INTRODUCTION

Cloud computing is the next big thing in the world of information technology computing. It offers pay per use model as against the conventional ownership model. Cloud computing is a technology that uses the internet and central remote servers to maintain data and applications. Cloud computing allows consumers and businesses to use applications without installation at their premises and access the data using Internet.

Cloud computing is about moving services, computation and/or data—for cost and business advantage—off-site to a service provider. By making data and services available in the cloud, it can be more easily accessed, often at much lower cost.

In the past, developing an application service required a large capital expense to build infrastructure for peak service demand before deployment. The risk of a service’s success combined with the operational requirement of a large capital expenditure investment severely restricted funding. Cloud computing addresses this problem by allowing expenses to track closely with resource use, thus following income rather than having to purchase for peak capacity before income is realized. Running application services on a cloud platform accomplishes this in three fundamental ways:

- It moves capital expense to operational expense, closely correlating expenses with resource use.
- It allows service owners to eliminate significant system-administration head count by avoiding the need for internally purchased servers.
- It smoothes the path to service scaling by not requiring the capital expense-intensive architectural changes needed to scale up service capacity in the event of service success.

Cloud computing consists of three services models, namely Software as a Service, Platform as a Service and Infrastructure as a Service. In addition, there are four deployment models, namely Public cloud, Private cloud, Community cloud and Hybrid cloud. The services provided are charged on the usage and thus it is referred as pay per use model. In India, the resources on offer have failed to match the development in technology and this is where cloud computing comes to the rescue, by
providing access to the necessary IT resources to satisfy IT needs in an affordable way.

At present, the businesses heavily depend on their IT infrastructure availability. Cloud based services can change the way computing takes place and make the services affordable for most of the businesses. New companies need not invest for their IT infrastructure cost and consume as their business grows.

Due to poor legal framework for cloud computing and lack of dedicated privacy laws, data security laws and data protection laws, cloud computing has not been able to generate trust amongst users in India. These aspects need to be looked at during the current study.

In recent times, India has become a global hub for a wide range of IT services ranging from hardware to software to networking and there is a strong possibility of this country becoming a strong base for the cloud based services. Large number of cloud service providers across the globe are eyeing the cloud market in India, which is still at a nascent stage.

Indian IT companies are competing amongst themselves to grab a larger share of the cloud market, which is likely to grow to 4.5 billion dollar by 2015 and add 1 lakh jobs in the market. The growth is likely to be across service and deployment models as specified above.

The cloud computing model has done wonders in the United States and European territory. In the Indian context, the impact and effectiveness of cloud computing needs to be measured. Cloud computing being a new computing technique provides ample scope to be explored in general and more specific from the point of view of Indian IT industry. Concerns over data security and privacy are hampering the growth of cloud based services in India and CIOs are reluctant to go for full fledged investment in cloud computing. The research intends to address the above concerns by measuring the effectiveness of cloud based applications on Indian IT sector.
LITERATURE REVIEW

Overview of cloud computing

Cloud computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the data centers that provide those services. The terms cloud, public cloud, utility computing, private cloud, surge computing or hybrid cloud computing, and Software as a Service are clarified to reduce confusion (Armbrust, M. et al., 2010).

Cloud computing is the next big thing in the evolution of on-demand information technology services and products. To a large extent cloud computing will be based on virtualized resources. It allows consumers and businesses to use applications without installing them and access the application data using internet (Hurwitz, J. et al., 2010).

The concept of virtualization has played a key role in the implementation of cloud computing. Virtualization is a process of creating a copy in software of a physical machine. The user of the machine gets a feeling that the machine is totally devoted to the user, whereas in reality, it performs the job for multiple users (McDonald, K. T., 2010).

When a major change arrives on the IT scene, it’s not always clear what the implications will be, if any, and so for large organizations a risk-managed wait-and-see attitude tends to prevail. Occasionally however some shifts offer cost savings, improvements to operations, or ways to tackle business problems that offer significant strategic advantage (Ryan, M. D., 2011).

Cloud computing is quickly beginning to shape up as one of these major changes and the hundreds of thousands of business customers of cloud offerings from Amazon (Amazon Web Services), Salesforce (Force.com), and Google (Google App Engine), including a growing number of Fortune 500 companies, is showing both considerable interest and momentum in the space (Marks, E. A. et al., 2010).

To be precise, there are currently unanswered questions and inherent challenges in adopting cloud computing as the IT solution for business processes. Notably, these include security of enterprise data that is stored in the cloud, risk of lock-in to cloud
platform vendors, loss of control over cloud resources run and managed by someone else, and reliability (Smith, R., 2009).

