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Determinants of Cloud Computing Adoption: A Comparative Study

Shailja Tripathi[1,*], Vaibhav Mishra[2]

[1]ICFAI Business School (IBS Hyderabad), IFHE University, India, shailja.tripathi@ibsindia.org
[2]ICFAI Business School (IBS Hyderabad), IFHE University, India, vaibhav.mishra@ibsindia.org

Abstract

Background: *This study investigates the determinants that influence the user's behavioral intention to use cloud computing in adopter and non-adopter firms. The research model is based on the theory of the Valence Framework of Behavioral Beliefs and Technology Acceptance Model (TAM). The present study examined the factors of perceived ease of use, perceived usefulness, perceived ubiquity, perceived benefits, perceived costs and perceived risks in determining behavioral intention to use cloud computing for the adopter and non-adopter firms.*

Method: *Data were collected using a questionnaire-based survey method. The valid responses received were 458. The sample size of adopters and non-adopter of cloud computing were 239 and 219, respectively. Exploratory Factor Analysis (EFA) and Structural Equation Modeling (SEM) was used for data analysis. Data analysis was done separately for both samples of the adopter and non-adopter firms The results showed that, for adopters firms, perceived usefulness, perceived ease of use, ubiquity, perceived benefits, and perceived risks were found to have a significant and direct influence on behavioral intention to use cloud computing. For non-adopters, perceived usefulness, perceived ubiquity, perceived benefits, perceived costs, and perceived risks were found to have a significant and direct influence on behavioral intention to use cloud computing. A comparison testing was also performed by examining the difference in the strength of path coefficients between adopters and non-adopters firms.*

Results: *The findings showed that the impact of favorable factors of perceived ubiquity and perceived benefits were found relatively more significant in the case of adopter firms than negative factors. Likewise, the impact of negative factors of perceived risks and perceived costs were found relatively more significant in the case of non-adopter firms.*

Conclusions: *The major contribution of this study is that it contributes to the understanding of progressive changes in the impact of behavioral beliefs and cognitive factors on behavioral intention to use cloud computing in adopter and non-adopter firms. This study also provides managers' practical understandings for cloud computing adoption during each phase of the adoption process.*

Keywords: Cloud Computing, Technology Acceptance Model, Valence Framework, Structural Equation Modeling, Behavioral Intention.

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Introduction

Cloud Computing allows data to store, manage and process online without the need for installation on personal physical computer or network (Marston et al, 2011). It also refers to the delivery of computing services like servers, storage, databases, networking, software and analytics over the Internet. According to a recent report by Gartner (2017), India's spending on IT will be 87.1billion dollars in the year 2018 with a 9.2% increment in comparison to the previous year. In the same line, Rao (2018) highlighted that India's spending on public cloud's Infrastructure as a Service (IaaS) and Software as a Service (SaaS) is set to reach $1 billion each. Likewise, Aggarwal (2017) reported that with the increasing growth and usage of Cloud Computing in Indian firms, it is expected to generate over 1.1 million new jobs by 2022. As Cloud Computing Technology (CCT) provides immense IT capability and cost-saving benefits for all types of organizations, its adoption is gaining thrust and rising very fast. Liu et al. (2018) highlighted that cloud infrastructure flexibility and integration are important to improve the firm's agility. According to Riera & Iijima (2019), digital business value can be achieved by using digital technologies like cloud computing and can be measured by the level of achievement that the organization had over the years as per its business objectives. CCT allows data to be stored on many remote virtual servers and can be hosted by a third-party service provider. Dropbox is an example of huge file storage on the cloud that can be accessed from any device through the Internet. According to Thakurta et al. (2018), currently many organizations have already relocated from on-premise systems to cloud computing service because it provides higher performance, better functionality, reduce operating costs and improved usability.

The four deployment models of cloud computing are public, private, hybrid and community cloud (Mell & Grance, 2011). Public cloud services are available publicly through the Internet. Gmail, Hotmail, Google docs are examples of this model. Private cloud services can be accessed under the control of the IT department of a company and only authorized users can be accessed through a secure VPN connection such as Microsoft Exchange. Hybrid cloud is the blend of the public and private cloud where user can store confidential data on private cloud whereas general data can be stored on the public cloud. In a community cloud, two or more organizations set up their own private cloud data center that has common interests and for their sharing purpose (Gupta et al, 2013). Mell & Grance (2011) highlighted that the three most popular service models of cloud computing are Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). IaaS is the lowest-level cloud service model that provides pre-configured hardware resources to users through a virtual interface such as Amazon's EC2, IBM's SoftLayer, and Google's Compute Engine. PaaS provides a platform to users for the development and managing the applications. It includes operating systems and a set of development tools like Google's App Engine, IBM's BlueMix, and Apache's Stratos. SaaS provides the application over the internet and can be directly used by the end-users, for example, Office365 and Salesforce.

Mell & Grance (2011) reported that the five characteristics of CCT are on-demand self-service, broad network access, resource pooling, rapid elasticity, and measured service. On-demand self-service specifies independent provisioning of resources without human interface with the provider while broad network access deals with the delivery of services over a network (Vouk, 2008; Marston et al, 2011). Resource pooling is providing a group of computing resources like storage, processing, memory, bandwidth, etc. to multiple customers. Rapid elasticity specifies that resources are dynamically scaled up and down with demand and, finally, measured service denotes the spontaneous control and effective use of computing resources on a subscription basis (Leavitt, 2009; Vaquero et al., 2009; Lin & Chen, 2012).

This study focus on identifying the factors that influence behavioral intention to use cloud computing. Past studies (Behrend et al., 2011; Wu et al., 2011; Obeidat & Turgay, 2012; Aharony, 2015; Arpaci, 2017) based on individual adoption of cloud computing only focus on

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personal characteristics related factors and cognitive factors of cloud computing adoption. Therefore, this study is highly motivated to include both positive and negative utility factors of behavioral beliefs in addition to cognitive factors in analyzing behavioral intention to use cloud computing.

The objective of this study is to empirically test a research model on behavioral intention to use cloud computing that includes positive and negative behavioral beliefs of the Valence Framework and cognitive factors of the Technology Acceptance Model (TAM). Specifically, this study answers the following research questions (1) influence of cognitive factors like perceived usefulness and perceived ease of use on behavioral intention to use cloud computing; (2) influence of positive utility and negative utility factors of behavioral beliefs on behavioral intention to use cloud computing; (3) Progressive changes of impact of the above factors on behavioral intention to use cloud computing from non-adopter to adopter firms. Therefore, this research intends to contribute to an enhanced theoretical understanding of the factors that influence behavioral intention to use cloud computing for non-adopter firms. This study also captures the differential impact of these factors among adopter and non-adopter firms.

Theoretical background

The Valence Framework of Behavioral Beliefs

The valence framework is a well-grounded consumer decision-making theory founded by Peter & Tarpey (1975), which explains consumer's behavioral intention by considering both positive and negative aspects of behavioral beliefs. The framework includes ‘‘perceived risk" and "perceived benefit" models in which the perceived risk model assumes that consumer acts to minimize any expected negative utility associated with adoption behavior, while the perceived benefit model focuses on the maximization of expected positive utility of consumer adoption behavior. Besides, Kim et al. (2009) also found that the valence framework is an appropriate model in explaining consumer online shopping behavior. This implies that this framework can be used to analyze the positive and negative impact of any IT on its adoption behavior. Similarly, Lu et al. (2011) adopted the valence framework to study the adoption of online banking to test and confirm its influence on both positive and negative behavioral beliefs. Likewise, Yang et al. (2012) applied valence framework and found that positive beliefs like a relative advantage, compatibility and negative beliefs like perceived risks, perceived fee are all important factors for mobile payment services adoption and use. The valence framework was also integrated with a health belief model to study the adoption of online health information services and found that perceived risk had a significant impact on acceptance (Mou et al., 2015).

