CHAPTER – 1: INTRODUCTION

The current study is intended to analyze various factors that contribute to adoption of cloud computing in organizations. This chapter gives an introduction to cloud computing, models of its service and deployment, importance to organizations and challenges in its adoption and presence and progress in India. This chapter also describes the motivation behind the study, objectives and relevance of the study and organization and pattern of the chapters included in the thesis.

1.1 Introduction to Cloud Computing

Businesses have been aggressively adopting cloud computing technology (CCT) to achieve strategic objectives. Cloud technology includes Cloud computing and Mobile Cloud computing. Cloud Computing is a technology that extends its services to the users through internet. According to Sharif (2010), cloud computing is the most recent technology being renowned by IT industry and having the potential to change the operation and usage of internet and information systems. As a new IT model, it assures to transform conventional delivery of IT with ubiquitous access, reduction of costs, and higher elasticity (Hsu et al., 2014). Mell & Grance (2011) considered CCT as a model that permits ubiquitous and convenient delivery of a collection of organized hardware and software services including network, server and storage on demand. According to National Institute of Standards and Technology (NIST), CCT implements computing jobs in an elastic and multitenant environment, where jobs may vigorously vary depending on demand of IT resources with minimum service provider interaction or management effort. According to IBM, a cloud is a pool of virtualized computer resources. Different workloads such as batch-style backend jobs and interactive and user-facing
applications can be hosted by a cloud. Cloud computing was originated in 1990 with the name of Active Server Page (ASP). In 1999, the Salesforce.com was a leading company in the market of cloud computing by delivering enterprise solutions with the help of a website. After that Amazon Web Service as a cloud service was launched by the company called Amazon in the year 2002. Then in 2006, Google Docs introduced to the forefront of public awareness. In the same year, Amazon introduced Elastic Compute cloud (EC2) as a commercial service on the web by allowing individuals as well as smaller firms to lease computers for executing their computing applications. In 2007, across the United States, there was collaboration across industries including IBM, Google and numerous universities. In 2008, Eucalyptus introduced the first open source Amazon Web Services Application Programming Interfaces (AWS API) as well-matched platform to install private clouds. Then the first open source software, Open Nebula was introduced to deploy private as well as hybrid clouds. Microsoft penetrated into the cloud computing market with Windows Azure in 2009. After that, many key players followed.

For business operations, CCT provides a platform which is flexible and highly scalable by outsourcing partial or full IT operations in order to carry out business using public cloud (Armbrust et al., 2010). CCT is a service based technology that integrates both hardware and software distributed through a network on demand regardless of time and location (Marston et al., 2011). Web applications like Web-mail, Flickr, YouTube and Google docs are widely used cloud services by individuals. Organizations also have begun to employ CCT as a means to meet their IT requirements (Lin and Chen, 2012). Its services include the data storage, usage and process on computers which are remotely located and accessed through internet. Consumers can make use of CCT for storing information like pictures or e-mail and accessing software like social networks, videos, games and music. Private data centers and IT departments can be
replaced by CCT in public organizations. With CCT, the firms can perform data transactions and data analysis and also value chain functions like sales and distribution, finance, manufacturing and customer service, information sharing and trading partner collaboration (Gartner, 2009; Pyke, 2009). Various players are providing cloud computing services economically (Marston et al., 2011).

Mell & Grance (2011) highlighted five important characteristics of cloud computing. On demand self-service addresses independent supply of IT resources without user interface with the provider. Broad network access indicates the delivery of IT resources through the internet. Measured service means the regular control and fulfillment of resource requests in an optimal way through pay per use method. Resource pooling means assembling of IT resources to supply to the several consumers. Rapid elasticity describes a vigorous scaling up and down of resources with demand.

1.2 Cloud Computing Service and Deployment Models

The three service models of CCT are Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) (Creeger, 2009; Sultan, 2010; Ojala & Tyrväinen, 2011; Marston, et al., 2011, Mell & Grance, 2011). SaaS was a rebirth of ASP as on-demand computing. In SaaS, software applications are kept on a server for hosting over internet for end user usage without installing and updating/upgrading software on the client’s machine. It is the most mature and biggest cloud model. Commercial vendors of SaaS include email applications like Yahoo Mail, Gmail and Hot-mail, commercial applications like Word processing, CRM
(Customer Relationship Management) and ERP (Enterprise Resource Planning), and social softwares like Google Apps, Facebook, Twitter, Microsoft Office Live and Salesforce.com (Gupta et.al, 2013).