On the other side of the coin are some benefits that can potentially change the game for many firms that are willing to be proactive in managing potential downside. These include access to completely different levels of scale and economics in terms of the ability to scale very rapidly and to operate IT systems more cheaply than previously possible. Easier change management of infrastructure including maintenance and upgrades as well as offering improved agility to deploy solutions and choice between vendors, particularly when cloud interoperability becomes more of a reality than it is today. Cloud computing also offers an onramp to new computing advances such as non-relational databases, new languages, and frameworks that are designed to encourage scalability and take advantage of new innovations (Cusumano, M., 2010). In fact, cloud computing holds the potential to dramatically change the businesses that adopt it, even if the technologies are only used internally. At the beginning of the new millennium there was not yet such a thing as a cloud computing vendor, though teams were already hard at work on several significant efforts and several of these eventually blossomed into key cloud computing vendors (Lebowitz, J., 2011).

Cloud computing is clearly an area of rapid evolution. Each category includes vendors focused on public, private, and hybrid cloud offerings; those focused on commercial as well as government markets; startups and the established; open source, open distribution, and traditional distribution models; and in many cases, all of the above. Of course certain vendors have offerings in more than one category; a handful intends to cover each category, though that will likely be difficult to achieve and maintain. In any case, here are the major categories, along with a few notes about the history that shaped each category (Ryan, W. M. et al., 2010).

**Infrastructure as a Service (IaaS)**

(Owens, D., 2010) Vendors in the Infrastructure as a Service (IaaS) category primarily fall into two broad groups: those that provide an existing IaaS and those that provide technology to enable IaaS. Vendors that provide an existing IaaS generally come from cloud technology providers (e.g., Amazon), managed services or hosting providers (e.g., Rackspace, Savvis, etc.), and integrated vendors such as HP, IBM, and Dell. The technology providers include those who provide software stacks to manage
physical or virtualized infrastructure (such as VMWare) as well as those who provide hardware (of varying degrees of commodity) that is intended for easy stacking, replacement, and so forth (all of the major hardware providers, several startups, and certain fresh entrants from nontraditional vendors, such as Cisco). This is a category that is likely to see significant innovation— in particular, as the trend towards commoditization of the infrastructure matures, then very-high volume providers of commodity infrastructure are likely to dominate, both amongst the ready to consume IaaS and the technology providers.

**Platforms as a Service (PaaS)**

There are two major subcategories in platforms as a service -- offerings that focus on providing management, operations, billing, provisioning, and related functions for cloud-based applications, and offerings that focus on providing application frameworks and fundamental capabilities (such as cloud-friendly data storage). Of course, too, there are offerings that bundle all of the above. Examples of those that provide management, application frameworks, and fundamental capabilities include Amazon, Appistry, and Google. Examples of those that provide only management are 3Tera, Rightscale, Enomaly, and Eucalyptus. Examples of those that provide primarily application frameworks or fundamental capabilities include Cloudera, Gigaspaces, Terracotta, and VMWare/ Springsource. Vendors in this category have generally come from one of two perspectives: either from the ‘‘top of the stack’’ and therefore they had an initial application focus, or from the ‘‘bottom of the stack’’ and therefore they were extending the infrastructure (typical for most management vendors) (Castelluccio, M., 2009).

**Software as a Service (SaaS)**

(Castelluccio, M., 2009) In many ways this category is both the most familiar and the most extensive, in that a significant portion of early cloud deployments were in this category. Whether it was search and e-mail by Google; e-mail and instant messaging by Yahoo, Google, and Microsoft; social networks such as LinkedIn, Facebook, and Twitter; customer management by Salesforce, and others; commerce from Amazon; content delivery from YouTube or any of dozens or hundreds of other examples— any reader of this book, and for that matter a very high percentage of the general population has personal experience with vendors in this space. The reason for this is
simple—making an application available over the Internet implies a commitment to providing web-scale, which in turn is an implicit commitment to cloud. It is that desire for—or fear of—scale that drove many of these vendors to initially develop and embrace cloud computing principles throughout the stack. This category generally includes those who best understand these principles, and as a consequence best exhibit cloud characteristics such as scale, elasticity, and so forth (Durkee, D., 2010).

Now, the question that arises is whether most of the future information technology applications will resort to cloud computing? With cloud computing, users can consume CPU cycles without buying servers and data centers. The third party can worry about the storage capacities and processing (Orr, B., 2008).

Security

Businesses currently use cloud-computing services with the uncertainty of jurisdiction, should legal action be initiated. Jurisdiction is the authority of a court to hear and decide a specific legal action. While standards, treaties and case law are developing worldwide, there currently is no simple test to determine jurisdiction for internet activities internationally, necessitating businesses to take the initiative to address cloud computing jurisdiction risk (Ward, B. T. et al., 2010).