Technology Acceptance Model (TAM)

Theory of Reasoned Action (TRA) and Technology Acceptance Model (TAM) have been widely used as the primary theoretical framework for understanding and explaining an individual’s adoption behavior in the field of information technology (Davis et al., 1989; Ajzen, 1991). The original TAM examined the mediating role of perceived usefulness and perceived ease of use and their relationships between external variables and the probability of information systems adoption (Wu & Wang, 2005). For a long time, TAM proved to be a useful theoretical model in helping to understand and explain usage behavior in information systems implementation (Legris et al., 2003). Later, Venkatesh & Davis (2000) proposed TAM2 by including subjective norms as a determinant of perceived usefulness in the original TAM model. Legris et al. (2003) declared that the TAM and TAM2 explained only 40% of the variance in use and concluded that TAM should be integrated with other models to increase its predictive capacity. Corresponding to this criticism, a unified theory of acceptance and use of technology model (UTAUT) was developed by Venkatesh et al. (2003) based on a thorough review of user adoption literature and eight prominent models including TRA, Theory of Planned Behavior (TPB), TAM and the innovation diffusion theory (DOI). Later TAM3 was developed by Venkatesh & Bala (2008) with determinants of both perceived usefulness and perceived ease of use and they also recommended future research directions on interventions based on these factors.

Earlier studies had investigated different models to study cloud computing adoption at the individual level. In the same direction of cloud computing SaaS adoption, Benlian & Hess (2011) analyzed the risks and opportunities in adopter and non-adopter firms from the perspective of IT executives. By using the TRA model, they found that cost advantages and security threats were the dominant factors for both adopter and non-adopter forms while economic risks were found as a critical risk factor for non-adopter firms. Likewise, Wu (2011) used the TAM-diffusion model to examine the important factors influencing the adoption of SaaS and found that perceived usefulness and perceived ease of use are two key factors of behavioral intention. This implies that perceived ease of use and perceived usefulness are two important factors that influence behavioral intention to use cloud computing. Similarly, Behrend et al. (2011) used TAM3 to examine the factors that influence cloud computing adoption in urban and rural community colleges of higher education and found that usage of cloud computing was influenced by perceived ease of use. With the help of the integration of the duo-theme decision-making trial and evaluation laboratory (DEMATEL), with TAM, Wu et al. (2013) found that intervention activities, such as training, organizational support and peers' support, etc. are important to increase the usage of cloud computing.

To check the adoption of cloud computing, Obeidat & Turgay (2013) integrated TAM and Social Exchange Theory model and found that cloud computing adoption takes place when cloud advantages outweigh the disadvantages of cloud computing adoption. Using TAM, Aharony (2015) examined the factors that might affect librarians and information specialists in making cloud computing adoption decisions in their firms. His findings showed that high scores in PEOU and personal innovativeness were due to high scores in the adoption intention of cloud computing. Likewise, TAM was applied and validated by Lal & Bharadwaj (2016) among IT executives and found that cloud computing adoption decision is impacted by the factors like easy to use interface, experience, and cloud service provider expertise and top management support. Similarly, extended TAM was used by Sharma et al. (2016) to assess the factors that affect cloud computing adoption by IT professionals and found that computer self-efficacy, perceived usefulness, trust, perceived ease of use, and job opportunity are the dominant factors of cloud computing adoption. Likewise, TAM was applied by Arpaci (2017) to inspect the antecedents and consequences of cloud computing adoption in education and found that training and education were impacted by perceived ease of use. In the same way, TAM-diffusion theory model was also applied by Asadi et al. (2017) to investigate the determinants of cloud computing adoption in the banking sector from the perspective of a customer and found that trust, cost, security, and privacy constructs had a strong positive effect on perceived usefulness, perceived ease of use, and trust. Their findings also showed the significant effects of perceived usefulness, perceived ease of use, cost, attitude towards cloud and trust on behavioral intention to adopt cloud computing. Kumar et al. (2017) applied an integrated model founded on Technology Acceptance Model (TAM), Diffusion of Innovation (DOI) and Technology-Organization-Environment (TOE) to examine cloud computing adoption by SMEs in India. They found that relative advantage, security concerns, top management support, external pressure, and service providers' support are the dominant factors in this regard. Li et al. (2019) evaluated the factors the cloud service transformation intentions in SMEs by integrating the two aspects of benefits and trust in analyzing cloud service transformation in SMEs. The study found that both trust and benefit significantly affect SMEs' transformation toward cloud computing services. Appendix A. shows the related literature review of cloud computing adoption.

Conceptual model and research hypotheses

The model focuses on the extension of TAM by incorporating the valance framework of behavioral beliefs. Valence framework considers both positive and negative aspects of behavioral beliefs. Perceived ubiquity and perceived benefits are considered as positive beliefs whereas perceived risks and perceived costs as negative beliefs in the valence framework. Figure 1 demonstrates the conceptual model and related hypotheses that the current study intends to examine.

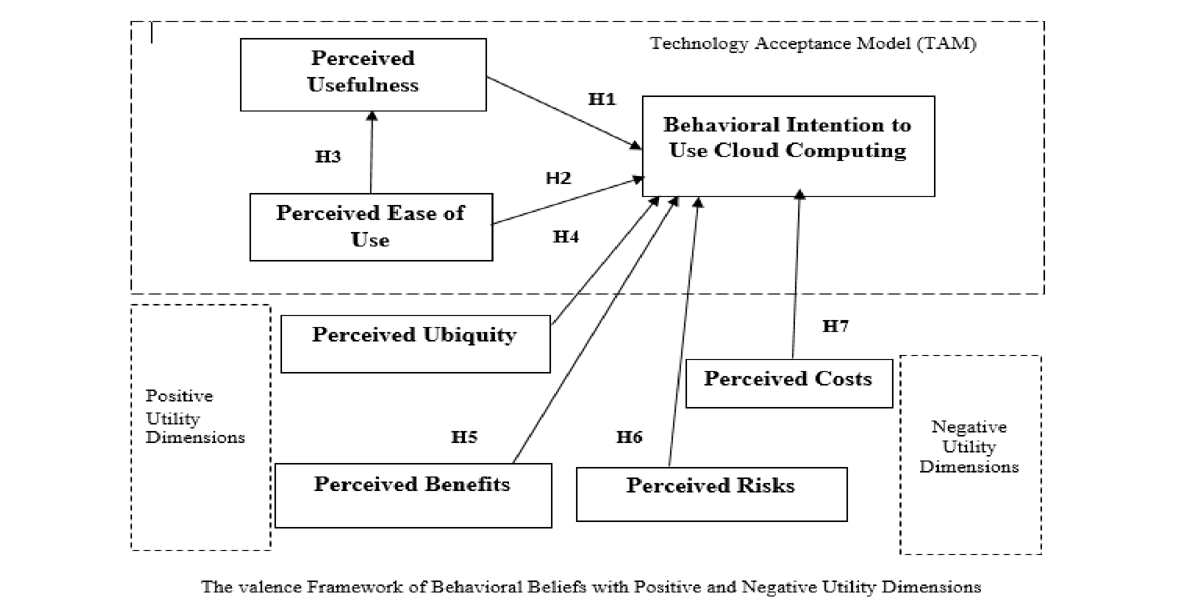

Figure 1 - Research Model

TAM proposes that behavioral intention to use technology depends on two beliefs - Perceived Usefulness and Perceived Ease of Use (Venkatesh & Bala 2008). Davis et al (1989) found a direct effect of Perceived Usefulness on adoption intention and also both a direct and indirect effect of perceived ease of use on intention through perceived usefulness. In the case of cloud services, Senk (2013) and Liu et al. (2018) reported cloud services can improve the business efficiency, agility, performance as well as productivity, thus perceived usefulness is an influential factor of its intention to use in the organization. Behrend et al. (2011) demonstrated in their study that ease of use of cloud services leads to its intention to use in the organization. Given the above, the following two hypotheses have been proposed to show the influences of perceived usefulness and perceived ease of use on behavioral intention to use cloud computing.

