Journal of International Technology and Information Management

Volume 26 | Issue 1 Article 6

1-1-2017

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Recommended Citation

Attaran, Mohsen (2017) "Cloud Computing Technology: Leveraging the Power of the Internet to Improve Business Performance," *Journal of International Technology and Information Management*: Vol. 26: Iss. 1, Article 6.
DOI: https://doi.org/10.58729/1941-6679.1283
Available at: https://scholarworks.lib.csusb.edu/jitim/vol26/iss1/6

Cloud Computing Technology: Leveraging the Power of The Internet to Improve Business Performance

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ABSTRACT

In recent years, Cloud Computing Technology (CCT) has emerged as a meaningful technology that could contribute to operational efficiency of an IT platform by providing infrastructure and software solutions for the whole IT needs of an enterprise via Internet. The cloud has revolutionized IT infrastructure. It is predicted that 2017 will mark the rapid proliferation of enterprises transitioning to the cloud-based computing technology. The utilization of this innovative technology makes collaboration easier among companies and has the potential to create financial and operational benefits. This study discusses potential strategic benefits of this technology, highlights its evolving technologies and trends and their future impact, reviews different phases necessary to deploy the technology, highlights key adoption factors, and surveys its potential application in different industries.

KEYWORDS*: Cloud Computing Technology (CCT); Public Clouds; Private Clouds; Hybrid Clouds; Community Clouds; Supply Chain Management (SCM)*

INTRODUCTION

As the competitive atmosphere of the business world grows, information technology facilitates collaboration among distant workers easier than ever. Using web-based software, organizations can monitor the external operating environment by creating linkages between suppliers, distributors and customers through a company's centralized location. This would facilitate collaboration between those factors and enable organizations to observe their continually changing environment (Attaran, 2007). Cloud Computing Technology (CCT) has

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emerged as a valuable way to improve collaboration among companies (XunXu, 2012). This architecture presents information technology as a paid service in terms of deployment and maintenance (Sean et al., 2011).
Cloud computing is a current trend in the next-generation application architecture. While cloud services such as webmail and YouTube have been widely used by individuals for some time, organizations have not begun to use cloud services as a tool for meeting their IT needs until 2009 (Angela et al, 2012). In the past few years, many companies have embraced CCT and are beginning to enjoy real business benefits from it. CCT is slowly emerging as a valuable way to improve internal efficiencies (Folinas, 2013**;** Shacklett, 2010; Schramm et al, 2011; Marston et al., 2011). Employing cloud-based technology could generate numerous advantages for adopters such as capital investment savings, simplified operations, scalability, improved information visibility, sustainability, and faster deployment.

Vivek Kundra, the first CIO of the US Federal Government, summarized cloud computing services offering as: "There was a time when every household, town, farm, or village had its own water well. Today, shared public utilities give us access to clean water by simply turning on the tap; cloud computing works in a similar fashion. Just like water from the tap in your kitchen, cloud computing services can be turned on or off quickly as needed. Like at the water company, there is a team of dedicated professionals making sure the service provided is safe, secure and available on a 24/7 basis. When the tap isn't on, not only are you saving water, but you aren't paying for resources you don't currently need." (Bhoir & Patil, 2014).

Cloud computing is expanding and being adopted in numerous business domains. According to the November 2016 Forrester report, the cloud market will accelerate faster in 2017 than in previous years primarily because enterprises around the world are looking to the cloud as a viable place to run core business applications. The global public cloud market will be worth $146 billion in 2017, up from $87 billion in 2015, and is growing at a 22 percent compound annual growth rate. Implemented properly, the technology has the real potential to enable accuracy, reliability, service enhancement, and cost reduction.

CCT is different from other historical IT models in that it focuses mainly on services, rather than technology. Here, technology (storage, CPU, networking equipment) is not the service, but the building blocks for a service. The technical details are kept away from consumers of the service. Consumers can place service requests via self-service and are billed for what they use.

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Cloud computing is one of the most promising and anticipated techno logies in recent years. The technology is not a new concept for most of the sectors and with proper planning could increase operational efficiency. For some users, the driving directive to "go all-in on the cloud" is a sure way to cut hardware costs. For others, the cloud will streamline operational efficiency and speed up development. Various deployments models of cloud computing makes the adoption attractive for any type of sector, depending on the need or usage. However, as with the introduction of other IT technologies, there are many issues to consider and overcome. It is not as easy or straightforward to "go to the cloud" as many users believe. The most impactful deployments require a detailed analysis of the users including the desired business outcomes (cost savings, speed to market, and increased service levels) and the services they need. This research discusses the three phases of cloud service adoption strategy and reviews top key factors to consider when choosing cloud services.