Cloud computing and storage infrastructures are becoming more powerful than ever before because individuals and organizations are developing them at an alarming pace. The existing laws have not kept pace with the rapid developments and hence there exists a potential for legal disputes (Wittow, M. H., 2010).

There are 4 models for deployment of cloud infrastructure, namely private, public, hybrid and community cloud. There are varying advantages offered by different service models of the cloud computing against the business and legal risk. The cloud computing is different in terms of lower flexibility as compared to traditional outsourcing agreements. There must be a contractual check list which addresses business continuity, data ownership and intellectual property issues and well defined performance metrics. It is advisable to have universal standards for maintaining and storing client data (Stettner, D. C., 2011).

The cloud service provider is the data processor and the customer using cloud services is the data controller. In this way the cloud provider shrugs off the responsibility for
legal compliance with the applicable data protection laws. In this regard it is better to discard the concept of single data controller and highlights the importance of joint data controller for better accountability of the service provider (Gilbert, F., 2011).

There are concerns about the privacy and confidentiality of data because the service providers have access to the entire customer’s data. The privacy concerns with cloud based conference management due to the possession of data by the system administrators needs to be addressed. The data mining may be used to prevent fraudulent activities that may be carried out on the consumer’s data (Anthes, G., 2010).

As cloud computing becomes more widely used by individuals and businesses alike and is increasingly viewed as a cheap, convenient, and viable alternative to the traditional desktop computer platform, the law is unfortunately still trailing behind the development of new technology. There is a great deal of uncertainty about how laws enacted in the mid-1980s, such as the ECPA, will apply to cloud computing (Velte, A. T., 2010).

A growing number of customers are becoming aware of their privacy online and are worried about their sensitive, confidential data stored in the cloud. Moreover, because it is expected that more and more sensitive data will be stored in the cloud, there is a real need for the law to be updated on the issues of data security and privacy to accommodate today’s realities (Lanois, P., 2011).

Computing may be offered as a public utility some times in the future (Sosinsky, B., 2010). Clouds are all the rage today, promising convenience, elasticity, transparency, and economy. But with the many benefits come thorny issues of security and privacy. In a sense, cloud computing simplifies security issues for users by outsourcing them to another party, one that is presumed to be highly skilled at dealing with them.

**Auditing**

As organizations move more data and applications to Internet based services, internal auditors need to take a close look at how these vital assets are managed and secured (Ames, B. et al., 2011). While service providers are marketing the security benefits of cloud services — such as stronger controls at lower costs, standardization of security practices, and replacement of legacy technologies — they also must expand control
over traditional IT risk areas and implement new control strategies to manage the broader inherent risk that comes with the cloud.

Cloud computing finds mention in Gartner’s top 10 strategic technologies for 2012. Gartner defines a strategic technology as one with the potential for a “significant impact” on the enterprise within the next three years. A significant impact is characterized by a high potential for disruption to information technology or the business, the need for a major dollar investment or the risk of being late to adopt (Ginovksy, J., 2010).

**Change and Disruption**

The cloud though with advantages can be disruptive force within the enterprise. On the vendor side, there are more than 2000 cloud software as a service provider companies alone. "It's true that most of the disruption caused by cloud computing relates to enterprise [operations] and IT. But it's also been pretty disruptive to the vendor community as well," says David Mitchell Smith, vice president at Gartner (Burns, C., 2011). Smith believes that a tremendous shakeout will occur over the next year or two. He predicts that by 2013 a small handful of vendors will emerge as leaders delivering both enterprise systems and cloud services.

**Cost**

(Gill, R., 2011) In early 2009 there was a brief firestorm of discussion over a McKinsey study 6 which seemed to show that the ‘‘emperor had no clothes’’— that cloud computing was, in fact, more expensive than a traditional big-server datacenter. Upon slightly closer examination it becomes clear that the study had an intrinsically limited scope: It really was comparing retail pricing of certain public cloud offerings to some basic conventional scenarios. In the ensuing discussion it became clear that this study, while valid in a certain narrow sense, was much more of a reflection of a limited view of cloud computing— public clouds or nothing, no meaningful sense of a platform (PaaS)—than of cloud computing as a whole. Also, the study was done at a time when there were relatively few offerings from which to choose, and hence relatively modest competition. The simple reality is that by incorporating a strong platform (PaaS) an enterprise can ensure real choice in cloud providers for their own applications, and with choice always comes the ability to drive down costs; by building on self-operating commodity building blocks the aggregate infrastructure
costs will inevitably be reduced significantly (both acquisition and operational costs); and with that same strong platform comes the ability to more tightly control energy costs. While cost of a cloud, as with any other criteria, must always be examined closely, in truth this is already a very strong advantage of the transition to cloud computing, and that advantage will increase as the industry matures.