H1: Perceived Usefulness positively influences behavioral intention to use cloud computing.

H2: Perceived Ease of Use positively influences behavioral intention to use cloud computing.

According to Davis (1989), perceived ease of use has a significant direct influence on perceived usefulness. When two systems are performing the same set of functions, the user should opt for the system that is easier to operate and more useful. Therefore, perceived ease of use may have a positive influence on perceived usefulness in cloud computing adoption.

H3: Perceived Ease of Use positively influences Perceived Usefulness.

The positive utility dimension in the valence framework measures the extent of relative benefit that users may derive by adopting services. The availability and accessibility of cloud computing services can be possible anywhere and anytime and this particular characteristic represents the ubiquitous nature of cloud computing. The ubiquitous nature of cloud computing helps the user to access the information or applications through their own device irrespective of their locations. The perceived benefits of cloud computing services are related to operational benefits that are expected by a firm from cloud computing adoption. The benefits include mobility, efficient reduction of costs, easy installation and maintenance and easy analysis of data over the internet (Armbrust et al., 2010; Hsu et al., 2014). According to Ross & Blumenstein (2013), perceived benefits of cloud computing represent cost reduction, scalability, portability, as well as reduced software and hardware obsolescence According to Hsu et al. (2014), perceived benefits affect the cloud computing adoption in the firms. Therefore perceived ubiquity and perceived benefits are considered as the positive utility dimensions in the study and may have a positive effect on behavioral intention to use cloud computing.

H4: Perceived Ubiquity positively influences behavioral intention to use cloud computing.

H5: Perceived Benefits positively influence behavioral intention to use cloud computing.

The negative utility dimension of the traditional valence framework is associated with its adoption behavior and is reflected through perceived risks and perceived costs. Prior studies have indicated that perceived risk and perceived fee are the two major factors for consumers' resistance to the finance-related mobile services (Luarn & Lin, 2005). In the present study, the non-monetary expenses are measured based on perceived risk, while the monetary expenses are assessed based on perceived costs. The implementation of cloud computing involves various investments to procure hardware, software, and networking. Hence, costs will be a deciding factor to go for cloud computing adoption and it is hypothesized that there is a negative influence of perceived costs on behavioral intention to use cloud computing. Ross & Blumenstein (2013) highlighted that the cloud raises several apprehensions about security and privacy in storing data. Security, privacy, and data integrity are the concerns that make firms cautious in adopting cloud computing technology (Truong, 2009). Therefore perceived costs and perceived risks may have a negative effect on behavioral intention to use cloud computing.

H6: Perceived Risks negatively influence behavioral intention to use cloud computing

H7: Perceived Costs negatively influence behavioral intention to use cloud computing.

Research Methodology

Data Collection and Sample

A quantitative research approach, using a questionnaire was adopted for data collection. The study targeted senior managers (CIO, IT manager and other senior staff) of firms as a sample population, who are responsible for making IT decisions in the organizations and must have at least two years of experience in cloud computing. The respondents are selected from the database of a project consultancy company, NIIR (National Institute of Industrial Research), which includes 7448 of SMEs and large firms of India. The firms belong to the sectors of IT, service, manufacturing, finance, and telecommunication, which have high cloud computing adoption rates as per CIO report (2010). The locations of the companies are Hyderabad, Bangalore, Mumbai, Chennai, and Delhi. Simple random sampling was performed to determine samples for this study. The simple random sampling method is a type of probability sampling technique where the selection of items entirely depends on chance. The sample size of 1000 respondents was selected for the survey. According to Dillman's (1999), questionnaires must send out to the respondents after the first-round contact through telephone to confirm their willingness to participate in the survey.

Senior managers were also asked about their experience in cloud computing and the duration of using cloud computing in their firms. Then finally, the questionnaires were sent to these managers through email or google form link. The data collection process lasted for approximately eight months, starting on December 17th, 2017 until September 14th, 2018. 490 responses were received who filled out the questionnaires, but only 458 (45.8%) valid respondents which become the final sample size for data analysis. Among 458 respondents, 239 respondents belong to the adopter and the other 219 from non-adopter firms. So data analysis was done separately for both samples of 239 adopter firms and 219 non-adopter firms. 84.4% and 85.5% of respondents are male in the case of adopter sand non-adopter of cloud computing respectively. Most of the respondents were between the age group of 25-30 years in both the samples. Likewise, most of the respondents have 5-10 years of experience in the area of cloud computing. Both adopter and non-adopter firms are mostly large-sized firms. The demographic information of the respondents is shown in Table 1. Table 2 shows the demographic analysis of adopter and non-adopter firms in terms of the type of industry, size and organizational structure of firms.

Instrument Development

All items in the questionnaire were adapted from pre-validated studies in the field of information systems. The scale items are converted to cloud computing context. Question items required to identify the relative contribution of all factors in the research model towards behavioral intention to use cloud computing. The final questionnaire contained total 33 questions on seven different constructs of the proposed research model, including perceived usefulness (5 items), perceived ease of use (6 item), perceived ubiquity (3 items), perceived benefits (6 items), perceived costs (3 items), perceived risks (7 items), and behavioral intention to use cloud computing (3 items). A pilot study was conducted among researchers and experts to make sure that the questionnaire is suitable for the research context. In this phase, the questionnaire was reviewed first by three IS professional who has more than ten years' of experience in cloud computing before the distribution. The questionnaire is then customized based on their suggestions. Each item of the construct was measured using a 5-point Likert scale, with values ranging between 1 (strongly disagree) and 5 (strongly agree). A questionnaire link was created with the help of google form. Google form is an online service provided by Google and is relatively effective in terms of time, effort, and cost. This link was sent to the email-id of the respondents.

Five items of perceived usefulness such as usefulness, efficiency, effectiveness, performance, and productivity have adopted from Davis et al. (1989) and Venkatesh & Davis (2000). Likewise, six items of perceived ease of use such as easy to learn, require less mental effort, clear and understandable, flexible, easy to become skillful and simple to use have adopted from Davis et al. (1989) and Venkatesh & Davis (2000). Three items of behavioral intention such as "I will use cloud computing in the next 6 months", "I expect to be a regular user of cloud computing" and "I intend to use cloud computing in the next 6 months" have adopted from the scale of Davis et al. (1989) and Venkatesh & Davis (2000). All the above scales are related to other technologies; hence the scale items are modified in the cloud computing context.