This research addresses different phases of cloud service adoption strategy and explores the many factors that may contribute to its success. Section II reviews evolving technologies and trends and discusses advantages and disadvantages of implementing this technology. Section III evaluates challenges facing enterprises adopting this technology**.** In section IV different phases necessary to develop and deploy the technology and key adoption factors are discussed. Section V reviews processes in different industries where this technology could alter and improve them. Finally, Section VI provides a summary and conclusion.

CLOUD COMPUTING TECHNOLOGY TRENDS

This section provides a general description of CCT, including the definition of cloud computing, its characteristics, its advantageous and disadvantageous over traditional IT, its service models, and its basic deployment models.

CLOUD COMPUTING TECHNOLOGY

Cloud computing, in its many forms, has become an integral part of IT. The term 'cloud' has been used to refer to platforms for distributed computing- a cluster of servers, network, software, interface, etc. which are required for the user to execute a particular task. 'Computing' refers to the delivery of this cluster as a service to the user where the user can use it as and when required. The user is relieved from owning a massive computing infrastructure and requiring upfront investment in it. Rather, it allows the user to use a similar infrastructure owned by

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other party at his/her own discretion and pay only for the time it is being used. This pay-per-use model enables convenient and on-demand network access to a shared pool of configurable computing resources such as servers, storage, applications, and services. Clients can connect to existing physical or virtual environments using different connectors. The user readily accesses all information online in a 24/7 format and from various types of devices – desktop, laptop, tablet, and smartphone.

Wikipedia defines cloud computing as a concept of using the Internet to allow people to access technology-enabled services that can be rapidly provisioned and released with minimal management effort and without knowledge of control over the technology infrastructure that supports them. As shown in Figure 1, cloud infrastructure is an umbrella that covers both the software and the hardware necessary to provide 24/7 pay-as-you-go service. The software (applications) are delivered as services to users in a software-as-a-service (SaaS) model via the web. The hardware and system software (cloud) are used to run applications that user access and use online.

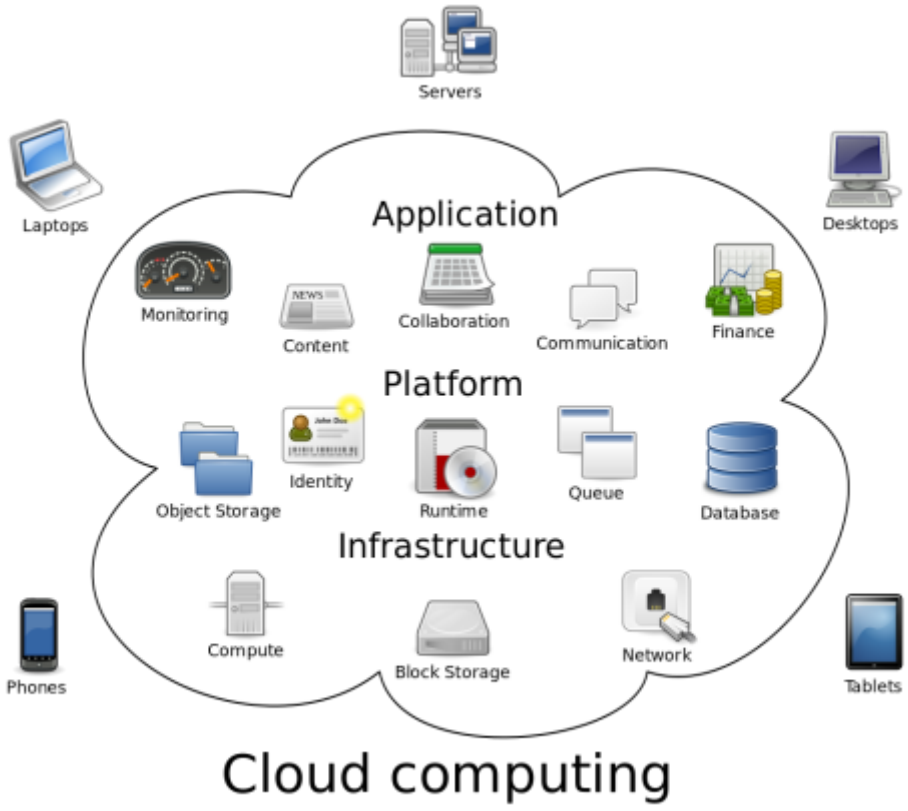

Figure 1. cloud computing
Source: wikipedia

CLOUD CHARACTERISTICS

CCT is based on a series of IT innovations and improvements, including the development of virtualization, the increasing capacity of the Internet and the growing sophistications of Internet-based technologies. The National Institute of Standards and Technology (NIST) describes the five characteristics of a cloud computing model, paraphrased below (Mell and Grance, 2011):