This will allow firms to rent computing power and storage from service providers and to pay on demand, with a profound impact on the cost structure of all the industries, turning some of the fixed costs into marginal costs of production. Such a change will have a substantial impact on the incentives to create new business, and through this, on investments and macroeconomic growth, job creation in all industries and job reallocation in the Information and Communications Technology (ICT) sector, and public finance accounts, through the direct impact on the public sector spending and the indirect one on the tax revenues \((\text{Etro, F., 2011})\).

Clouds provide a powerful and often unattainable IT infrastructure at a moderate cost. In addition the individuals and small businesses are freed from worries about obsolescence and lack of flexibility \((\text{Greengard, S., 2010})\).

**Future**

\((\text{Blum, J., 2012})\) Advances in sensing technologies are yielding vast quantities of data that must either be processed on the fly or archived for later consumption, or both. Unfortunately, new applications, eager to harvest such data, are starkly limited by current techniques that tend to be hard to scale up, difficult to adapt, and largely batch-oriented.

To enable organizations and individuals to leverage their newfound wealth of information, Intel Labs is investigating key new cloud computing technologies that will deliver higher performance for stored data at scale, lower latency for streaming data despite greater processing complexity, and a lower-cost network infrastructure. The goal is to drive exciting new breakthroughs in robotics, computational perception, personal media, mobile computing, cluster analytics, machine learning, and similar applications \((\text{Kozuch, M. et al., 2011})\).
OBJECTIVES OF THE STUDY

- To study and understand the willingness of IT companies to adapt cloud computing
- To compare and contrast cloud computing with conventional computing approach.
- To understand the factors that restrict/facilitate the adaption of cloud computing amongst IT companies
- To determine the nature of businesses, which have implemented cloud computing.
- To understand the penetration level of cloud computing applications amongst the users
- To understand challenges faced by companies in moving from ownership model to cloud model.
- To study the acceptance level of service model and deployment model amongst companies.
- To evaluate the benefits and damages of cloud computing on IT sector.
HYPOTHESIS OF THE STUDY

H_{01}  There are no significant differences in awareness levels of cloud computing.

H_{02}  There are no significant differences in acceptance levels of cloud computing.

H_{03}  There are no significant differences in penetration levels of cloud computing.

H_{04}  There are no significant benefits differences in acceptance levels of cloud computing.

H_{05}  There are no significant differences in operational effectiveness between conventional computing technology and cloud computing
RESEARCH METHODOLOGY

Sources of Data

➢ Primary Data

□ Survey using Structured Questionnaire (Users of Cloud Services, Potential Users of Cloud Services, Service Providers of Cloud)

□ In depth Interviews (Influencers)

➢ Secondary Data

□ Literature from Business House using Cloud services

□ Literature from Companies offering Cloud services

□ Books, Journals and Periodicals

□ Literature from related websites

□ Contemporary Research on related topics

Research Design

The research intends to measure the impact made by cloud computing on IT companies. It will also measure the effectiveness over traditional computing techniques. It would be temporal in nature and would be conducted on a sub-section of the respondent population. Thus the design adopted for Research is Quantitative Conclusive Causal Cross-Sectional.

Sampling Type

The sampling will involve Developers of IT organization, Users of cloud computing, Potential users of cloud computing and Influencers. The division of the participants has been formed on the basis of the common attributes within a stratum. A random sample from each stratum will be taken in a number proportional to the stratum's size when compared to the population. These subsets of the strata will then be pooled to form a random sample. Thus
the sampling used will be Stratified Random Sampling. This Sampling type was adopted to reduce the potential for human bias in the selection of units of analysis to be included in the sample. Stratified random sample will provide us with an unbiased and diversified sample.
### Sampling Plan

#### Developers

IT Companies

- Large (Turnover > Rs. 10000 Crores) - 10
- Medium (Turnover Rs. 100 Crores to Rs. 10000 Crores) - 50
- Small (Turnover < Rs. 100 Crores) - 100