For the construct, perceived ubiquity, the three items have adopted from Kimand Garrison (2009) such as "providing communication and network accessibility", "anytime-and-anywhere communication and connectivity", and "using technology for personal and business purposes". Likewise, for the construct perceived benefits, six items of customization, easily analyze data on the internet, reduce deployment time, reduce IT costs, reduce IT employees costs and ubiquitous access have adopted from Hsu et al. (2014). Similarly, seven items of confidentiality, incompatibility, insufficient service quality guarantee, Internet bottleneck, service outages, underperformance and vendor lock-in, for the construct perceived risks, have adopted from the scale of Hsu et al. (2014). For the construct perceived costs, items such as set-up cost, maintenance cost, and training cost have adopted from the scale of Premkumar & Roberts (1999) and Kuan & Chau (2001). Appendix B. presents a summary of these items and related references.

Data Analysis and Results

Exploratory Factor Analysis (EFA) and Structural Equation Modeling (SEM) were used for data analysis. Under SEM, confirmatory factor analysis (CFA) and Path Analysis were done. According to Ruscio & Roche (2012), it is best to conduct EFA before proceeding to CFA in the case of very little a priori knowledge of developed structural. Therefore, EFA was performed to test the basic structure of the factor. Then construct reliability, construct validity and goodness of model fit were checked through CFA. In the end, to examine the proposed hypotheses and structural model fit, path analysis was performed.

Exploratory Factor Analysis (EFA) was performed to identify the set of items that represent the dimensions of each of the larger constructs of the measurement model. Data analysis was conducted by structured equation modeling using AMOS 20 to examine the measurement and structural model in the proposed framework. Confirmatory Factor Analysis (CFA) was performed by following the two-step approach recommended by Anderson & Gerbing (1988), firstly the measurement model was examined and construct reliability and validity were tested. Then, the structural model was examined, and the hypotheses were tested.

Descriptive Statistics

Table 1 presents the demographic statistics for both adopters and non-adopter. The statistics showed that 84.4% and 85.5% of respondents are male in the case of adopter sand non-adopter of cloud computing respectively. Most of the respondents were between the age of 25 and 30 in both the samples. Hence the two samples had a similar distribution in terms of gender and age. The distribution in terms of the overall experience was different in the two samples. Most of the respondents have 5-10 years of experience in the area of cloud computing in the case of the adopter (62.3%) and non-adopter firms (45.6%). In the adopters' sample, 4.2% of respondents had between 10 to 15 years of experience whereas in the non-adopter sample the percentage of respondents of this category was 18.7%. Similarly, in the adopters' sample, 6.3% of respondents had more than 15 years of experience whereas in the non-adopter sample the percentage of respondents of this category was 11.8%.

Table 1 - Profile of Respondents

	Firms		
Age	**Adopter (239)**	**Non-adopter (219)**	**Adopter and Non-adopter**
25-30	132	92	224
30-40	77	75	152
40-50	23	39	62
>50	7	13	20
Gender			
Male	201	194	395
Female	38	25	63
Overall Experience			
2-5 years	65	52	117
5-10 years	149	100	249
10-15 years	15	41	56
>15 years	10	26	36

In the case of respondents profile based on industry as shown in Table 2, most of the responses received from the IT industry i.e. 57.7% from adopters and 42% from non-adopters. The next larger responses received from the service sector i.e. 24.2% from adopter firms and 29.7% from non-adopter firms. Most of the adopters (74.8%) and non-adopters (50.2%) firms are large-sized firms. Most of the small-sized firms belong to non-adopters i.e. 33.7% whereas adopter firms consist of 22.2 % of small-sized firms. Similarly, most of the non-adopters (15.9) firms are medium-sized whereas only 2.9% of medium-sized are adopter firms. In the case of organizational structure, Most of the non-adopter firms (45.6%) have simple organization structure and most of the adopter firms (51.4%) have a hierarchical structure.

Table 2 - Respondents Profile based on Industry

	Firms		
Type of industry	**Adopter (239)**	**Non-adopter (219)**	**Adopter and non-adopter**
IT	138	92	230
Services	58	65	123
Finance	19	18	37
Manufacturing	12	19	31
Others (Retail, Telecommunication, and Pharmaceuticals)	12	25	37
Firm Size			
Small	53	74	127
Medium	7	35	42
Large	179	110	289
Organization Structure			
Simple	83	100	183
Hierarchical	123	72	195
Functional	9	26	35
Others (Divisional and Matrix)	24	21	45

Reliability and Validity

Both EFA and CFA were performed to assess the reliability and validity of the scales. The Kaiser Meyer Olkin (KMO) measure of sampling adequacy for adopters sample and non-adopters sample was 0.838 and 0.788, respectively, indicating the appropriateness of using the principal components factor analysis on the data. Bartlett's test of sphericity also produced a significant test result by rejecting the null hypothesis. Each item has a greater loading on its corresponding factor than the cross-loadings on other factors, showing a clear loading matrix. Construct reliability and validity were further examined by confirmatory factor analysis. As shown in Table 3, the Cronbach's α (alpha) were all above 0.8, indicating good reliabilities of the scales (Nunnally & Bernstein, 1978). The average variance extracted (AVE) for each construct was above 0.6, representing good convergent validities (Baggozi & Yi, 1988). Discriminant validity was examined by comparing the square root of the AVE of each construct and its correlation coefficients with other constructs. As shown in Table 4 and Table 5, for both datasets, the square roots of the AVEs are larger than all corresponding correlation coefficients, suggesting good discriminant validities of the scales (Hair et al., 2010).

Table 3 - Scale properties

Variable	Item	Standard Loading	Adopters Cronbach's α	Adopters AVE	Non-Adopters Standard Loading	Non-Adopters Cronbach's α	Non-Adopters AVE
PU	PU1	0.72	0.89	0.62	0.68	0.88	0.57
	PU2	0.75			0.72		
	PU3	0.79			0.75		
	PU4	0.81			0.78		
	PU5	0.87			0.83		
PEOU	PEOU1	0.74	0.92	0.67	0.74	0.92	0.66
	PEOU2	0.79			0.79		
	PEOU3	0.76			0.76		
	PEOU4	0.84			0.84		
	PEOU5	0.83			0.83		
	PEOU6	0.90			0.89		
PUB	PUB1	0.81	0.89	0.73	0.80	0.89	0.73
	PUB2	0.87			0.86		
	PUB3	0.89			0.89		
PB	PB1	0.80	0.96	0.79	0.79	0.96	0.78
	PB2	0.85			0.85		
	PB3	0.88			0.88		
	PB4	0.91			0.91		
	PB5	0.93			0.92		
	PB6	0.93			0.93		
PR	PR1	0.79	0.96	0.77	0.79	0.96	0.76
	PR2	0.82			0.82		
	PR3	0.84			0.84		
	PR4	0.89			0.88		
	PR5	0.91			0.91		
	PR6	0.92			0.92		
	PR7	0.95			0.93		
PC	PC1	0.88	0.91	0.78	0.87	0.91	0.78
	PC2	0.89			0.88		
	PC3	0.89			0.89		
BI	BI1	0.84	0.93	0.81	0.84	0.93	0.81
	BI2	0.91			0.91		
	BI3	0.95			0.94		

To assess the potential common method bias of our self-reported data, Harman's one-factor test as proposed by Podsakoff & Organ (1986),was performed on the constructs and found that seven factors are present and the covariance explained by one factor in non- adopters' dataset and adopters' dataset is 14.52% and 15.49% respectively. This specifies the datasets used in this study are free from the problem of common method bias.