1. **On-demand self-service.** Computing resources such as server time and network storage are obtained as needed without requiring human interaction with the service provider.
2. **Broad network access.** Resources are available over the network and accessed through standard mechanisms (e.g., mobile phones, tablets, laptops, and workstations).
3. **Resource pooling.** Resources are pooled to serve multiple consumers, with different physical and virtual resources dynamically assigned and reassigned according to demand.
4. **Rapid elasticity.** Resources are elastically provisioned and released, sometimes automatically, to scale rapidly up and down with demand.
5. **Measured service.** Systems use metering to automatically optimize resource use (e.g., storage, processing, bandwidth, and active user accounts).

CLOUD DEPLOYMENT MODELS

NIST Special Publication 800-145 identifies four Cloud Computing Deployment models (Mell and Grance, 2011):

1. **Public Clouds:** The cloud infrastructure is made available to the general public or a large industry group and is owned by an organization selling cloud services. Public cloud services are sold on demand, typically by the minute or hour. Customers only pay for the CPU, storage, or bandwidth they consume. It is a cost-effective way to deploy IT solutions, especially for small or medium sized businesses. Google Apps is a prominent example of a public cloud that is used by many organizations of all sizes. Leading public cloud providers include Amazon Web Services

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(AWS), Microsoft Azure, IBM SoftLayer, and Google Compute Engine (Figure 2).

2. **Private Clouds**: The cloud infrastructure offers many of the benefits of a public cloud computing environment and it is operated solely for an organization. It may be managed by the organization or a third party and may exist on premise or off premise. Private clouds provide greater control over the cloud infrastructure, and are often suitable for larger installations.

3. **Hybrid Clouds:** It is a composition of a public and private cloud models with orchestration and automation between the two. A Public cloud is used for non-critical information and bursting workloads that must scale on demand, while mission-critical workloads or sensitive data and applications are kept within private clouds under the control of the organization. Hybrid cloud computing strategy enables users to capitalize the flexibility of the cloud while still realizing value from traditional infrastructure.

4. **Community Clouds:** The cloud infrastructure is a shared cloud computing service environment that is available to a limited set of organizations or employees (such as banks or heads of trading firms). The members of the community generally share similar security, privacy, performance, and compliance requirements.

CLOUD SERVICE MODELS

Cloud computing is delivered via six main service model architectures: SaaS, PaaS, IaaS, DaaS and FaaS. The following summarizes definitions and gives examples of each model (Matsumoto, 2012):

1. Software as a Service (**SaaS**) – Applications are deployed over a network (Web) and are accessible via browser or program interface. Since applications are offered through software on demand, they can be deployed quickly which bring ease of use and financial benefits. Examples of companies providing this type of platform are Google Apps (email, calendar, documents), Salesforce.com, and Intuit-QuickBooks.

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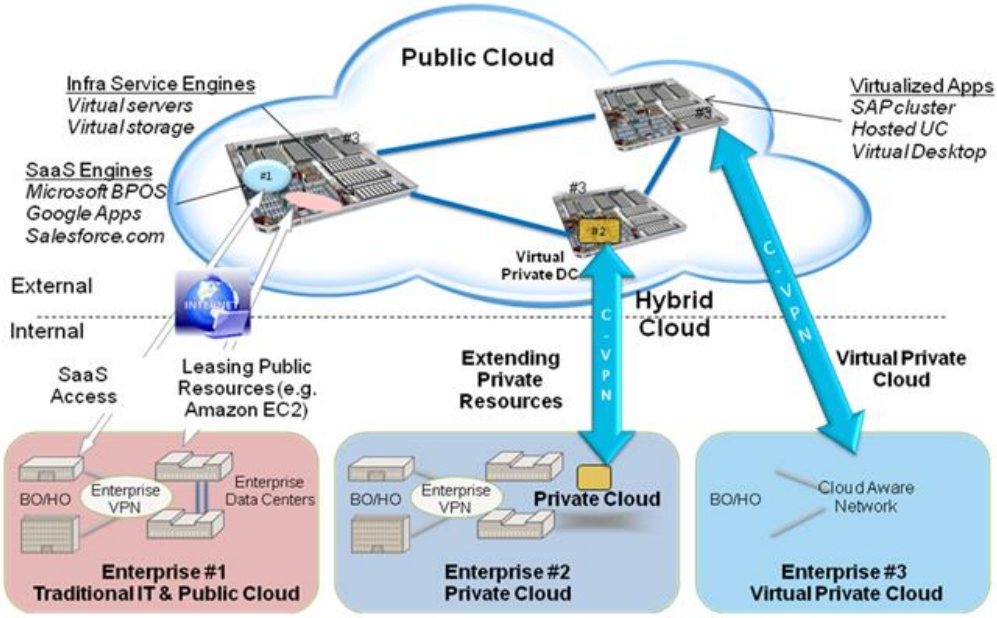