PaaS model provides platforms for operating systems, database storage, middleware and software development and tools. Microsoft Azure Services, Google App Engine platform, Amazon Web Services (AWS), Rackspace cloud sites, Amazon’s relational database services, etc are popular vendors of PaaS (Gupta et.al, 2013).

In IaaS, infrastructure like hardware, software and devices for storage and network can be accessed with proper authentication. Amazon EC2 (Elastic Compute Cloud), Rackspace cloud servers, Elastic Block Storage (EBS), Simple Storage Service (S3) and Joyent and Terremark are examples of this service (Gupta et.al, 2013).

In addition, the four deployment models of CCT include public, private, hybrid and community cloud. Public cloud is provided by a service provider and it is cost effective for small and medium sized businesses (SMBs) to deploy IT solutions. Example of public cloud is Google Apps. Large organizations can manage a private cloud in their premises. US government cloud certified by FISMA (Federal Information Security Management Act) is an example of this model. A group of enterprises can use and control a community cloud with common interests. Example includes the US federal government’s community cloud, built on Terremark’s Enterprise cloud platform. Hybrid cloud is a blend of public and private clouds and examples are
Eucalyptus, Expedient, Fujitsu Hybrid Cloud Services (FHCS) and HP hybrid cloud management.

1.3 Importance of Cloud Computing to Organizations

Ercan (2010) highlighted the capability of CCT being adopted for various organizations with dynamic scalability and as a service offering usage of virtualized resources through the Internet. Several companies are coming forward with their innovative cloud computing solutions. Microsoft cloud solutions such as Microsoft Office 365 and Microsoft Dynamics CRM Online are a set of web based tools for the use of small businesses, independent consultants and professionals. The public cloud provided by Windows Azure is highly flexible and scalable. IBM extends its cloud computing services in the name of IBM SmartCloud Solutions having a broader portfolio for private, public or hybrid cloud computing. IBM SmartCloud for Social Business is a portfolio of online services, such as social networking and collaboration that is delivered through the SaaS model. VMware provides vCloud Hybrid service as IaaS that offers two distinct cores compute services, Dedicated Cloud and Virtual Private Cloud provide the customers a set of resources to compute, storage and network. Amazon Web Services help several businesses around the globe by providing an infrastructure with high reliability, scalability and cost effectiveness. Rackspace provides an open cloud with its enterprise level hosting services to different businesses of all sizes in the world. As cloud computing company, Salesforce.com is well-known for its on-demand provision of CRM applications on a subscription basis.

1.4 Challenges of Cloud Computing Adoption
Despite several uses and promises of CCT, there are several barriers to adopt it. Security is a very important challenge of cloud computing because protecting sensitive information on a public cloud remains a vital problem. The need of steady and speedy internet connectivity is another noteworthy barrier for CCT as distribution of cloud services depends on the internet (Lin & Chen, 2012). Poor standardization of application program interfaces and platform technologies may not allow the firms to easily switch over to other cloud services. Lack of interoperability can discourage firms to adopt CCT (Armbrust et al., 2010). Khajeh-Hosseini et al. (2012) categorized the risks in using cloud computing into five. Loss of governance and interoperability problems come under policy and organizational risks. The problems of leakage and loss of data are grouped under technical risks. Legal risks include the issues related to licensing of software and protection of data. Fourth categories of risks include the problems related to infrastructure such as network. The last category of risks relates to project and business risks that discourage firms to adopt CCT.