Table 4 - Factor correlation coefficients and square roots of the AVE (Adopters Firms)

Constructs	PU	PEOU	PUB	PB	PR	PC	BI
PU	**0.62**						
PEOU	0.01	**0.67**					
PUB	0.01	0.02	**0.73**				
PB	0.05	0.05	0.13	**0.79**			
PR	0.11	0.04	0.05	0.22	**0.77**		
PC	0.08	0.08	0.02	0.55	0.17	**0.78**	
BI	0.02	0.22	0.06	0.21	0.19	0.11	**0.81**

Table 5 - Factor correlation coefficients and square roots of the AVE (Non-adopters)

Constructs	PU	PEOU	PUB	PB	PR	PC	BI
PU	**0.57**						
PEOU	0.11	**0.63**					
PUB	0.12	0.12	**0.73**				
PB	0.04	0.05	0.11	**0.78**			
PR	0.05	0.03	0.15	0.11	**0.76**		
PC	0.23	0.07	0.01	0.14	0.03	**0.78**	
BI	0.02	0.02	0.03	0.18	0.21	0.23	**0.81**

The actual and recommended values of the model fit indices are listed in Table 6. Except for GFI and NFI in non-adopter's dataset were slightly below the recommended values, the actual values of all other fit indices were better than the recommended value of 0.90 or above, which demonstrate a good fit between the model and data (Gefen et al., 2000). This study derived RMSEA as 0.047 for adopter firms and 0.053 for non-adopter firms, which is in good agreement with the ranges of values reported by Hair et al. (2010) and Byrne (2001).

Table 6 - Fit indices and recommended values

Fit index	χ^2/df	RMSEA	GFI	CFI	NFI	NNFI
Recommended value	<3	<0.08	>0.90	>0.90	>0.90	>0.90
Adopters value	2.25	0.047	0.932	0.927	0.951	0.967
Non Adopters value	1.69	0.053	0.886	0.918	0.898	0.954

Notes: RMSEA, root mean square error of approximation; GFI, goodness of fit index; CFI, comparative fit index; NFI, normed fit index; NNFI, non-normed fit index.

Results

The sample size of adopters and non-adopter of cloud computing are 239 and 219, respectively. Therefore, the sample sizes are large enough for PLS. Path analysis was performed using partial least squares (PLS) to test the consistency of the results across different statistical methods. The measurement model was converted to a structural model to test the proposed hypotheses. The simplified structural models are shown in Figure 2 and Figure 3 for the adopter and non-adopter firms. The hypotheses proposed were tested using standardized regression weight estimates and p-values, as shown in Table 7. In terms of behavioral intention to use cloud computing, the positive effects of perceived usefulness (Hypothesis 1) were supported by both adopter and non-adopter firms. The positive effect of perceived ease of use (Hypothesis 2) on behavioral intention was supported in the case of non-adopter firms but not for adopter firms. The positive effects of perceived ubiquity (Hypothesis 4) and perceived benefits (Hypothesis 6) on behavioral intention were supported in the case of both adopter and non-adopter firms. The negative effect of perceived risk (Hypothesis 7) on behavioral intention was also found to be significant for both adopter and non-adopter firms. The negative effect of perceived costs (Hypothesis 5) on behavioral intention was found significant for a non-adopter firm but was not found significant for adopter firms. The mediating effect of perceived ease of use on perceived usefulness and behavioral intention (Hypothesis 3) was also found significant for both adopter and non-adopter firms.

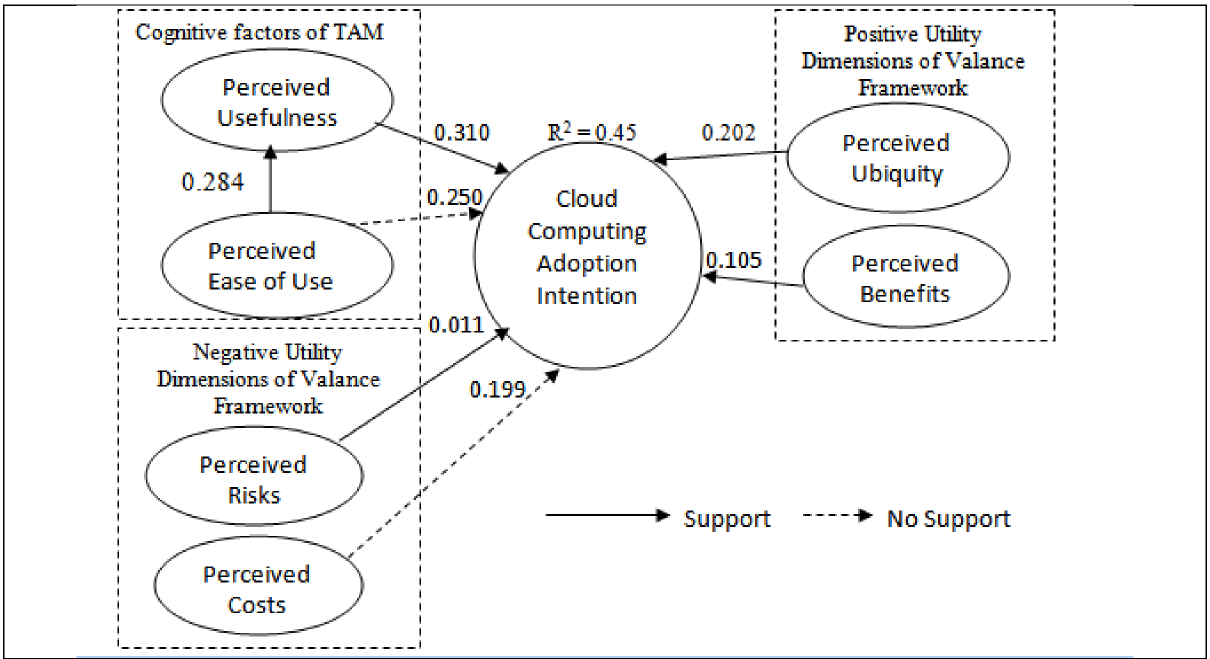

Figure 2 - Structural Model (Non-Adopter Firms)