Figure 2. Public cloud
Source: – Retrieved from Syed Imran, 2013

2. Platform as a Service (**PaaS**) – This platform provides an agile development environment that makes it easier for the user to develop applications quickly and adopt it instantly. The wait for deployment of suitable hardware and software for application is eliminated. Users can use the platform to build applications using languages, libraries, services, or tools supported by provider. Examples of companies providing this type of platform are Google App Engine, Windows Azure, and Force.com.
3. Infrastructure as a Service (**IaaS**) – This platform provides general purpose support services including infrastructure services such as database, storage capacity, networking, and other computing resources. The user has control over operating systems and deployed applications. This model is referred to as utility computing. Examples are Amazon Web Services, CenturyLink, and Rackspace.
4. Storage as a Service (**SaaS**) – This platform provides users with data storage interface and charges them on basis of amount of storage used. The interface can be used by any of the other three service model architectures types or accessed directly by users. Examples of direct usage are: Amazon's really simple storage Commercial: Charged on basis of amount of storage used.

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5. Desktop as a Service (**DaaS**) – Desktop operating system (typically Windows) and applications are delivered securely via remote infrastructure.
6. Function as a Service (**FaaS**) – The newest trend in cloud service model architectures is "serverless" cloud computing. In this platform, the cloud (using a load balancer) automatically figures out what server setup an application needs. It is becoming the leading framework for developers.

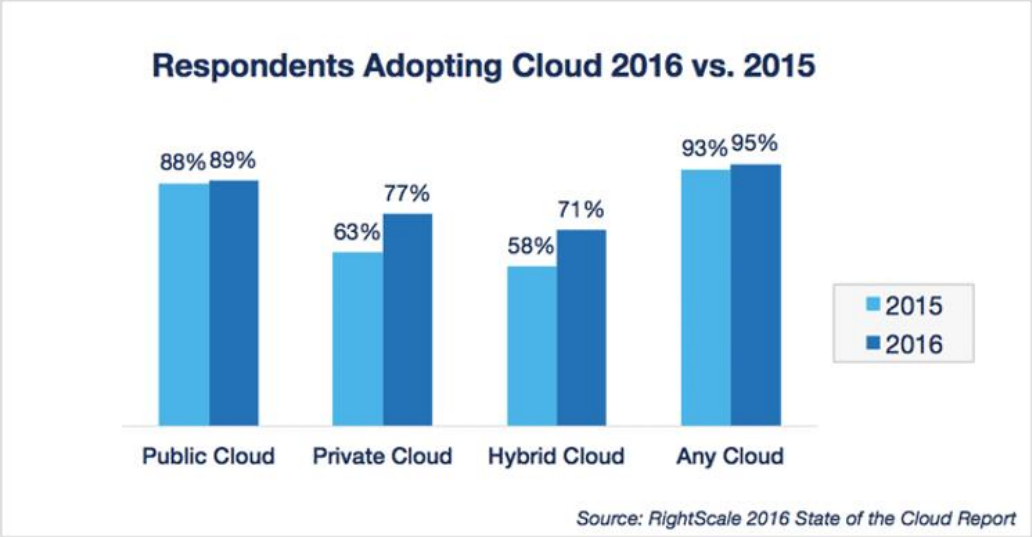

Figure 3. Cloud Computing Trends

CLOUD COMPUTING TRENDS

In 2016, RightScale conducted the annual survey of the cloud computing trends. The study found that 77 percent of 1,000-plus enterprise IT professionals said that they are using private clouds, with 89 percent procuring public cloud services. The remainder was planning to implement some form of cloud technology in the next 12 months. Also, 71 percent of respondents said they were adopting a hybrid cloud model. Moreover, more enterprise workloads moved to both public and private cloud over the last year, with the private cloud growing faster. There was also a strong growth in hybrid cloud adoption as public cloud users added private cloud resource pools (Figure-3). According to the same report, companies providing cloud-based services are also growing quickly. For example, Amazon Web Services (AWS), created the first wave of cloud computing with a few simple compute and storage services in 2006. A decade later, AWS is operating at an $11 billion run rate (RightScale, 2016).

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ADVANTAGES AND DISADVANTAGES OF CLOUD COMPUTING TECHNOLOGY

Cloud computing is an easy to adopt technology with simple and the latest architecture. Cloud computing dramatically lowers the capital investment in hardware and software infrastructure for smaller and medium size companies. These companies can acquire IT capacities that were not possible in past. The technology enables most software sectors less resource-intensive ways to get the programs that they need to run their businesses.

