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Cloud Computing: Software as a Services Business Application Challenges

By

Rakhi Singh, Surabhi Pandey
Galgotias College of Engineering & Technology Greater Noida.
Army Institute of Management & Technology (AIMT), Greater Noida.
Rakhi2k11@gmail.com , surabhipandey1@yahoo.co.in

ABSTRACT
Information technology is still evolving and changing rapidly. At present almost everyone in this world can get connected to the Internet. Organizations are striving for attaining their full potential by rapidly realizing innovative business models while simultaneously lowering the IT barriers for driving in innovations and changes. This has resulted into the invention of a new delivery model of IT Services, which is now popularly known as SaaS or Software as Service - a software distribution model in which applications are hosted by a vendor or service provider and made available to customers over a network, typically the Internet. The concept is simple and attractive: Use the ERP Software Service and Pay the Subscription Fee.
SaaS is one of the services of Cloud Computing, which is based on a "one-to-many" model whereby an IT application is shared across multiple clients/users. It fundamentally uses Cloud Computing Platform for delivering IT enabled Services. There are certain technical challenges involved in the adoption of SaaS technology and some of the challenges are Data security, Customization and Scalability and this research paper is to find out the challenges involved in SaaS business application by both secondary as well as primary data analysis The main aim of this research effort was to examine the challenging factors for the adoption of ERP/Business Application on Software as a Service Delivery Model and for that very purpose 6 factors are identified based on literature review and tested with collected primary data .

Keywords
Cloud ERP, SME, SaaS, PaaS, IaaS Cloud Computing, ERP, IS, Multitenant, HRM, SCM, CRM, MRP

1. INTRODUCTION
Cloud Computing refers to the general acuity of allowing people to access technology-enabled services using the internet. Its vigorously scalable and often virtualized resources are delivered as a service over the Internet which also provides a superior facility to the user, and is characterized by new, internet-driven economics. Users need not have knowledge of, or expertise in, or control over the technology infrastructure "in the cloud" that supports them. Cloud computing can considerably reduce IT costs and complexities while improving workload optimization and service delivery. Cloud computing infrastructure for application development is enabling to build robust, enterprise-class applications in a fraction of the time and at a much lower cost.
Enterprises, particularly big organizations are interested in Cloud computing because it comes with several potential benefits. The Pay-As-You-Use consumption model can be applied more conveniently even to the business applications e.g. in ERP (SaaS – Software as a Service). This transfers the traditional Capital Expenditure (CapEx) model to an Operational Expenditure (OpEx) model. ***SaaS basically uses Cloud Computing Platform for delivering IT enabled Services.***

Today organizations are turning to the cloud business systems in increasing numbers and basically there are many reasons for the same. Few of them as listed below.

- Organizations do not want to buy the servers and hire the IT resources.
- Becoming more complex, and challenging to manage.
- Organizations have complex ERP/Business systems need something easier and more economical.
- Top management doesn't want to spend it on an ERP system.

The vast majority of SaaS solutions are based on a multi-tenant architecture. In this model, a single version of the application, with a single configuration (hardware, network, operating system), is used for all customers ("tenants"). To support scalability, the application is installed on multiple machines which technically termed as horizontal scaling. While an exception rather than the norm, some SaaS solutions do not use multi-tenancy, but use other mechanisms—such as virtualization—to cost-effectively manage the large number of customers in place of multi-tenancy.
An ERP/IT Business Applications solution seeks to integrate and streamline business processes and their associated information and various work flows. Modules in an ERP/Business Solution typically includes: Manufacturing, Supply Chain, Financials, Customer Relationship Management, Human Resource/ Payroll and Inventory Management. The top ERP vendors are SAP, Oracle Corporation, Microsoft Corp, Infor ERP (formerly Baan), Sage Group, Ramco Systems etc. In conventional model, ERP/IT Application solution is being implemented and installed in the Customer's premises. In this case, all the necessary hardware / software/user license need to be purchased by the customer.

Implementation of conventional ERP system involves lots of planning, huge capital investments and is a time consuming process. In addition to these, regular up gradation costs, other investments, maintenance costs can be quite troublesome for the customers. On the other hand, SaaS ERP is devoid of any technological concern and saves the huge initial investment of both time and money. The customer can use the SaaS ERP only

for his business purpose and leave the technical and maintenance related worries rests to the vendor. The vendor gains by serving a number of customers at a time.

