Suitability and Adoption Issues of Cloud Computing for Entrepreneurs

Ranjit Abraham

BTC College of Engineering & Technology,
Syrian Park, Arjun Hills,
Koothattukulam, Kerala, INDIA.

Sarath Chandar Rao Sanku

Little Angels Business School,
9-7-14, Shimorenjaku, Mitaka-shi,
Tokyo, JAPAN.

Abstract—**Cloud Computing has progressed rapidly from hype to become a meaningful utility for entrepreneurs and start-ups as a cost-cutting, scalable Information Technology service alternative to that provided by traditional computer solution providers. However, concern about its security, privacy and extreme dependence on the Internet connectivity still persists. An entrepreneur's business architecture needs to be carefully evaluated in determining the role cloud computing could play to achieve the goals and objectives of the business. In this paper, we study the different cloud service and deployment models and do a SWOT analysis for cloud computing. Market analysis using Porters five forces and an entrepreneur's risk management is portrayed to better enable decision making for the benefit of entrepreneurs.**

Keywords—entrepreneurs; cloud models; porter's market analysis; SWOT; risk matrices

I. INTRODUCTION

Peter Drucker defined an entrepreneur as "one who searches for change, responds to it and exploits opportunities". In the hands of an effective entrepreneur, innovation becomes a tool to convert a source into a resource. With the advent of technology, new domains such as cloud computing have grabbed the attention of entrepreneurs, often associated with high growth, technology oriented, have a greater risk and high potential for Return On Investment (ROI). Start-ups to be successful need to be scalable with the ability to grow rapidly with limited investment. Many entrepreneurs do not possess sufficient funds to invest in the procurement of expensive computer hardware, software and/or support infrastructure.

The premise for Cloud Computing (CC) is to dramatically reduce the upfront costs of computing by providing organizations the functionality of existing Computer Technology Services. In a strange sense, CC promises to become a utility much like electricity, water, gas and telecommunications in terms of its usage regulations. The entrepreneur's perspective is the ability of CC to provide for resources as required; thereby keeping costs down and serves as a green initiative in that business with car-bon footprint lowered considerably [1]. There are obviously concerns such as the privacy of the web storage, security of data and the inherent risk in losing internet connectivity.

Cloud Computing (CC) was created for commercial purposes in 2007 by industry giants like Google and Amazon. CC was developed using precepts focusing primarily upon the provision of providing one of these services: Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). Today CC service companies are in competition with traditional computer solution providers who do the same on-site by installing, configuring computer hardware and developing software applications. In addition, the potential and impact of CC drawn from surveys, studies and experiences of companies show a lot of inconsistency. Current findings indicate that CC is no longer just hype but is progressing as a trend [2]. With the availability of faster, cheaper, and more reliable Internet, there is a growing tendency among the companies to use the various cloud architectures, applications and, services.

Under the current economic situation, many companies of today face tremendous pressure to reduce costs wherever possible and IT budgets are the traditional choice of target for cost cutting initiatives [3]. Despite the fact that companies have begun exploiting the potentials of the cloud for services, there is a total absence for foundation and methodologies for informing the process of cloud adoption. In view of this, the present practice of adopting clouds and their services could be well described as off-the-cuff, deficient in systematic guidance and rigor. Often, the selection is based on the reputation of the cloud provider, the service level agreement (SLA) statements, the terms and conditions, peer recommendations and clouds' reputation, previous experiences and the like from biased or subjective ad hoc inputs [4].

The entrepreneur's business architecture plays a vital role in determining the adoption of CC to achieve the goals and objectives. There is no doubt that implementing CC from a business perspective can be a risky strategy in terms of financial, security, and performance factors [5]. Cloud customers should conduct a comprehensive assessment of access privileges (i.e. stating who will have access to their data and what level of access they will have) as well as transparency measures. Return on Investment (ROI) expected of the cloud service, the management of the cloud, defining the areas of the business that would operate without the aid of the cloud, and most importantly, determining the business policies, processes and personnel training for the

solutions to work well are some of the key factors to be considered [6].

This paper will briefly study the various models of service and deployment of CC; touch upon the various factors which

Fig. 1. Cloud Computing Service Models

influence CC; market analysis using Porter's five forces and the risks involved in choosing CC through a framework which could aid the entrepreneur in his/ her successful adoption of this new utility.