1.5 Cloud Computing in India

According to a recent 2016 report of Gartner (http://www.gartner.com/newsroom), the cloud market in India has been aggressively expanding with public cloud services and the highest growth will come from IaaS followed by PaaS and SaaS. Jetley (2014) echoed the IDC report that several small organizations in India were interested to adopt cloud computing and hence, Google and Microsoft became aggressive to tap the small business segment in India. According to Laha (2015), the big Players like TCS, Infosys, HCL and Tech Mahindra are bidding for cloud computing service providers to save costs on their in-house installation and in-house
development of solutions. Hence, Indian service providers have huge competition on their pricing of solutions. There is the proper scope for cloud computing in India with increased successful implementations in Indian companies. Multinational companies (MNCs) like IBM, Microsoft and VMware opened their cloud centers in India and are aggressively developing the cloud applications. Salesforce.com is providing its cloud services to several Indian companies like National Research Development Corporation, Bharti, Polaris, SIFY Technology and eBay India. Companies like Tata Communications, CRL, Zoho are three Indian cloud providers, Further large IT firms, such as Infosys and TCS have penetrated the Indian cloud market. Pressmart in Hyderabad provides *electronic publishing and digitization* solutions to print industry by facilitating transmission of data across various platforms such as social networking websites, mobile, RSS, etc. Another Indian cloud provider Novatium develops cloud based mobile applications for the Indian market.

US tech giant, Oracle, also predicted that India will be among the top beneficiaries from cloud computing (http://cio.economictimes.indiatimes.com/news/). Enterprise cloud is likely to become the safest place for IT processing with nearly 60 percent IT organizations shifting their systems management to the cloud in 2017. The Future Group, India’s largest retailer, uses cloud based data warehousing and analytics for storing and analyzing huge retail data. They utilize CCT to handle their customer loyalty program for analyzing and storing millions of giant data. Dr. Reddy's Laboratories set up SaaS based CRM application of Salesforce to track and improve its sales cycle.

1.6 Motivation of the Study
Marston et al (2011) stated that the main barrier of cloud computing is a perception or attitude of an individual, but not technical. Therefore, it is important to study both cognitive influence processes as well as technological influence processes to analyze user acceptance of cloud computing.

According to Benlian and Hess (2011), major IT adoption decisions are taken by IT executives, i.e. individuals rather than organizations. The technology cannot improve organizational performance if is not properly used. The common problem includes manager’s resistance to the end user’s system. There is a need to better understand why people accept or reject cloud computing in order to increase individual adoption. There is a requirement of identification and evaluation of factors such as job relevance, perceived cost, perceived benefit, perceived risks and perceived ubiquity that contribute to managerial decisions to adopt cloud computing in the organization.

The past research studies related to TAM (Behrend et al, 2011; Wu et al, 2011, Obeidat and Turgay, 2012; Aharony, 2015) identified various factors that affect the user acceptance of cloud computing in the organization by the individuals. The factors identified include perceived usefulness (PU), perceived ease of use (PEOU), perceived advantages and perceived disadvantages, personal innovativeness, self efficacy, openness to experience, computer competence and social media use. Behrend et al. (2011) and Wu et al. (2011) carried out their study in the education arena and examined the factors that showed the way for students to adopt CCT. Opitz et al (2012) and Alharbi (2012) suggested that respondents should be the IT professionals in the firms for cloud computing research study. Dachyar et al (2012) reported that
the use of CCT depends on the opinions of decision makers in the firms. Obeidat & Turgay (2012) took their study among mid to top level managers who either had functional IT responsibility or affected by adoption of cloud computing. They studied only two factors - perceived advantages and perceived disadvantages, that influence user acceptance of cloud computing. Aharony (2015) carried out their study among two groups of information professionals - librarians and information specialists, to investigate the factors that influence CCT adoption. He analyzed that behavioral intention to use CCT was impacted by several of the TAM variables (PEOU, personal innovativeness), personal characteristics and computer competence.