There are certain technical challenges involved in the adoption of SaaS technology and some of the challenges are Data security, Customization and Scalability. SaaS applications provide customers centralized, network-based access to data with less overhead and the customers trusting the SaaS vendor to keep every information/data safe and away from prying eyes. Therefore, data is of utmost importance aspect both for the customers and providers of SaaS Solutions.

1.1 Cloud Computing Deployment Models

There are following deployment models for cloud based IT Solutions.

Private cloud: The cloud infrastructure is provisioned for exclusive use by a single organization comprising multiple consumers (e.g., business units). It may be owned, managed, and operated by the organization, a third party, or some combination of them, and it may exist on or off premises.

Community cloud: The cloud infrastructure is provisioned for exclusive use by a specific community of consumers, from organizations that have shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be owned, managed, and operated by one or more of the organizations in the community, a third party, or some combination of them, and it may exist on or off premises.

Public cloud: The cloud infrastructure is provisioned for open use by the general public. It may be owned, managed, and operated by a business, academic, or government organization, or some combination of them. It exists on the premises of the cloud provider.

Hybrid cloud: The cloud infrastructure is a configuration of two or more distinct cloud infrastructures (private, community, or public) that retain unique entities, but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load balancing between clouds).

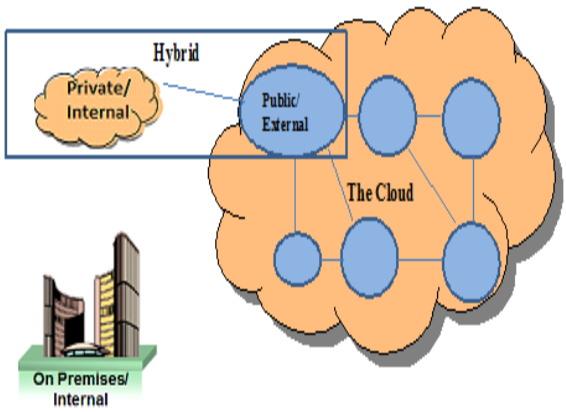


Figure1: Cloud Computing Deployment Model

1.1.1 *Cloud Computing Service Models*

Three significant cloud computing service models as detailed below.

*Software as a Service (SaaS):*The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure. The applications are accessible from various client devices through either a thin client interface, such as a web browser (e.g., web-based email), or a program interface. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user-specific application configuration settings.

Platform as a Service (PaaS): The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages, libraries, services, and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly configuration settings for the application-hosting environment.

*Infrastructure as a Service (IaaS):*The capability provided to the consumer is for provision processing, storage, networks, and other fundamental computing resources, where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems, storage, and deployed applications; and possibly limited control of select networking components (e.g., host firewalls).

1.2 Important Characteristics of SaaS Cloud Computing

- **Agility** improves with users' ability to re-provision technological infrastructure resources.
- **Application Programming Interface** (API) accessibility to software that enables machines to interact with cloud software in the same manner the user interface facilitates interaction between humans and computers.
- **Cost** is claimed to be reduced and in a public cloud delivery model capital expenditure is converted to operational expenditure. This is purported to lower barriers to enter, as infrastructure is typically provided by a third-party and does not need to be purchased for one-time or infrequent intensive computing tasks. Pricing on a utility computing basis is fine-grained with usage-based options and fewer IT skills are required for implementation (in-house).
- **Device and location independence** facilitate users to access systems using a web browser irrespective of their location (e.g., PC, mobile phone). As infrastructure is off-site (typically provided by a third-party) and accessed via the Internet, users can connect from anywhere.