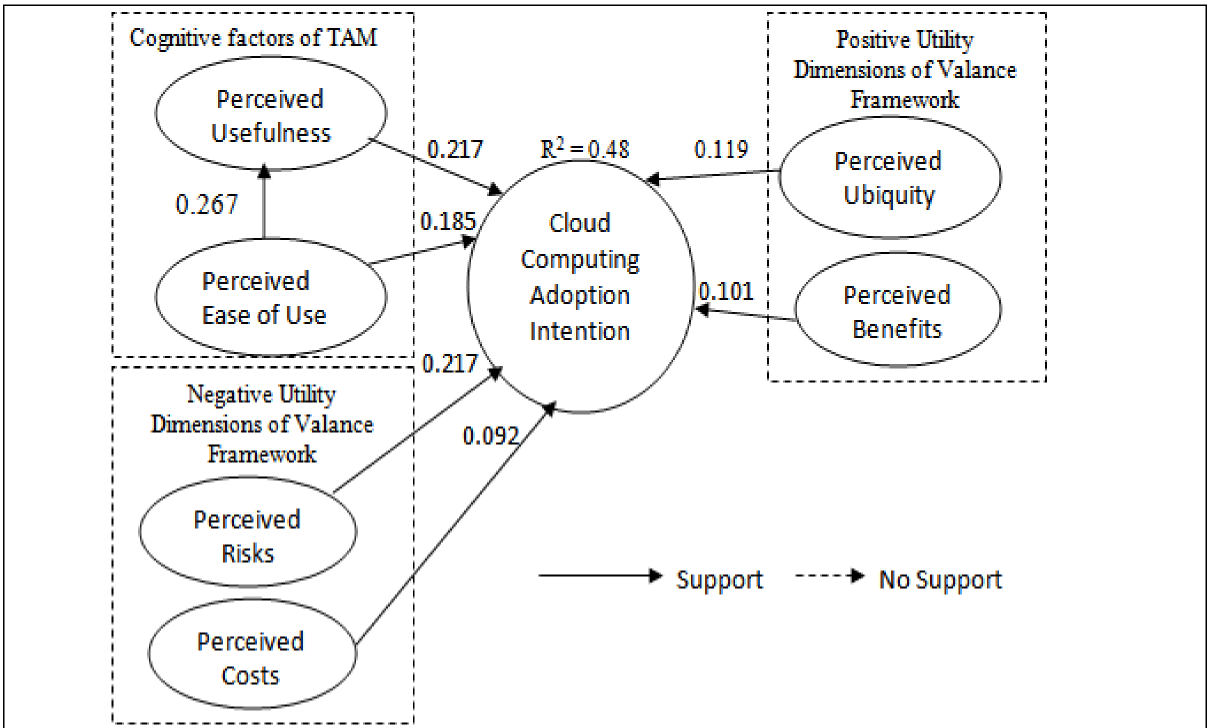

Figure 3 - Structural Model (Adopter Firms)

Table 7 - Model comparison results between adopters and non-adopter firms

Path	Standardized path coefficients (Non-Adopter Firms)	p-values	Support	Standardized path coefficients (Adopter Firms)	p-values	Support
PU→BI	0.310	***	Yes	0.217	***	Yes
PEOU→BI	0.254	0.23	No	0.185	0.01	Yes
PEOU→PU	0.284	***	Yes	0.267	***	Yes
PUB→BI	0.202	0.04	Yes	0.119	0.03	Yes
PC→BI	0.199	0.11	No	0.092	0.03	Yes
PB→BI	0.105	***	Yes	0.101	***	Yes
PR→BI	0.011	0.02	Yes	0.217	0.04	Yes

Discussion

The present study examined the factors of perceived ease of use, perceived usefulness, perceived ubiquity, perceived benefits, perceived costs and perceived risks in determining behavioral intention to use cloud computing for the adopter and non-adopter firms. The following findings emerge from our analysis. For adopters, perceived usefulness, perceived ease of use, perceived ubiquity, perceived benefits, and perceived risks are found to have a significant and direct influence on behavioral intention to use cloud computing. For non-adopters, perceived usefulness, perceived ubiquity, perceived benefits, perceived costs, and perceived risks are found to have a significant and direct influence on behavioral intention to use cloud computing.

The results of this study show that costs related to implementing cloud computing such as setup, maintenance, and training costs do not influence behavioral intention for adopter firms but it influences behavioral intention to use cloud computing for non-adopter firms. The findings coincide with the findings of Benlian & Hess (2011)that economic factor like costs is the most important factor for non-adopter firms of cloud computing as adopter firms satisfied with basic cloud computing economics. The relationship between perceived ease of use and the behavioral intention was found insignificant for adopter firms rather than non-adopter firms. This result is in good agreement with the findings of Venkatesh & Davis (2000) and Venkatesh & Bala (2008) that the influence of perceived ease of use on an intention to use become weakened over time once the user gets accustomed with the technology. The negative effect of perceived risks on both adopter and non-adopter firms was found significant in the study. This result is coinciding with the finding of Benlian & Hess (2011) that security threats of cloud computing were the dominant factors for both adopter and non-adopter forms. Perceived Ubiquity was found significant for both adopter and non-adopter firms as reported by Park & Ryoo (2013) and Hsu et al. (2014) that the main characteristics of cloud computing are omnipresence or ubiquitous access. Perceived Usefulness and Perceived Benefits were found significant for both adopter and non-adopter firms. This means that cloud providers should encourage more organizations to adopt and use cloud computing, by providing cloud services based on usefulness and benefits. In other words, cloud services are useful for an individual to carry out the task more quickly at the same time that it enhances customization and provide benefits like easy data analysis on Internet, reduce deployment time, reduce IT infrastructure costs and also reduce IT employee's costs.

A comparison testing was also performed by examining the difference in the strength of path coefficients between adopters and non-adopters as shown in Table 8. The table shows that the negative effect of perceived risk on behavioral intention is stronger for non-adopters than adopter firms. This result coincides with the findings of O'cass & Fenech (2003) that the user's perception of risk with the technology decreases over time. The table also showed that the positive effects of perceived usefulness, perceived ubiquity, and perceived benefits are stronger for adopter firms than non-adopters firms. The results are coinciding with the findings of Kwak et al. (2002) and Ristola (2010) that the adoption of technology is influenced by familiarity with its benefits and usefulness. It can be observed from table 8 that the impact of perceived ease of use on perceived usefulness was found stronger in the case of adopter firms. This finding coincides with the finding of Venkatesh & Davis (2000) that with increasing experience, the impact of perceived ease of use on perceived usefulness will be stronger because users find the technology more useful, once he or she becomes contented with the usage of the technology. Thus, the result supports Hypothesis 3.

Conclusions, Implications, and Limitations

This study covers several vital inferences for managers and the organization to focus on particular factors like perceived usefulness, perceived costs, perceived risks and perceived benefits that affect the successful adoption of cloud computing. Since in this study, data was collected from senior managers of the firm, the empirical analysis of data also gives several insights into the contribution and significance of these factors. The managers can examine advantages, disadvantages as well as business impacts of cloud computing adoption. Since perceived risks were found to have a negative influence on behavioral intention to use cloud computing for the adopter and non-adopter firms, this study provides an important managerial implication that cloud providers should give assurance of data security and privacy in a cloud computing environment. Companies should evaluate potential risks and qualitative benefits of technology to achieve an understandable business rationale (Kürschner et al., 2010). Therefore, cloud vendors should come up with promising risk-mitigation strategies by including mandatory security standards e.g., data encryption technologies and virtual private networks with cloud service to enhance its adoption in the organization.
The contributions of this study are that it provides all-inclusive insight into the decision making process of cloud computing adoption. This study also provides managers' practical understandings for cloud computing adoption during each phase of the adoption process. It contributes to the understanding of progressive changes in the impact of behavioral beliefs and cognitive factors on behavioral intention to use cloud computing in adopter and non-adopter firms. This is one of the first studies that examine the adoption of cloud computing using a combination of valence framework and technology acceptance model. Also, this study is first of its kind that identifies distinguishing factors related to the behavioral intention to use cloud computing from adopters to non-adopters.

This study has limitations in some ways. Firstly, a survey was done, covering a few Indian metropolitan cities like Hyderabad, Bangalore, Chennai, Mumbai, and Delhi that might not a true representation of the suitable population of India. Hence, future research may be focused to increase the sample size by covering all the metropolitan cities of India proportionally. Another limitation is there is no inclusion of control variables like firm size, organizational structure, and industry type and moderators such as age, gender, and experience in this study, which can make the model more robust.