II. CLOUD COMPUTING MODELS

The official definition of Cloud Computing (CC) by the international standardization body NIST (National Institute of Standards and Technology) is as follows: "Cloud Computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (example: network, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction." From a service perspective, consumers get global access appropriated in any quantity at any time and use the cloud services as needed without any human interaction with the service provider.

The CC concept permits users to use any standard web browser to be able to transmit or receive computing services via the Internet. The growing availability of high bandwidth internet access is a pre-requisite for CC. Dial-up connections (slow connections) tend to make CC intolerable and/ or it can become quite impossible to enjoy the benefits of CC. At least, Broadband access is essential for Cloud Services.

A. Cloud Computing Service Model

For the end user, the CC industry offers distinct service models, and this pertains to the different layers of the CC architecture. The services are remotely available by utilizing communication channels and require a payment for use. Fig. 1 depicts each of the type of Cloud Service Models, the users and a brief description of the service.

1) *Software as a Service (SaaS):* SaaS is the most popular among the three cloud service models - with SaaS, organizations can run applications on the cloud, avoid the need to install, maintain and run the application on Server machines within the company. A variety of services from SaaS may include:

- Office related applications such as email, spreadsheets and presentations.

- Billings for managing subscriptions and usage to services and products.

- Tools for Collaboration for workgroups, users within & across the enterprise.

- Management of web-based application content.

- Document management that includes tracing and access to relevant documents.

- Customer Relationship Management (CRM) for managing customer interaction.

- Manage finance related processes such as tax, expense and sales.

- Manage several human resource tasks such as Sales and commission tracking.

- Enterprise Resource Planning (ERP) for managing both internal and external resources through an integrated computer-based system [7].

- Data backup and data retrieval for personal/ enterprise usage.

2) *Platform as a Service (PaaS):* This service model enables application development and deployment without the complexity and cost of procuring and managing the underlying software and hardware. Some of the example uses include

- Business Intelligence applications such as data analysis, reporting systems and dashboards.

- Database Services for scalable relational/ non-SQL database solutions.

- Application development and testing platforms, which may expand and contract as per requirements.

- Integration Development and deployment of integrated applications in the cloud and for in-house use.

- Providing platforms enabling development of general-purpose applications.

3) *Infrastructure as a Service (IaaS):* This service model enables storage as well as compute capabilities as a service. Example usage includes

- Running cloud-based systems that are dynamically provisioned and configured.

- Services to manage cloud infrastructure platforms, and

- Scalable storage for applications, backups and data archival needs.

B. Cloud Computing Deployment Models

The popular cloud deployment models for an entrepreneur are Public, Private, Community and Hybrid cloud as shown in Fig. 2. The public cloud available by leveraging the internet and from third-party service providers enables deployment of IT solutions in a cost-effective way for start-up businesses. Google Apps is a well-known example of a

public cloud used by large and small organizations. On the other hand, a private cloud offers similar benefits of the public cloud environment except that it is managed within an organization. At an added
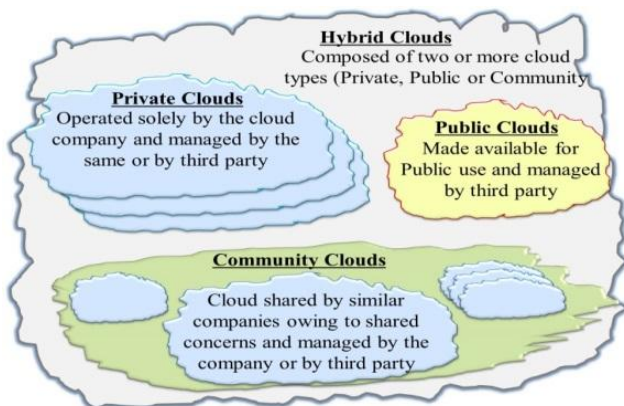

Fig. 2.   Cloud Computing Deployment Models

cost, private clouds provide much more control over the cloud infrastructure and are often suitable for large installations. A private cloud could be also managed by a third party provider.

A hybrid cloud combines the features of both public and private clouds - usually, information that is non-critical is outsourced to the public cloud, while data and services that are business-critical are controlled by the organization. The community cloud is a multitenant infrastructure shared by a specific group of organizations who have common computing concerns. Community clouds may be implemented either as private or hybrid cloud.

The authors emphasize that the loss of control is rapidly emerging as the number one inhibitor to the adoption of public CC services. According to Borderless Security: Ernst & Young's 2010 Global Information Security Survey, "Many companies are concerned about giving up control of access to their business information and relying on the cloud to provide secure authentication, user credentials and role management."