- **Virtualization** technology allows servers and storage devices to be shared for increased and optimum utilization. Applications can be easily migrated from one physical server to another.
- **Multi-tenancy** enables sharing of resources and costs across a large pool of users thus allowing for:
  - **Centralization** of infrastructure in locations with lower costs (such as real estate, electricity, etc.)
  - **Peak-load capacity** increases (users need not engineer for highest possible load-levels)
  - **Utilisation and efficiency** improvements for systems that are often only 10–20% utilised.
- **Reliability** is improved if multiple redundant sites are used, which makes well-designed cloud computing suitable for business continuity and disaster recovery.
- **Scalability** and Elasticity via dynamic ("on-demand") provisioning of resources on a fine-grained, self-service basis near real-time, without users having to engineer for peak loads.
- **Performance** is monitored and consistent and loosely coupled architectures are constructed using web services as the system interface.
- **Security** could improve due to centralization of data, increased security-focused resources, etc., but concerns can persist about loss of control over certain sensitive data, and the lack of security for stored kernels. Security is often as good as or better than other traditional systems, in part because providers are able to devote resources to solving security issues that many customers cannot afford. However, the complexity of security is greatly increased when data is distributed over a wider area or greater number of devices and in multi-tenant systems that are being shared by unrelated users.
- **Maintenance** of cloud computing applications is easier, because they do not need to be installed on each user's computer and can be accessed from different places.

Business Value of Cloud Computing services [SaaS]

Cloud-based systems immediately open options for access to new and cost-effective ways to address company goals and objectives. For example:

- Being able to get services up and running quickly;
- Lower upfront deployment costs;
- Ease of access;
- Pay for software solutions you need, when you need them;
- Access to automatically updated software and security

2. BACKGROUND AND HISTORY

The term "cloud" has been actually borrowed from telephony services. The telecommunications companies, who until the 1990s primarily offered dedicated point-to-point data circuits, began offering Virtual Private Network (VPN) services with comparable quality of service but at a much lower cost. By switching traffic to balance utilization as they deemed it workable if they were able to utilize their overall network bandwidth more effectively. The Cloud symbol was used to denote the demarcation point between that which was the responsibility of the provider from that of the user. Cloud Computing extends this boundary to cover servers as well as the network infrastructure.

The underlying concept of Cloud Computing dates back to 1960s, when John McCarthy opined that "Computation may someday be organized as a public utility". Almost all the modern day characteristics of cloud computing (elastic provision, provided as a utility, online, illusion of infinite supply), the comparison to the electricity industry and the use of public, private, government and community forms were thoroughly explored by Douglas Parkhill [1966]

Salesforce.com is one of the pioneers of the software as a service model of distributing business software, in which access to business software is purchased on a subscription basis and hosted offsite was established by Marc Russell Benioff in [1999] who is a Chairman and CEO of Salesforce.com, the leading enterprise Cloud Computing Company. They also provided the concepts of "on demand" and SaaS is an abbreviation for "Software as a Service "The key for SaaS is that it is customizable by customers requiring limited technical support. Business users have enthusiastically welcomed the resulting flexibility and speed.

Amazon played a key role in the development of Cloud Computing by modernizing their data centers after the dot-com bubble, which, like most computer networks, were utilizing as little as 10% of their capacity at any one time just to leave room for occasional spikes. Having found that the new cloud architecture resulted in significant internal efficiency improvements whereby small l, fast-moving "two-pizza teams" could add new features faster and easier, Amazon started providing access to their systems through Amazon Web Service (AWS) on a utility computing basis in 2006.

In 2007, Google, IBM, and a number of universities embarked on a large scale cloud computing research project. In early 2008, Eucalyptus became the first open source AWS API compatible platform for deploying private clouds. By mid-2008, Gartner saw an opportunity for Cloud Computing "to shape the relationship among consumers of IT services, i.e. between those who use IT services and those who sell them", and observed that organizations are switching from company-owned hardware and software assets to per-use service-based models" so that the "projected shift to Cloud Computing will result in dramatic growth in IT products in some areas and significant reductions in other areas."

3. LITERATURE REVIEW

Many researchers have their different opinion on the challenging factors, which become obstacle in the adoption of this technology.

Benlian.A, Hess.T, Buxmann. P [2009], "Drivers of SaaS-Adoption": Analysis revealed that patterns on the decision on

SaaS-adoption differ across application types. Social influence, attitude toward SaaS-adoption, adoption uncertainty, and strategic value turned out to be the strongest and most consistent drivers across all application types. Furthermore, we found that firm size does not matter in SaaS-adoption, since large enterprises and small- and medium-sized companies had similar adoption rates.

According to Armbrust et al, [2009] "A Berkeley View of Cloud Computing" identified 10 Obstacles and Opportunities for Adoption and Growth of Cloud Computing. According to the market research company IDC prediction [2010] web cast IDC IT Cloud Services.