#### Users

<table>
<thead>
<tr>
<th></th>
<th>Private</th>
<th>Public</th>
<th>Community</th>
<th>Hybrid</th>
</tr>
</thead>
<tbody>
<tr>
<td>SaaS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Banks 1</td>
<td>Banks 5</td>
<td>Banks 1</td>
<td>Banks 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Insurance 5</td>
<td>Insurance 1</td>
<td>Insurance 1</td>
</tr>
<tr>
<td></td>
<td>Retail 1</td>
<td>Retail 5</td>
<td>Retail 1</td>
<td>Retail 1</td>
</tr>
<tr>
<td></td>
<td>Travel 1</td>
<td>Travel 5</td>
<td>Travel 1</td>
<td>Travel 1</td>
</tr>
<tr>
<td></td>
<td>Medical 1</td>
<td>Medical 5</td>
<td>Medical 1</td>
<td>Medical 1</td>
</tr>
<tr>
<td>PaaS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Banks 1</td>
<td>Banks 2</td>
<td>Banks 1</td>
<td>Banks 1</td>
</tr>
<tr>
<td></td>
<td>Insurance 1</td>
<td>Insurance 2</td>
<td>Insurance 1</td>
<td>Insurance 1</td>
</tr>
<tr>
<td></td>
<td>Retail 1</td>
<td>Retail 2</td>
<td>Retail 1</td>
<td>Retail 1</td>
</tr>
<tr>
<td></td>
<td>Travel 1</td>
<td>Travel 2</td>
<td>Travel 1</td>
<td>Travel 1</td>
</tr>
<tr>
<td></td>
<td>Medical 1</td>
<td>Medical 2</td>
<td>Medical 1</td>
<td>Medical 1</td>
</tr>
<tr>
<td>IaaS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Banks 1</td>
<td>Banks 5</td>
<td>Banks 1</td>
<td>Banks 1</td>
</tr>
<tr>
<td></td>
<td>Insurance 1</td>
<td>Insurance 5</td>
<td>Insurance 1</td>
<td>Insurance 1</td>
</tr>
<tr>
<td></td>
<td>Retail 1</td>
<td>Retail 5</td>
<td>Retail 1</td>
<td>Retail 1</td>
</tr>
<tr>
<td></td>
<td>Travel 1</td>
<td>Travel 5</td>
<td>Travel 1</td>
<td>Travel 1</td>
</tr>
<tr>
<td></td>
<td>Medical 1</td>
<td>Medical 5</td>
<td>Medical 1</td>
<td>Medical 1</td>
</tr>
</tbody>
</table>
Potential Users

- Banks: 20
- Insurance: 8
- Organised Retail: 10
- Travel: 10
- Medical: 20

Influencers

- IT Consultants: 100

Sample Size: 433

Research Area

Across India – Especially cities like Mumbai, Bengaluru, Pune, Hyderabad.

Hypothesis Test

The Hypothesis would be done using Statistical methods as below

- Parametric Test
  - z-test
  - Anova

- Non Parametric Test
  - Chi-Square
SCOPE

Probably more than anything we’ve seen in IT since the invention of timesharing or the introduction of the PC, cloud computing represents a paradigm shift in the delivery architecture of information services. In the past, developing an application service required a large capital expenditure to build infrastructure for peak service demand before deployment. The risk of a service’s success combined with the operational requirement of a large capital expenditure investment severely restricted funding. Does cloud computing address this problem? The answer to this question will be looked at during the current study.

This research will cover IT and ITES companies having potential to use cloud based services. As the facts and figures show that the importance and usage of cloud computing is growing at an exponential rate, in countries like US, Europe and other advanced countries, this research will help in communicating to the Indian IT industry and also individuals as to how this type of computing will help grow business and build a strong brand name.

This research will also cover 5 best IT spenders in the country. The sectors identified are Banking, Insurance, Travel, Medical and Organised Retail.
LIMITATIONS

- The research shall cover Cloud computing as the computing methodology.
- The other computing methods are beyond the scope of the study like:
  - Grid computing
  - Application Service Provision (ASP)
  - Conventional computing
  - Distributed computing
- The research shall be a sample study across the country.
UTILITY

The adaption of cloud based services is increasing at a rapid rate across the globe. Hence movement from ownership model to service model seems inevitable in the early stages of cloud computing. This study will prove to an asset for an organization moving from capital expenditure to operation expenditure model.

Reach: The current study will reach the cloud service providers as well as the consumers and potential consumers across the country.

Cost Effective: The current study will guide the target audience in studying the economies in order to move from ownership to service model.

Effective: Having compared the cloud based computing with the traditional methods of computing, the current study will enlighten the effectiveness of moving from capital expenditure to operational expenditure.

Cloud-computing service models are often self-service, even in internal models. Previously, an organisation had to partner with IT to develop the application, provide an execution platform, and run it. Now, much like Amazon, IT departments define use policies for automated platform and infrastructure services with line-of-business-owners developing applications on their own to meet those requirements.