III.   CLOUD COMPUTING MODELS

Like any Industry, IT also needed to reinvent itself – driven by the growth in communication bandwidth and growing familiarity with the Internet. The typical traditional business model of "single-provider, one-stop provision of outsourcing" is replaced by a network of different service providers, offering a wide range of services and products on different levels. Comparing traditional computing with cloud computing, CC operations are on a bigger scale; within a single cloud we have different users accessing its services and applications.

For a business venture, SWOT analysis is a strategic planning method used to evaluate the Strengths, Weaknesses, Opportunities, and Threats involved. The identification of SWOTs is important since the pertinent steps in the process of planning for achievement of the selected objective can be derived from the SWOTs. Fig. 3 gives a SWOT analysis for Cloud Computing.

The most important feature and often-quoted feature for CC technologies is that entrepreneurs and start-ups can shift focus to the business management rather than the technology management, and dedicate efforts on the KPIs that have important impacts on the business. Below we describe the key features in favor of cloud computing:

- Reducing up-front investment costs by leveraging a predictable and convenient monthly fee based CC
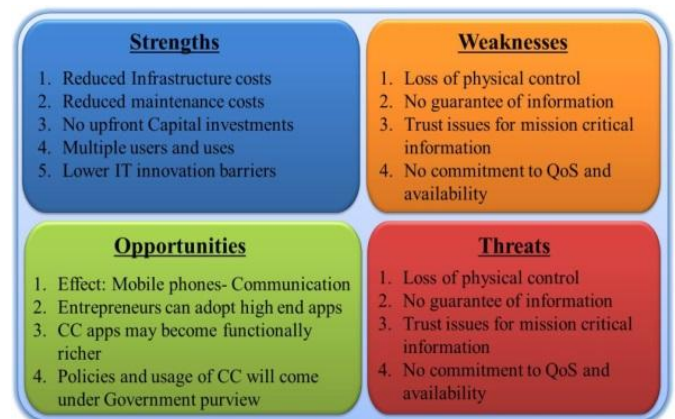

Fig. 3.   SWOT analysis for Cloud

model to eliminate overheads such as software licensing. This is true for small, mid-size and start-up organizations who will otherwise have to do costly investments for the IT infrastructure.

- Having to avoid software upgrades and staffing to manage and maintain own application servers on-premises. CC solutions become a viable alternative if they include free software upgrades, maintenance and the like.

- Security of data continues to be a major concern for organizations as they need to schedule periodic backups in-house. Properly planned CC technology can ensure safety and availability 24/7 anywhere, anytime for business data.

- Typically large investments are required for start-ups to hire experts and for advanced training to minimize errors and risks. In this context, choosing CC solutions can help them manage technology and relieve them from issues related to deployment, performance, integration and security.

- CC technology can be advantageous to entrepreneurs who need immediate value at reduced total-cost-of-ownership. The key advantage being the ability to deploy faster in the cloud over deployments on premise.

- CC technologies can provide added flexibility compared to on premise systems because the business only pays for what they use, scale easily to meet new

needs without the additional investment for the hardware and software infrastructure.

- With effective planning, utilizing CC solutions, an organization can get improved security, manageability and compliance. Further, the organization irrespective of its location gets instant internet mobility and access to their business data anytime.

- CC solutions help lower total-cost-of-ownership (TCO) and faster ROI than on-premises solutions for establishing Enterprise Resource Planning (ERP).

- Increasingly, many organizations choose CC technologies to become more productive by putting greater focus back on running the business rather than managing their in-house technology.

IV. MARKET ANALYSIS USING PORTER'S FIVE FORCES

Porter's model [8] refers to five forces that determine the attractiveness (i.e. likely levels of average profitability) of an industry or market. They are - (a) The threat of substitute products. (b) The threat of new entrants (c) The bargaining power of sup-pliers (d) The bargaining power of buyers and (e) The intensity of industry rivalry.

For an entrepreneur, the choice of developing a product or a service demands one of these possible solutions: (a) To create in-house using various infrastructural modes (b) To outsource the entire work to an external agency (c) To partially outsource some of the infrastructural modes (d) To share and build via social networks (e) To license each part of the product to separate vendors or (f) Lastly, to go for a mix of all of the previous types. For a technology service or product, the risks of each type have to be suitably evaluated towards an optimum solution. Applying Porter's five forces (Fig. 4) analysis along segments, one can determine the causes and influences of each force.