Survey: Top Benefits and Challenges are Security, Availability and Performance Still Lead Challenges; Cost and Lock-In Worries Rise

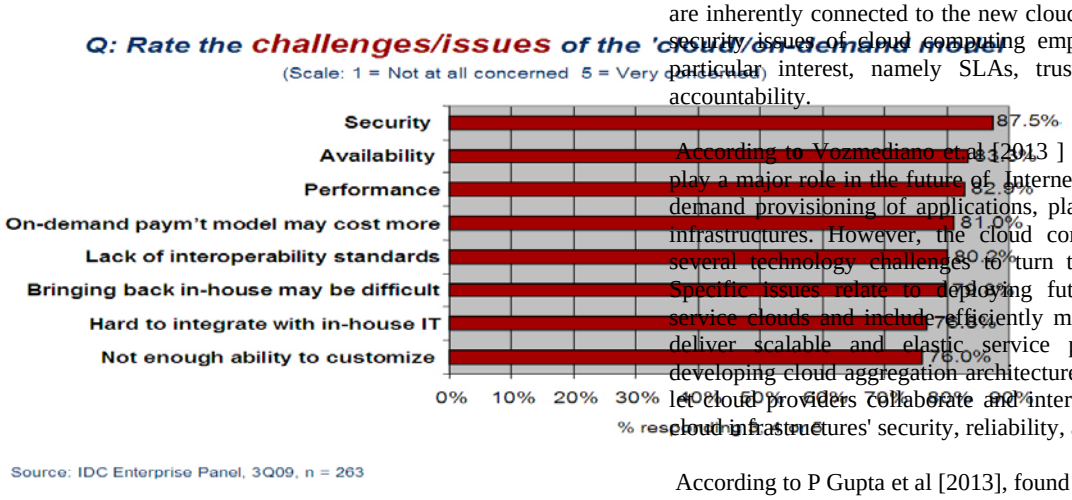


Figure2: IDC Report (2010) on Rating of Cloud computing challenges/ issues.

Dawei.sun et al [2011], studied on Surveying and Analyzing Security, Privacy and Trust Issues in Cloud Computing Environments, main aim of researcher was to highlight the major Security, privacy and trust issues in current existing cloud computing environments and help users recognize the tangible and intangible threats associated with their uses. We cover two main aspects of security, privacy and trust issues, which include:

(a) Surveying the most relevant privacy, security and trust issues that pose threats in current existing cloud computing environments, and

(b) Analyzing the way that may be addressed to eliminate these potential security, privacy and trust threats, and providing a high secure, trustworthy, and dependent

(c) Cloud computing environment.

Janssen.Marijn and Joha. Anton [2011], "CHALLENGES FOR ADOPTING CLOUD-BASED SOFTWARE AS A SERVICE (SAAS) IN THE PUBLIC SECTOR". It was found that SaaS could provide many benefits which are related to the outsourcing of the local control, installation and development of software which could result in potential cost-savings and better cost control. There are also many challenges that need to be addressed including ensuring the quality, privacy, security and business continuity which require the implementation of organizational changes and governance mechanisms for public sector organizations are adopting SaaS.

Hailu & Alemayehu [2012], "FACTORS INFLUENCING CLOUD-COMPUTING TECHNOLOGY ADOPTION IN DEVELOPING COUNTRIES" The purpose for studying this topic is to examine factors that influence IT leaders in the developing countries in the selection and adoption of cloud-computing technology.. The study will evaluate developing countries IT investment decision makers' attitudes and perceptions of the need, reliability, cost effectiveness, and security effectiveness of cloud computing.

C. Rong et al [2012], discussed about cloud computing benefits and security challenges in the current cloud computing model, including both the conventional security challenges that can be applied to cloud computing and a number of new challenges that are inherently connected to the new cloud paradigm. The current security issues of cloud computing emphasized three areas of particular interest, namely SLAs, trusted data sharing, and accountability.

According to Vozmediano et al [2013] , Cloud computing will play a major role in the future of Internet Services, enabling on-demand provisioning of applications, platforms, and computing infrastructures. However, the cloud community must address several technology challenges to turn this vision into reality. Specific issues relate to deploying future infrastructure-as-a-service clouds and include efficiently managing such clouds to deliver scalable and elastic service platforms on demand, developing cloud aggregation architectures and technologies that let cloud providers collaborate and interoperate, and improving cloud infrastructures' security, reliability, and energy efficiency.