The replacement of on-premise solutions with the cloud computing model has the potential to deliver several immediate benefits to users including no server to maintain, no IT infrastructure to set up, no upfront license fees, and no software programs to buy, install and maintain on premise. Getting more IT storage traditionally requires more hardware and more expense. In the cloud, there is more flexibility. One is able to store massive amount of data cheaply and acquire resources on demand. Companies can scale up as computing needs increase and scale down again as demands decreases, which eliminates the need for massive investments in local IT infrastructure. Managing resources are easier in the cloud. Computing resources can be deployed very quickly which bring ease of use and financial benefit. The technology provides the ability to choose the IT resources needed in a way that can grow over time or instantaneously as needs change.

Cloud computing technology also improves collaboration by allowing dispersed groups of people to meet virtually and share information. Another big advantage of cloud is providing reliable services delivered through data centers and built on servers. The Cloud often appears as a single point of access for all consumer's computing needs. Furthermore, cloud storage provides a better business continuity planning by protecting data and systems. The providers of cloud services have advanced strategies to ensure that mission- critical data is backed up and protected in a secure and safe location. Cloud storage gives the ability to conduct business that minimizes downtime and loss of productivity.

Cloud computing helps organizations realize major benefits in two main categories of business and technology efficiency. CCT enables organizations to accelerate time to market and increase business agility. However, these evolving cloud technologies and approaches can create security gaps and human errors. There are other disadvantages that have been attributed to implementation of the technology in businesses including platform inconsistency, network vulnerability, data unreliability, and business discontinuity. Table 1 summarizes the findings.

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OBSTACLES TO RAPID ADOPTION

There are numerous challenges in applying cloud computing technology in a way that would allow for its significant and rapid growth. As reported by the RightScale 2016 State of Cloud Report, the biggest challenges for rapid adoption of technology are lack of resources/expertise, security and compliance. As more organizations are placing more workloads in the cloud, the need for expertise has grown. Training of IT and development staff will be critical in helping address this challenge. Although data centers do take strong security measures, concerns about the cloud's security remain.

Security/data control is the most often cited issue with migration to the cloud. There are broad span of concerns in cloud computing security including network security, data security, compliance, governance, and more. Gonzalez et al. surveyed the state of the art in cloud security and concluded that the top three major security problems facing enterprises in cloud adaptation are legal issues, compliance and loss of control over data (Gonzalez et al, 2012). Other studies identified top cloud security threats as listed below (Winkler 2011, 2012), (Raguram, 2014):

- Trusting vendor's security model
- Customer inability to respond to audit findings
- Obtaining support for investigations
- Loss of physical control
- Data dispersal and international privacy laws
- Exposure of data to foreign government
- Quality of service guarantees

Categories	Advantages	Disadvantages
Business Efficiency	• Business continuity • Cost proficient: pay per use, based on resources consumed • Enables full customer self-service • Release resources when no longer needed • Predictive cost modeling for a growing organization	• Business discontinuity • Performance inconsistence due to sharing of resources with various other companies

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	• Turns capital investment/fixed cost into operating costs/variable costs • Reduced cost – take advantage of economies of scale across users of cloud • Rapid development/improved mobility • Disaster recovery: able to store massive amount of data cheaply • Can be provided by 3rd party (e.g. Amazon) or on in-house network • Leverage on big data analytics and mobile computing • Easy customization • Continuous improvement • Improved collaboration by allowing dispersed groups of people to meet virtually and easily share information	• Transparency: not getting a whole lot of insight into your network • Fewer options • Lock-in
Technology Efficiency	• Reduced system administration overhead: automated provisioning • Increased utilization through sharing of resources • No need for design deployment environment to meet maximum load • Increased/matched reliability and security • More flexibility: acquire resources on demand • Better alignment of IT resources • Elastic Scalability • Ability to mix and match public and private cloud as well as co-located and on-premises physical infrastructure • Built-in disaster recovery capabilities and expertise • Choice and agility • Little to no maintenance	• Network vulnerability • Platform inconsistency • Availability of features • Lack of control and options for scalability • Reliability and security • Security gaps & human errors

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	• Less environmental impact- fewer data centers worldwide and more efficient operations, less real estate required	

Table 1: Advantages And Disadvantages of CCT

- Potential for massive outages
- Malicious Insiders and Abuse of Cloud Services
- Service Traffic Hijacking — Phishing, buffer overflow attacks, and loss of passwords
- Reliability of cloud service provider's service
- Governance — data control, security control, and lock-in
- Network security — transfer security, firewalling, and security configuration
- Data security — cryptography, redundancy, and disposal

The cloud infrastructure is always, to a certain degree, an open and shared resource. Therefore, it is major targets for cyber attackers. Cloud computing systems and services are subject to malicious attacks from both insiders and outsiders. Side-channel attacks, identity hijacking, and distribution of malicious code have all been observed. Therefore, management of security in cloud environments needs to be carefully analyzed and maintained.