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Appendix A. Related Literature on Cloud Computing Adoption

	Author	Factors		Country	Methodology
1.	Li et al. (2019)	Perceived benefit, Trust belief, Demand uncertainty, Information asymmetry, Information security, Vendor scarcity, Vendor scarcity, Cloud service transformation intention	Transaction cost theory (TCT) and agency theory models	China	Partial least squares (PLS)
2.	Liu et al. (2018)	CI flexibility, CI integration, operational agility, partnering agility and customer agility.	Theory of IT infrastructure capability.	China	Partial least squares (PLS) based structural equation modeling with Smart PLS 2.0.
3.	Alkhater et al. (2018)	Quality of service, Security, Privacy, Trust, Relative advantage, Compatibility, Top management support, Firm size, Technology readiness, Compliance with regulations, Physical location	An integrated model	Saudi Arabia	SEM analysis technique
4.	Raut et al. (2018)	Lack of security and privacy, Lack of sharing and collaboration, Lack of top management support, Lack of IT supply source, Lack of compatibility, Lack of finance, Lack of IT infrastructure, Lack of confidentiality Lack of integrity, Lack of operational and technical support, Lack of technology readiness, Lack of IT standards, Lack of global distribution network, Lack of partnerships	Literature Survey And Expert Opinions	India	Interpretive structural modeling (ISM) approach.
5.	Raut (2018)	Trust (T), management style (MS), technology innovation (TI), risk analysis (RA), and perceived IT security risk (PITR), decrease of internal systems availability (F1) (PITR cluster), utilization of internal resources, assurance of data privacy, innovativeness , and previous experience	TOE framework	India	A hybrid three-stage Structural Equation Modeling (SEM) - Artificial Neural Network (ANN) - Interpretive Structural Modeling

					(ISM) approach
6.	Saleem et al. (2018)	Complexity, compatibility, relative advantage, top management support, firm size, technical readiness, competitive pressure, and trading partner pressure,	Technological-organizational-environmental (TOE) framework	Capital of Jordan-Amman	Multiple regression analysis.
7.	Senarathna et al. (2018)	Relative advantage, security, privacy, flexibility, leadership awareness, flexibility, slack and interconnectedness, competitors, market, regulations and service	TOE Framework	Australia	Multiple regression methods used for data analysis
8.	Kumar et al. (2017)	Perceived usefulness, Perceived ease of use, Relative Advantage, Compatibility, Security and Privacy, Technology readiness, Top Management Support, Firm Size, External Pressure, Service Provider Support, Adoption Intention	An integrated model founded on Technology Acceptance Model (TAM), Diffusion of Innovation (DOI) and Technology-Organization-Environment (TOE)	India	Structural Equation Modeling
9.	Asadi et al. (2017)	Perceived Usefulness, Perceived Ease of Use, Perceived Benefits, Security and Privacy, Social Influence, Attitude towards CC adoption , Trust, Cost	TAM-diffusion theory model (TAM-DTM) with the introduction of three new constructs namely trust, cost, and security and privacy.	Malaysia	Survey data were analyzed using the partial least squares (PLS) method while SmartPLS was used to test the hypotheses and to validate the proposed model.
10.	Arpaci (2017)	Continued use intention, attitudes, perceived usefulness and ease of use, knowledge creation and discovery, knowledge sharing, knowledge storage, knowledge application, innovativeness and training and education	Technology Acceptance Model	Turkey	Structural equation modeling

11.	Priyadarshinee et al. (2017)	Perceived IT security risk, risk analysis, technology innovation, usage of technology, industry usage, trust, management style, cloud computing adoption and business performance	Ranking model	India	Analytic Hierarchy Process approach, n Exploratory Factor Analysis and Confirmatory Factor Analysis
12.	Haslinda Hassan (2017)	Top management support, IT resources, and employee knowledge, cloud computing adoption	Conceptual model	Malaysia	Partial Least Squares (PLS) (via SmartPLS version 2.0 software)
13.	Liu et al. (2016)	Cloud infrastructure flexibility (CI flexibility) and cloud infrastructure integration (CI integration), Partnering Agility, Market turbulence, firm performance, business lifecycle	Business lifecycle theory	China	The theoretical model was tested using PLS analysis.
14.	Sabi et al. (2016)	Awareness, Cost, Risk, Relative advantage, Compatibility, Complexity, Observability, Trialability, Results demonstrable, Ease of use, Usefulness, National infrastructure, ICT infrastructure, Intent to adopt & use	Integrated model based on Diffusion of Innovation theory and Technology Acceptance Model	SubSaharan Africa	Structural equation modelling (SEM) using SmartPLS
15.	Lal & Bharadwaj (2016)	Perceived Usefulness, Perceived Ease of Use, Relative advantage, Vendor Credibility, Organizational Flexibility, Cloud-based Service model adoption (SaaS, PaaS, IaaS)	TOE Framework and TAM	India	Conceptual paper
16.	Sharma et al. (2016)	Perceived Usefulness, Perceived Ease of Use, computer self-efficacy, trust, and job opportunity, CC adoption	TAM	Oman	Multiple linear regression (MLR) and neural network (NN) modeling
17.	Adjei (2015)	Service providers' ability, integrity and benevolence	A trust framework	Ghana	A combination of interviews and focus group discussions
18.	Gangwar et al. (2015)	Relative advantage , Compatibility, Complexity, Organizational competency, Top management support,	TAM-TOE framework	India	Exploratory factor analysis and confirmatory factor analysis

		Training and education, Competitive pressure, Trading partner support, Perceived ease of use, Perceived usefulness, Adoption intention			using SPSS AMOS
19.	Aharony (2015)	Personal innovativeness, perceived ease of use, threat and challenge, self-efficacy and openness to experience, computer use and social media use	Extended TAM	Israel	Hierarchical regression
20.	Gutierrez et al. (2015)	Relative advantage, top management support, competitive pressure, complexity, compatibility, firm size, technology readiness and trading partner pressure, cloud computing adoption	TOE	UK	Principal component analysis and logistic regression.
21.	Garrison et al. (2015)	trust, managerial capability, technical capability, Cloud-deployment performance.	Resource based View Model		structural-equations model using AMOS 7.0 analytical software
22.	Tsai & Hung (2014)	Service quality, the degree of maturity of infrastructure, price, the degree of technological maturity, R&D investment, perceived risk, economic situation, diffusivity of cloud application	framework of system dynamics	Taiwan	ANN (Artificial Neural Network)
23.	Hsu et al. (2014)	Perceived Benefits , Business Concerns (BC) , IT Capability , External Pressure, Adoption Intention	Technology–organization–environment (TOE) framework of innovation diffusion theory	Taiwan	Structural Equation Modeling
24.	Oliveira et al. (2014)	Security concerns, Cost savings, Relative advantage ,Complexity, Compatibility, Technology readiness, Top management support, Firm size, Competitive pressure, Regulatory support, Cloud computing adoption	A research model based on the innovation characteristics from the diffusion of innovation (DOI) theory and the technology-organization-environment (TOE) framework	Portugal	Analysis was done using Smart-PLS software