According to P Gupta et al [2013], found that "Five factors influencing the cloud usage by the business community", Business requirements of various large enterprises are ease of use and convenience is the biggest favorable factor followed by security and privacy and then comes the cost reduction

4. RESEARCH METHODOLOGY

Purpose of the study

The key purpose for studying this topic is to analyse and investigate the current prospects and challenges involved in acceptability of Business applications on SaaS delivery model. This study focuses on critical comparative cost-benefit analysis of the SaaS based Business/ERP solution with traditional IT/ERP solutions and identifies the challenges faced by the IT Companies (Service Provider) as well as user organizations. This includes identification of the major factors which are restraining & affecting the decision of user organization for adoption/implementation of cloud computing based IT solutions in their organizations. Further the study will also evaluate various other known issues pertaining to SaaS applications i.e. technical architecture, customization, data Security, contracting/SLA, performance, availability, pricing and integration with other systems etc. Extensive literature review of cloud computing was done to find out the challenging factor of SaaS adoption of cloud computing

4.1 Research Objectives

The research objectives are to identify and analyse various technical/business issues that have become obstacles in the adoption of ERP/Business Solution on SaaS Model by various organizations especially in India and influence decision making at the same time.

4.2 Research Design

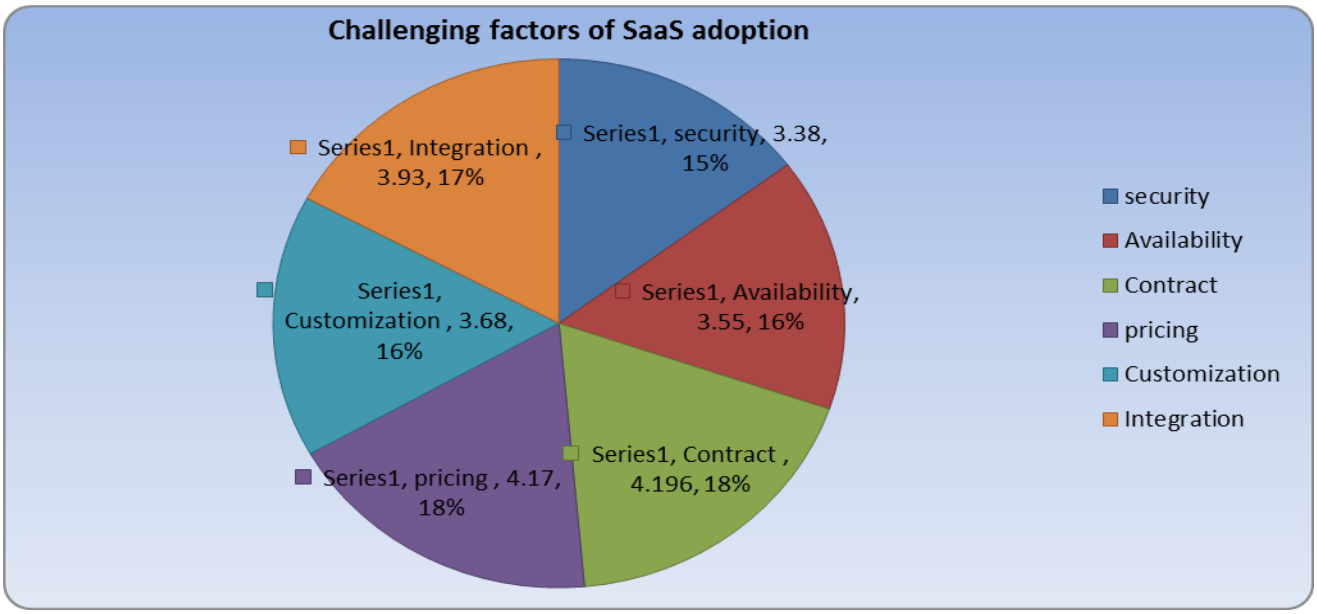
The research design for this study is descriptive. The major purpose of descriptive research is description of the state of affairs as it exists at present. Descriptive research includes surveys and fact-finding enquiries of different kinds. The methods of data collection depend upon the sources of data collection including primary source of data and secondary source of data. For this study, primary data collected through structured close ended questionnaire collected through direct interview and some through email, telephonic interview. To collect secondary data, websites and external sources have been utilized.