Threat of substitution products: The main competition for CC comes from the traditional Information Technology (IT) driven companies. This can change only if the cloud is regarded as not secure compared to traditional networking infrastructure. The competition between the big cloud players is also substantial when viewed in terms of speed and complexity, higher service levels, lower prices and contractual terms. For an entrepreneur, SaaS is likely to be the choice in CC.

Key Threat of new entrants: As a new emergent service, new companies catering to the CC marketing industry will grow profoundly as the market expands. As the industry grows we shall witness increased levels of competition. New entrants offer different threats for the different types of companies within the cloud. IaaS service seeking organizations will have fewer entrants because of the cost of competing against large players whereas, SaaS service seeking organizations with small initial investments and new entrants will readily enter the industry. Reduced fixed costs, reduced cost for adopting the new technology, and relative absence of restrictions by the government will entice new entrants.

Bargaining power of suppliers: The bargaining power of suppliers is weaker than that of buyers. This arises due to the greater market transparency, Standard Models (CMM, ISO,

ITIL etc.,) and due to Market Saturation. In the IaaS segment, the large companies will need to have costlier and bigger servers for the data centers in order to run hosting solutions. In fact, due to a loss of business from a lower need for the smaller servers due to cloud services, the suppliers of small and medium sized servers will actually be at a disadvantage as they need to sell servers to remain solvent. This provides the entrepreneur a strong means to bargain with cloud providers.

Bargaining power of buyers: As more CC companies enter the business, the entrepreneur (buyers) has strong bargains to take advantage. The contractual terms for cloud hosting need renewal and if cross portability arrives, then the buyer can actually dictate terms with the cloud companies. There is of course, the monopolistic nature of IaaS companies
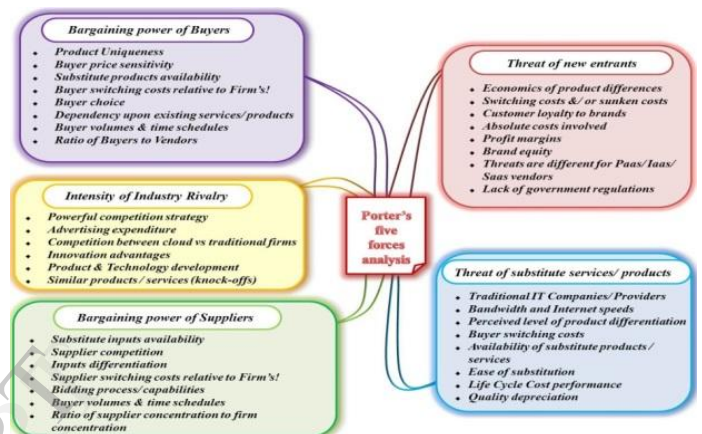
to consolidate and merge together in order to create a massive

Fig. 4. SWOT analysis for Cloud

cloud. Amazon Cloud services has positioned itself high in the market place and the lack of government oversight of the cloud at this point is a significant risk for the cloud as a choice of selection.

Intensity of Industry rivalry: Companies like Amazon dominate in providing hosting solutions because of the relative high cost of entry. However, even CC follows Moore's Law and so costs should come down eventually with time. For an entrepreneur, the risk is that monopolistic cloud companies may increase costs for data volumes, access (read and write) and for computational intelligence. Furthermore, in the SaaS segment, where the entrepreneur is most likely to enter, competition will intensify with each new software application laden with features as a dominant selling point. Once again, the entrepreneur must be careful in the development of a product or service, taking into consideration the ease of duplication by others in the same industry.

V. ENTREPRENEURIAL RISK MATRIX

Risk is associated with the uncertainties associated with events. In context of this paper, risk is commonly to be associated with an uncertain event or condition that, if it occurs, results in unwanted consequences.

The analysis of risk [9] attempts to identify and quantify the potential outcomes from a certain set of events. Risk

analysis must answer the triplet question: What can go wrong? How likely is this event? What are the outcomes or consequences if the event occurs?

The analysis identifies a single event or a sequence of events (called scenarios) that can lead to an undesired consequence. The event or scenario is a cause that, if it occurs, results in an adverse consequence of some degree of severity. Such an event could be the result due to shortage of trained computer personnel for performing a project critical task. Shortage of personnel is an event that may lead to higher costs for the project, reduced quality in the results or a delay in the schedule. Note that events can and may reside in a "project" environment and may result in the project success or failure, and includes project management practices, or external partners.