There are other challenges facing rapid adoption, including the costs of managing the cloud and the speed of uploading files. The cost in the cloud could increase rapidly such as for certain
customizations to meet business needs. Large files can take a long time to upload causing frustration and inconvenience for day-to-day business. Other challenges include governance and control, complexity of building a private cloud, and performance issues. Figure-4 highlights these challenges as reported by users. The survey also identified that many companies implemented configuration management tools that allowed them to standardize and automate deployment and configuration of servers and applications that ultimately optimized cloud costs.

Another recent study, conducted in Taiwan, investigated the concerns that IT professionals have with regard to the adoption of cloud services. The findings of the study suggest that the primary concerns of IT managers and software engineers are compatibility of the cloud with company policies, IS development environment, and business needs, and relative advantages of adopting cloud solutions (Angela et al, 2012).

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CLOUD COMPUTING DEPLOYMENTS

Implementing a successful cloud computing strategy takes time and effort. Many parts of the company will be affected, there are complex decisions to be made, and various stakeholders must be involved. Many companies have not been successful with deployment of cloud computing due to the failure of developing a cloud strategy rooted in the delivery of IT services linked to their business outcomes. Furthermore, many enterprises do not know how to initiate their cloud projects. Before deploying cloud service in a company, the need to determine where cloud services will add business value need to be identified. Then a scalable deployment approach must be planned.

ADOPTION STRATEGIES

Gartner conducted a 12 month long research of enterprises with cloud management strategies and identified the three phases of cloud service adoption strategy that are described below (Smith, 2016):

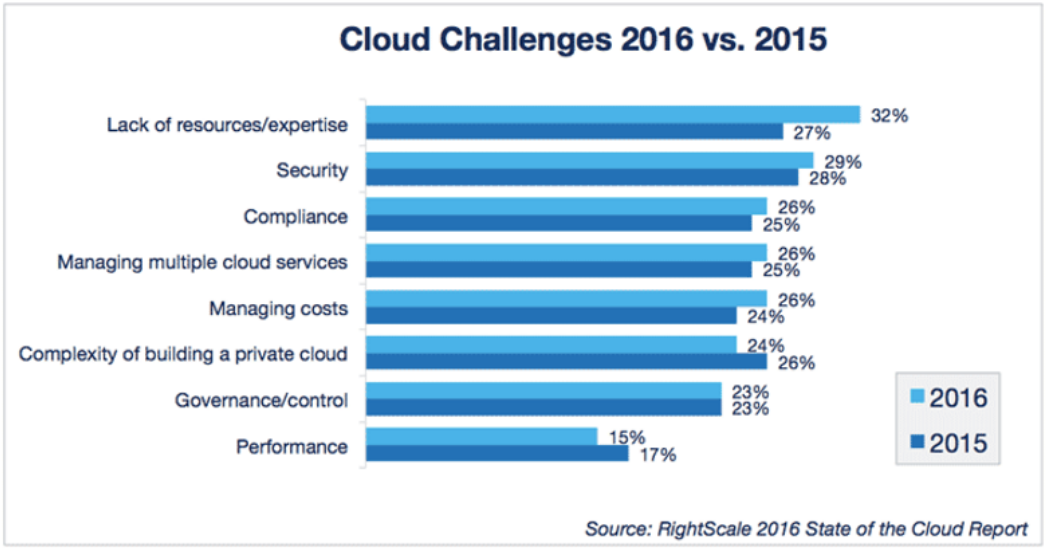

Figure 4. Challenges Facing Enterprises Adopting CCT

In the **elementary phase**, companies begin to learn about cloud technology and perform detailed analysis of their applications and the services they need. Cloud computing focuses primarily on services, rather than technology. The services offered can range from automated IT tasks, IT services and automated business processes. The delivery of cloud computing services to users is based on what

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they need. Consumers of the service place service requests via self-service and are billed for what they use. The most impactful deployments start with users fully understanding the desired business outcomes and then identify the services that will be offered via the private and/or public cloud. Questions such as what services the users need, how much of the service will be consumed, when the service will normally be consumed, which users consume the service, and what is a reasonable price for the service needs to be answered.

In **Phase II**, users need to document and analyze the internal processes that will be affected by the chosen cloud services. During this analysis, the users should study the internal IT processes involved with offering the services. This might highlight a need to flatten, reconfigure, realign, refine or eliminate inefficient processes and target manual repetitive processes to be automated. The types of security that will be applied to cloud deployment also need to be addressed.