Sample Technique: - This study used stratified random sampling techniques as data have been collected from the heterogeneous group. The targeted sample size was 110, but actual data collected from 100 companies that include 50 user companies using SaaS business application, 40 Non – User companies and 10 SaaS solution Service provider IT Companies. One respondent from one company, hence survey executed at company level where staff members of each company responded about adoption of SaaS business application in their organization.

4.3 Data Analysis

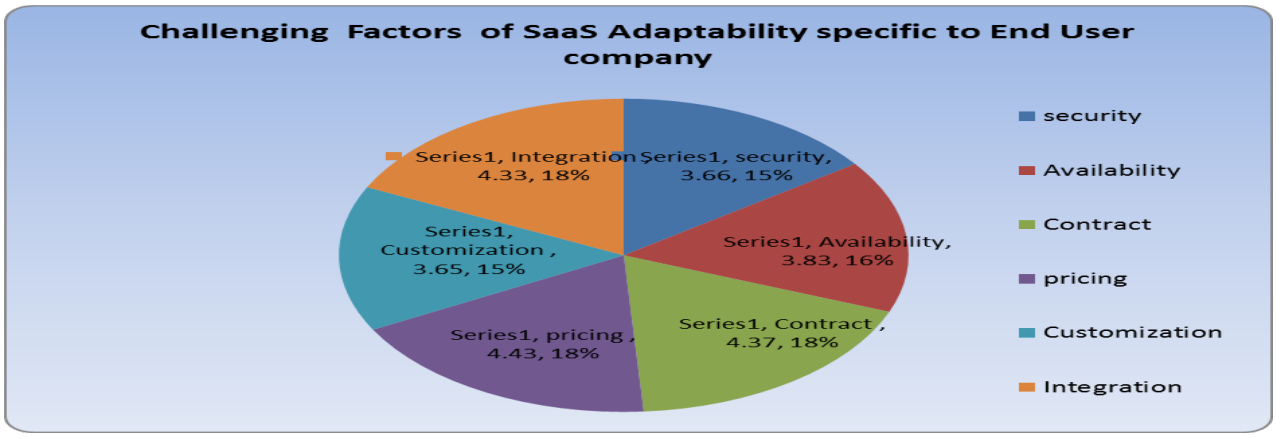
Statistical analysis was performed on the data/response collected from around 100 companies that included data/response from the user, non-user companies and Solution Providers of SaaS IT solutions. Tools used for data & statistical analysis: Microsoft Excel 2010.

1. **Challenging factors for the Adaptability of SaaS solution**
   (Covering all types of enterprises i.e. User , Non-User and Solution Provider)



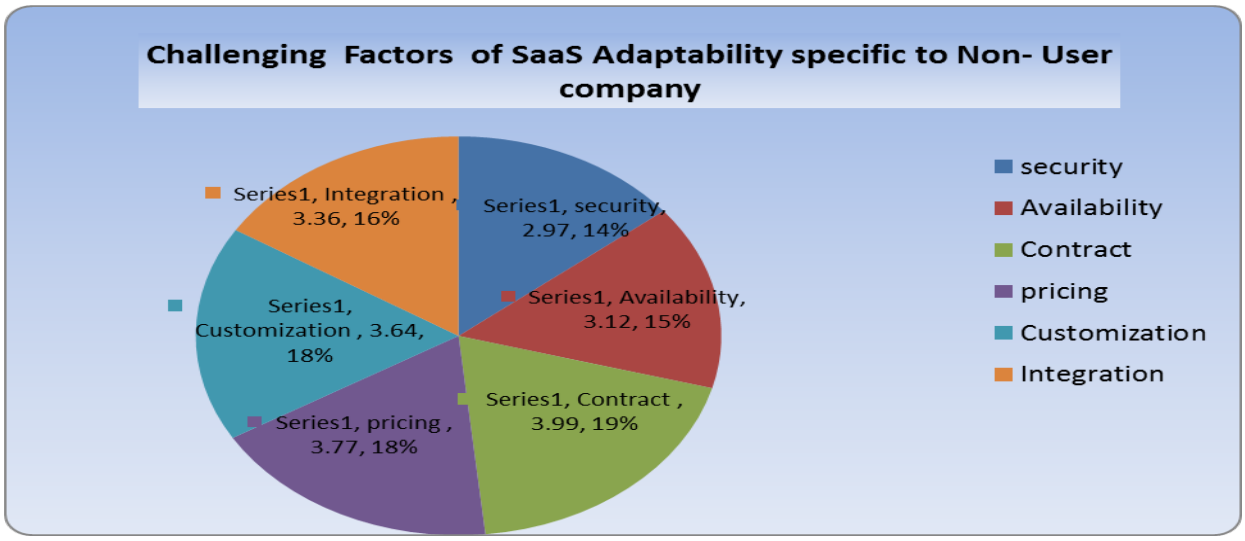
2. **Interpretation** :- Contract and pricing scored similar percentage of 18% ,Integration comes next with 17% . However, 'availability and customization'and Security scored 16% and 15% respectively.