25.	Lian et al. (2014)	Data Security, Perceived Technical Competence, Cost, Top Manager Support, And Complexity, CIO Innovativeness, Compatibility, Adequate Resource, And Perceived Industry Pressure, Government Policy, Perceived Technical Competence, Cost, Benefits, Relative Advantage	TOE (Technology-Organization-Environment) framework and HOT-fit (Human-Organization-Technology fit) model	Taiwan	Analysis of Variance (ANOVA) technique
26.	Obeidat & Turgay (2013)	Perceived Advantages, Perceived Disadvantages, adoption intention, actual adoption	Applied Social Exchange theory into TAM	US	Paired tailed tests and the t-statistic
27.	Wu et al. (2013)	Perceived Usefulness, Perceived Ease of Use	The duo-theme decision making trial and evaluation laboratory (DEMATEL) with TAM	Taiwan	Case study methodology
28.	Ross & Blumenstein (2013)	Cloud-based business strategies	Resource view of the firm and transaction Costs economics	Australia	Qualitative research
29.	Alshamaila et al. (2013)	Relative advantage, uncertainty, geo-restriction, compatibility, trialability, size, topmanagement support, prior experience, innovativeness, industry, market scope, supplier efforts and external computing support, competitive pressure	TOE framework	England	Qualitative approach in the form of Semi structured interviews
30.	Gupta et al. (2013)	Cloud computing usage by SME, ease of use and convenience, security and privacy, reliability, sharing and collaboration, and cost reduction.	Conceptual Model	Singapore and neighboring countries like Malaysia, India	PLS (Partial Least Square) technique
31.	Park & Ryoo (2013)	Omnipresence, collaboration support, switching enablers, satisfaction with incumbent IT, breath use of incumbent IT, switching inhibitors, social influence, personal innovativeness ,	Two-factor model	Korea	PLS (partial least squares) approach

		intention to switch towards cloud			
32.	Lin & Chen (2012)	Relative advantage, compatibility, complexity, observability, and trialability	Diffusion of Innovation	Taiwan	Exploratory study which used a survey by interview approach
33.	Benlian & Hess (2011)	Cost advantages , Strategic flexibility, Focus on core competencies , Access to specialized resources, Quality improvements, Perceived risks, Perceived opportunities, Performance risk, Economic risk, Strategic risk, Security risk, Managerial risk	Theory of Reasoned Action.	Germany	PLS based structural equation modeling
34.	Wu (2011)	Perceived usefulness , Perceived ease of use, Behavioral Intention, Attitude towards Technology, Innovation, Security & Trust, Perceived Benefit and Social Influence	TAM	Taiwan	PLS path modeling
35.	Behrend et al. (2011)	Usefulness, ease of use, Access to personal copies of software, Reliability, Personal Innovativeness, Anxiety towards technology, Actual use, Intention for future use, future usefulness perceptions	TAM3	Southeastern USA	A path analytic model
36.	Low et al. (2011)	Relative advantage, top management support, firm size, competitive pressure, trading partner pressure and cloud computing adoption	TOE Framework	Taiwan	Logistic regression analysis.
37.	Truong (2010)	Customization, alignment, inter-connectivity, mediators are innovation and collaboration. Moderators include security, intellectual property and reliability, competitive advantage	Resource Based View Model		Conceptual paper

Appendix B. Questionnaire Items

Perceived Usefulness (PU) [Davis et al., 1989; Venkatesh & Davis, 2000]		
PU1	Useful	I would find cloud computing useful.
PU2	Increase efficiency	Using cloud computing would increase my efficiency.
PU3	Increase productivity	Using cloud computing increases my productivity.
PU4	Accomplish the tasks more quickly	If I use cloud computing, I would accomplish my tasks more quickly.
PU5	Effective for the tasks	I would find cloud computing effective for my tasks.
Perceived Ease of Use (PEOU) [Davis et al., 1989; Venkatesh & Davis, 2000]		
PEOU1	Easy to learn	Learning to operate cloud computing would be easy for me.
PEOU2	Require less mental effort	Using cloud computing would require less mental effort.
PEOU3	Interaction is clear and understandable	My interaction with cloud computing would be clear and understandable.
PEOU4	Flexible	I would find cloud computing services flexible to interact with.
PEOU5	Easy to become skillful	It would be easy for me to become skillful at using cloud computing services.
PEOU6	Simple to use	In general, It is simple to use cloud computing.
Cloud Computing Adoption Intention (AI) [Davis et al., 1989; Venkatesh & Davis, 2000]		
AI1	I will use cloud computing in the next 6 months.	
AI2	I expect to be a regular user of cloud computing.	
AI3	I intend to use cloud computing in the next 6 months.	
Perceived Ubiquity (PUB) [Kim & Garrison, 2009]		
PUB1	In my job, cloud computing providing communication and network accessibility "anytime-and-anywhere" is very crucial.	
PUB2	In my job, cloud computing provides me anytime-and-anywhere communication and connectivity.	
PUB3	How frequently do you use cloud computing for personal and business purposes?	
Perceived Benefits (PB) [Pei-Fang Hsu, Soumya Ray & Yu-Yu Li-Hsieh, 2014]		
PB1	Customization	Cloud services can be customized and designed based on company's needs.
PB2	Easily analyze data on Internet	Cloud services can analyze data on the Internet simultaneously
PB3	Reduce deployment time	Cloud services can shorten IS deployment time.
PB4	Reduce IT costs	Cloud services can reduce IT expense (ex: IT devices, IT maintenances, etc.).
PB5	Reduce IT employees costs	Cloud services can reduce IT personnel.
PB6	Ubiquitous access	Once connected to the Internet, users can use the system (Mobility).
Perceived Risks (PR) [Pei-Fang Hsu, Soumya Ray & Yu-Yu Li-Hsieh, 2014]		
PR1	Confidentiality	Cloud computing leads to customer or confidential information leakage.
PR2	Incompatibility	Cloud computing is difficult to integrate with previous IT systems.
PR3	Insufficient service quality guarantee	Cloud cannot provide solid quality guarantee.
PR4	Internet bottleneck	Cloud computing has poor network transfer speed.
PR5	Service outages	Cloud computing leads to unexpected service outages
PR6	Underperformance	Cloud computing leads to underperformance of the software and hardware

PR7	Vendor lock-in	Cloud computing restricted to a particular provider, difficult to switch (Data Lock-in).
Perceived Costs (PC) [Premkumar, G., and Roberts, M. (1999), Kuan, K. K., & Chau, P. Y. (2001), Lian, J. W., Yen, D. C., & Wang, Y. T. (2014)]		
PC1	Set-up cost	The cost of establishing cloud computing technology is high.
PC2	Maintenance cost	The cost of maintaining cloud computing technology is high.
PC3	Training cost	The cost of cloud computing technology user training is high.

About the Author

Dr. Shailja Tripathi is currently working as an Assistant Professor in the Operations & IT department of IBS Hyderabad, IFHE University, India. She did her MBA (IT), PhD in IT and Management. She has around 8 years of experience in teaching technical and management subjects like Information System for Managers, Business Process Integration, Database Management Systems, and Introduction to Information Technology. Had published many research papers in both national and international journals in the areas of IT and management. She is an Editorial Member and Reviewer of International Journals like Research Hub, Journal of International Technology and Information Management and Australasian Journal of Information Systems. Her Research areas are Cloud Computing, Cloud Security, Mobile Computing, Social Media, Internet of Things, Block chain technology etc. She was also invited as session chair for 10th ICCCNT conference organized by IEEE at IIT Kanpur in 2019.

Dr. Vaibhav Mishra is currently working as an Assistant Professor in the Operations & IT department of IBS Hyderabad, IFHE University, India. He has completed his engineering in computer science from Uttar Pradesh Technical University, India. Subsequently, he completed an MBA and PhD from the Indian Institute of Information Technology (IIIT), Allahabad, India. During his PhD, Dr. Mishra got the MHRD scholarship. He has few certificates in his account like Six Sigma (Quality Management) – 'Green Belt' from KPMG, ISO 20000-1:2005 (IT Service Management, lead auditor) from BSI, R-Programming-Practical Approach from IIT Kanpur. He has published research articles in international journals of repute (indexed in SCOPUS and ABDC-A), such as International Journal of Bank Marketing, American business review, International Journal of Electronic Business, etc. He has also reviewed the journal articles for various journals like Information & Management Elsevier (ABDC- A*), International Journal of Indian Culture and Business Management –Inderscienece, International Journal of Sustainability in Higher Education, etc. His areas of interest are Management Information System, Database Management System, Technology Management, E-commerce, Quality Management.