In **Phase III**, users should map applications and workloads to the associated cloud services. Each workload should be reviewed for its applicability to cloud computing and its location environment. Next, a detailed review of the overall architecture of the workloads that make up the application is required. Finally, users should determine the security profile for each workload — for example, can it reside off-premise and must it be encrypted? After the user analyzes the workload, decisions should be made regarding what cloud computing deployment model is best for the organization's applications and workloads. Should the workload run in a public cloud, an on-premises private cloud, or should it be run on a combination of on-premises and public cloud. Table 2 provides a summary of deployment phases.

Adoption Phases	Recommended Activities
Phase I **Elementary Phase: Identify your cloud computing IT services**	• Begin to learn about cloud technology • Perform detailed analysis of applications and the services needed • Identify which services are wanted and/or needed • Identify which service should be offered, procured and/or supported? • Determine how much of the service will generally be consumed • Determine what is a reasonable price for the service?

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Phase II **Intermediate Phase: Document the internal processes that will be affected by the cloud services you choose**	• Study the internal IT processes involved with offering the services • Revise or eliminate inefficient processes • Target manual repetitive processes to be automated. The goal should be that any action that can be automated should be automated • Look for synergies to be built across the infrastructure that support a given service or application • Determine how the environment will be monitored and maintained after it has been provisioned • Determine what security will be applied to cloud deployment
Phase III **Final Phase: Map applications and workloads to the associated cloud services.**	• Study the internal IT processes involved with offering of the services • Analyze each workload for its applicability to cloud computing and its location environment • Determine the overall architecture of the workloads that make up the application • Determine the security profile for each workload — for example, can it reside off-premises, and must it be encrypted?

Table 2: Cloud Computing Deployment Phases

KEY FACTORS TO CONSIDER

The role of central IT teams in cloud deployment has been evolving over the last few years especially within larger enterprises. As applications of cloud based services increased, central IT began to take the role as a broker of cloud services to ensure appropriate management, governance, and control. In 2016, business units within the enterprises increasingly agreed that central IT should play a role in selecting, brokering, and governing cloud services. They also agreed that

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central IT should set policies for cloud use and select public and private cloud technologies (RightScale, 2016). The IT team must discuss the challenges and the questions that must be considered in order to succeed in the new cloud era. New players and new offerings constantly enter the scene. With so many options—private clouds, public clouds, hybrid cloud, and "multi-cloud"— deciding how best to move forward can be overwhelming for the IT teams. The top three key factors to consider when choosing cloud are: performance, cost and agility as described below (Turbonomic, 2016):

1. **Performance –** Application performance is responsibility of the users in the cloud and it largely rests on central IT teams' ability to predict resource needs and understand the real-time application demand. You have performance issues if you underestimate the size of instances your applications need. Over-estimate and you waste budget. The real work of your IT team is making sure the applications get the resources they need to perform and that instances are performing as expected.
2. **Cost –** Using economies of scale, cloud providers can offer a lower cost per transaction or service. Yet operating VMs in the cloud is not cheap or simple. Costs can quickly rise depending on how many VMs are being hosted in the cloud. Over-sizing instances is a costly decision. With any public cloud, you do not "pay for what you use." Instead, you "pay for what you think you will use." Your IT team needs to decide on number of instances you are running in a public cloud. They also need to make sure that you are using only the resources you need in the public cloud. The performance benefits and the cost savings are considerable if your instances are appropriately sized based on real-time application demand.
3. **Agility –**Most cloud services provide to types of agility to their customers. First, the agility offered to developers for creating business applications more quickly. Second, the agility of their infrastructure and operations teams to empower developers, managing the use of those resources, while continuously maintaining performance. There are often tradeoffs on both ends. What enables developer agility challenges infrastructure and operations teams' agility. Agility does not come without a thoughtful approach to the cloud platform you choose. The cloud makes agility possible, but does not guarantee it. More importantly, without guaranteed performance agility is useless.

MEASURING THE BUSINESS IMPACT OF CLOUD

IT spending in CCT is booming. According to IDC Forecasts, one of every three dollars spent on IT infrastructure is spent on CCT. The same survey predicts that

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spending on public cloud will top $500 billion by 2020. With the ever increasing cloud spending, organization leaders will demand greater spending accountability. The biggest cloud challenge for many organizations might be "Measuring ROI." It is easy for companies to focus on technology implementations but much more difficult to deeply understand operational benchmark and track financial metrics. What metrics can organizations use to measure business performance? Some organizations are using a methodology called Value Engineering to produce value metrics. Others are using financial metrics to measure technology's ROI.