For a preconceived project scenario to be used for SaaS development the possible tools and support mechanisms have

Fig. 5. QoS and outcomes for similar investment in Cloud, Traditional and technology mix

been summarized and a sample risk matrix has been created to emphasize and to highlight the implications of cloud and traditional technologies and a mix of both. Fig. 5 is a sample representation for a typical SaaS product/ service development and maintenance (with associated software and hard-ware requirements) that may be used by a start-up. It shows that CC definitely has a lot to recommend in such a scenario. A similar risk matrix with additional constraints could be similarly used for small and medium sized companies (SMEs).

To simplify the quantification and qualitative aspects of risk, certain key assumptions in making the risk matrix are as follows:

- For a given capital base, the risk matrix reveals the type of infrastructure possibilities that present themselves to an entrepreneur using CC, traditional IT computing and a mix of both.

- The activities are typical of a SaaS development and implementation project - strictly for illustration purposes and must not be construed as valid in every case.
- For simplicity, it has been assumed that the skill set of human resources for the computing infrastructures are identical in nature and cost to company.
- Cloud, Traditional computing or a mix requires equal number of human capital.

The Internet connectivity provides high data security, reliability and redundancy.

VI. CONCLUSIONS

Cloud computing an emerging paradigm with associated risk, provides a high potential path for investment and to get better Return on Investments. The authors have taken suitable steps to ensure that entrepreneurial forays into CC are a valid and justifiable venture. Using Porter's five-force analysis, some of the findings such as the threats facing new entrants, threats due to substitution products, the bargaining power of both suppliers and buyers and lastly the competitive nature of the industry have been summarized and the findings are in favor of CC. The authors also used a Risk Matrix to represent the likely outcomes and consequences of using CC, traditional IT model and with a mix of both systems. The inferences derived indicate that CC is a very efficient mechanism to jump start a new service or product (but the entrepreneur must remain aware of the many other risks previously identified). This research study is part of an ongoing research work into CC and this paper is limited in scope. There are many avenues for further research and development and these include Comprehensive CC Cost Modeling, CC implementation Frameworks, Regulations in CC Security and Information Management and the most challenging process of beginning the transition from traditional computing to CC. After all, CC is going where nothing else has gone before – the future of humankind!

Colour Code	Low Priority	Mitigate	Fix-it-Now	Avoid

Summarizing Support Scenarios				Type of Infrastructure				
Support for		Possible Activities	Supporting Model	All Cloud	80% Cloud	50% Cloud	20% Cloud	All Traditional
High ↑ Service Quality ↓ **Low**	Support business Initiatives and Continuous Improvement	Project Support for Tech Enhancements	Support model: 24x7 for production 12x5 for non-production Production/Non-production ratio 40:60	20 % support for business Initiatives and Continuous Improvement	Lower resources availability leading to poor Support	In adequate resources to handle these services	Insufficient resources to handle these services	No human resources to handle these services
		Moves/ Adds/ Changes						
		Tools Development						
		Engineering Major Version Upgrades						
	Support Application change	H/W & S/W lifecycle management		20% support for Application change	Support will be inefficient	20% support for Application change		
		Development and staging system incident Management						
		Sustaining Engineering Patch Management						
		Audit Remediation						
	Critical Run Business service elements	Regulatory Compliance		60% resources for critical issues and rest allocated for Support & Improvement	60% resources works in issues but rest can be allocated to changes	80% resources work in critical issues & rest may handle changes	Some services may be affected	100% HR works on mitigation of issues. Change requests handling is impeded
		Data Replication Management						
		Backup & Restore						
		Production System Change Management					90% human resources work on issues & rest can handle change requests	
		Office hours support for Development Systems						
		24X7 Incident Management for Production Systems						
		Core services (LDAP, DNS, Kerberos, NIS, SMTP, SNMP)						
CONSEQUENCES								
	Product or Service Quality			Some product or service fails to meet Standards	Several customers complain verbally	Several customers complain in writing	Important/ Key/ Major companies cancel contracts	Loss of substantial market share due to problems
	Asset Or Financial Loss			Noticeable damage exceeds 10000 US$	Noticeable damage exceeds 10000US$	Large damage exceeds 0.1 M US$	Major damage exceeds 1M US$	Major damage exceeds 10 M US$

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