3. **Challenging Factors of SaaS Adaptability w.r.t. to User companies of SaaS solutions**



Interpretation :- Integration ,Contract andPricing all 3 important factors scored 18%. However, availability,security and customization scored 16% , 15% and 15% respectively.

4. Challenging Factors of SaaS Adaptability specific to Non User Companies



Interpretation:- Contract, Pricing and Customization scored 19%, 18% and 18% respectively. However, integration,availability andsecurity scored 16% , 15% and 14% respectively.

5. FINDINGS

Following are some of the important factors which are limiting the adoption of SaaS as a business solution.

- Data security factors.
- Customization factor
- Data availability factors
- Integration factors
- Contract factors
- Pricing factors

Quantitative analysis was performed on data collected from 100 companies that includes both user and non – user companies and Challenging factors percentage is different for both the user and non-users companies .

- Challenging factors for the Adaptability of SaaS solution (Covering all types of enterprises i.e. User , Non-User and Solution Provider- Contract and pricing scored similar percentage of 18% ,Integration comes next with 17% . However, 'availability and customization'with 16%and Security scored 15% respectively.
- Challenging Factors of SaaS Adaptability w.r.t. to User companies of SaaS solutions- Integration ,Contract andPricing all 3 important factors scored 18%. However, availability,security and customization scored 16% , 15% and 15% respectively.
- Challenging Factors of SaaS Adaptability specific to Non User Companies- Contract, Pricing and Customization scored 19%, 18% and 18% respectively. However, integration,availability andsecurity scored 16% , 15% and 14% respectively.
- According to literature review Security and availability are most concerned issues but according to primary Data analysis Security and availability is got less

weightage as compared to contract, integration and pricing are highly concerned factors.

6. CONCLUSION

Software as a Service (SaaS) is gaining momentum across global markets. Specific to India, most organizations are increasingly realizing the latent benefits that this model of IT service delivery can provide which spawns the interest for SaaS and its adoption. However, this is highly dependent on cloud services providers meeting enterprise user concerns on issues ranging from pricing, to availability guarantees, to security. There are various technical/business issues that have become obstacles in the adoption of ERP/Business Solution on SaaS Model by various organizations especially in India and influence decision making at the same time despite of challenges, the cloud services market will see significant growth during the next five years. Taking into account the current development on the market of cloud computing, it has clearly seen that potential users/customers are still unaware of the benefits of SaaS Business Model and still have some doubts for implementation of SaaS. This leads to the fact that the providers have to push and educate the customers such that they are convinced about the security of the model. From the moment that the customer is released from the prejudice of ―unsecured SaaS model, it is believed that the demand will be pulled by the customer. This scenario promises a high adoption of Enterprise Applications on SaaS in the business world and potentially announcement of a new era for cloud computing.

SaaS heralds an alternative approach to empower organizations with the provision of business impacting IT solutions through a web-based delivery model and it can be deployed rapidly and eliminates the need to invest in infrastructure and ongoing software maintenance costs that traditional applications require.

For SMBs, SaaS has always been a viable option, given that there is a monthly subscription instead of huge upfront costs, but for large enterprises, the benefits of SaaS are not too hard to find. Technology updating, easy adoption, scalability is just few of them. SaaS has many benefits in terms of money , cost and time as compare to challenges . The need of SaaS solution is closely associated with attempts to improve the business value of IT investments, whereas an ERP/business solution seeks to integrate and streamline business processes and their associated information and work flows in an organization.

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