All the above studies focused mainly on cognitive factors and personal traits that impact user acceptance of cloud computing. These studies did not consider perceived ubiquity, perceived risks, perceived benefits, perceived costs and job relevance and their interaction with other identified factors. It will be interesting to study the influence of these factors along with other factors in CCT adoption. This is the motivation for proposing this work. Moreover, due to meager research work done in user acceptance of cloud computing, this research work is motivated and intended to fill this research gap to address those factors in the point of view of decision making professionals that decide the IT policy for organization. This study is also highly motivated to expand the scope of research about the TAM from the perspective of IT professionals who have experience in cloud computing in the organizations and also highlight the importance of both technological influence processes and cognitive influence processes in assessing technology acceptance of CCT.
1.7 Objectives of the Study

This study seeks to analyze the individual adoption of cloud computing in the firms. The overall objectives of this study are given below:

1. To study the effect of cognitive influence processes like perceived usefulness, perceived ease of use and job relevance on the behavioral intention to use cloud computing in organizations;

2. To study the effect of technological influence processes like perceived ubiquity, perceived cost, perceived benefits and perceived risks on the behavioral intention to use cloud computing in organizations; and

3. To examine the effect of job relevance on perceived usefulness and behavioral intention to use cloud computing.

This study is also intended to test the factors that affect the actual usage of cloud computing.

1.8 Relevance of the Study

The study is intended to benefit the academicians and researchers and even the organizations in understanding the factors that affect the individual adoption of cloud computing in the organization. The major contributions of this study are segregated and shown below:
• The detailed literature review on the various factors that affect the individual adoption of cloud computing will give a conceptual clarity on this topic to researchers on how these factors influence the adoption of CCT in the organization.

• Future research may examine and use the outcomes of this study in the successful cloud computing adoption in the organization.

• This study helps organizations understand the factors which influence the behavioral intention to use and actual usage of cloud computing. So, the results from this study would be useful for practitioners.

• This study assessed two important questions empirically: “What factors impact users’ acceptance of CCT?” and “does TAM generalize to CCT?” the study extended the existing technology acceptance research and validates the earlier research findings related to TAM.

1.9 Chapter Organization and Pattern

This study aimed to analyze the influence of different factors on behavior intention to use cloud computing. The groundwork is spread among seven chapters and each chapter dealt with the relevant contents. Chapter1 gives an introduction to cloud computing, its service and deployment models, its importance and challenges to the organizations and the motivation and objectives of the study.
Chapter 2 summarizes the current existing literature on cloud computing adoption. The chapter begins with the literature review related to the technology adoption at individual level along with the related frameworks/models, such as Theory of Reasoned Action (TRA) and Technology Acceptance Model (TAM) followed by the literature review related to the adoption of CCT at both the organizational and individual levels. The chapter also reviews the literature available on the determinants of cloud computing.

Chapter 3 deals with the development of hypotheses by providing support for these hypotheses from theory. The noteworthy literature gaps that were identified by an extensive literature review have been highlighted. After defining and describing each construct that takes part in each hypothesis, relevant research reports have been mentioned to support the hypothesis. The items that make up each construct are also described. From all the hypotheses that are framed, a research model has been developed. A detailed explanation of the regression equations related to these hypotheses is presented. Finally, the endogenous and exogenous variables used in the study are listed.

Chapter 4 detailed research methodology followed in this study. It deals with the scale items, sample, sampling process, questionnaire development and the sampling frame characteristics. The survey instrument with all the constructs and their corresponding items are detailed. This chapter describes how and to whom the questionnaire will be administered. This chapter ends with describing how data analysis has been carried out.
Chapter 5 deals with detailed analysis of the respondents’ data. It reports the descriptive statistics and the demographic profile of the respondents. Exploratory factor analysis (EFA) is carried out to analyze whether the factors obtained and the items grouped by past researchers are similar in this study. The measurement model is examined for adequate reliability and validity. The results of model evaluation and model fit indices are explained through confirmatory factor analysis (CFA). This chapter presents the result of Structural equation modeling (SEM) along with path coefficients. The supported and not-supported hypotheses are properly distinguished.

Chapter 6 deals with the summary of the results of EFA, CFA and SEM. It discussed about the factors influencing Behavioral Intention and Actual Usage of cloud computing. The possible reasons for the results obtained are discussed. This chapter ends with the presentation of the finally validated research model.

Chapter 7 ends the study by pointing out the implications and future research directions of the study in detail. The theoretical and managerial implications of this study are presented. Following this, the various directions available for further research are examined.

The questionnaire, additional results of descriptive statistics, Q-Q plots and histograms of individual items (or measures) are given in Appendices following the References part.