes up his perception about ease of using a cloud based software. Perceived ease of use significantly affects the attitude of customer in actually using the cloud based software. Also perceived ease of use of cloud based software helps in establishing the usefulness of cloud based software. A favourable attitude developed towards cloud based software drives user intention of using the cloud based software for his or her job. This conclusion is

Figure 2: Path Model

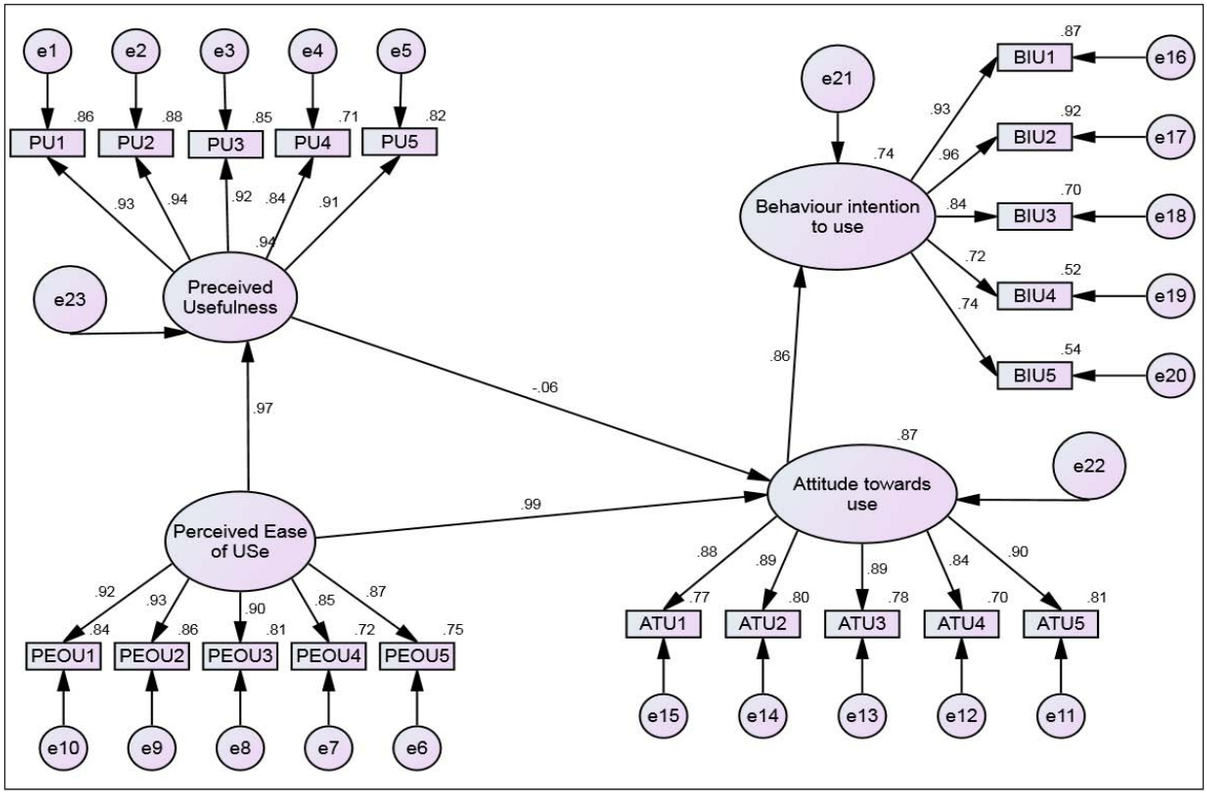


Table 4: Results Summary

Hypothesis	*Path*	*Path Coefficient*	*p-value*	*Results*
H1	Perceived Usefulness → Attitude toward Usage	-0.06	0.866	*Not supported*
H2	Perceived Ease of Use → Attitude toward Usage	0.99	0.006	Supported
H3	Perceived Ease of Use → Perceived Usefulness	0.97	0.001	Supported
H4	Attitude toward Usage → Behavioural Intention to Use	0.96	0.001	Supported

in line with prior research done by Davis (1989) and Hu *et al.* (1999) about technology adoption factors.

This study helps provide cloud based software companies' insight into factors which help in cloud software adoption. It is recommended that cloud based software providers should adopt a mobile first strategy since mobile is gradually becoming a customer preferable mode of computing device due to mobility and ease of use it offers. Customer prefers using a cloud application on mobile due to ease it offers. They should also focus on providing flexible payment options depending upon user country and a seamless integration of payments which enhances user's experience. Other important insight is about industry users having a positive attitude towards cloud based software. Cloud based software is no longer just a project being considered for pilot or trial use. It has well-established ground based upon business benefits it offers and is already been used by small and large companies around the globe. A strong positive opinion of industry stakeholders & decision makers about of cloud based software has significantly affected the behaviour intention of users to use cloud based software for their jobs.

It is evident that major companies such as IBM, Oracle, SAP and Microsoft which have been dominating the industry software space since last 50 years gradually moving their software portfolio on cloud. More and more software are being offered by them on cloud as users find it easy to adopt a cloud based software as compared to traditional on premise software. This change in user

behaviour, with growing preference for cloud based software adoption also opens up tremendous opportunity for new entrepreneurs.

Entrepreneur can quickly launch a new cloud based software application sitting anywhere in the world without a lot of capital expenditure. Also cloud computing has enabled companies to enter international and global market easily.

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