Performance Metrics	Recommended Measurements
Improving Reliability	• Percentage of monitored applications • Percentage of apps met Service Level Agreement (SLA)
Accelerating Agility	• Average time to deploy an application • Average delivery time of new products or services
Increasing Compliance & Improving Data Privacy	• Percentage of Non-Encrypted Traffic • Percentage of Managed Nodes

Table 3: Performance Metrics for Measuring Cloud ROI

HP recommends four performance metrics that organizations need consider when adapting a cloud strategy. The first two are considered as important metrics in showing ROI. These two metrics can prove that the cloud can maintain and improve performance benchmark (Chau, 2013).

1. Improving reliability
2. Accelerating agility
3. Increasing compliance
4. Improving data privacy

Table 3 summarizes performance metrics and recommended measurements that will help establish benchmarks after the transition to the cloud.

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COMMON USES OF CLOUD COMPUTING TECHNOLOGY

The breadth and impact of CCT continues to expand as the technology gains acceptance and functionality, making it a feasible means of IT solutions in a variety of industries. Cloud-based computing emerges as a rapidly evolving technology that more and more companies are willing to adopt in order to improve their efficiency.

The technology is not a new concept for many sectors like banks, automobile, retail, health care, education, and logistics (Al-Hudhaif et al., 2011). CCT is also widely used as major enablers for the manufacturing industry. The technology has the potential to transform the traditional manufacturing model, help it with product innovation, and create effective factory networks with collaboration. Various deployment models of cloud computing makes the adoption easy for any of these sectors. The technology is credited with increasing competitiveness through cost reduction, greater flexibility, elasticity, and optimal resource utilization.

One of the many incentives for using the cloud is probably the test and development environment which requires significant manpower and time. With cloud computing, users can access a readily available environment tailored for their needs. This often combines automated provisioning of physical and virtualized resources and could save significant money. Another use of a hybrid cloud is tapping into vast quantities of both structured and unstructured data to harness the benefit of extracting business value by retailers and suppliers. Social networking platforms are using clouds to provide analytics on behavioral patterns of consumers' buying patterns. Another aspects offered by leveraging cloud computing is the ability to store files and be able to access, store, and retrieve them from any web enabled device. The user has 24/7 availability, speed, scalability and security for the data stored. In this scenario, users pay for the amount of storage that is actually consumed and do so without the worries of overseeing the daily maintenance of the storage infrastructure. The cloud can also offer cost saving when it comes to a disaster recovery solution when compared to the traditional site with fixed assets, rigid procedures, and a much higher cost. Cloud-based backup is yet another benefit derived from using this technology. Users now backup data automatically and dispatch them to any location across the wire with the assurance that neither security, availability nor capacity is compromised.

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Among the many incentives for using the cloud, supply chain management stands out. A supply chain includes all the activities related to the flow of goods and information from the raw material stage to the delivery of goods to the end user. Supply Chain Management (SCM) is a vital part of every business entity. SCM encompasses the planning, design, implementation, and control of all of the logistics processes including procurement, warehousing, inventory control, manufacturing, distribution, and order fulfillment functions of a business.

Companies continue to initiate SCM improvement initiatives based on the growing recognition that excellent supply chain performance has strategic value that can lead to (Attaran, 2012):

- Rapid financial payback, often within months;
- Improvements in productivity and profits;
- Improvements in customer positioning and product quality;
- Enhancements in long-term relationships with suppliers

Before the Internet came along, the aspirations of most organization's supply chain software were limited to improving their ability to predict demand from customers and make their own supply chains run more smoothly. The cheap, simple, and universally accepted Internet communication standards, has enabled companies to connect their supply chain with the supply chains of their suppliers and customers together in a single network that optimizes costs for everyone involved. Extreme market competition and a dynamic business environment have forced companies to adopt state-of-the-art practices to optimize both the cost and operational efficiency of their supply chain. In recent years, CCT has emerged as a meaningful technology that could contribute to this optimization. The utilization of CCT in supply chain management could lead to financial and operational benefits. It enables start-up companies to establish themselves in a short period of time, without significant investment in infrastructure. Cloud computing has the potential to speed up the pace at which new revenue-generating products and services are introduced in the market. It also forces companies with traditional supply chains to reinvest in themselves. The technology has the potential to make supply chains more dynamic, more scalable, and more capable of supporting the financial objectives of the shareholders (Li, 2011, Ferguson and Hadar, 2011, Singh, 2009).

Table 4 provides examples of situations where cloud computing is used to enhance the ability to achieve business goals.

ISSN: 1543-5962-Printed Copy ISSN: 1941-6679-On-line Copy

SUMMARY AND CONCLUSION

The digital revolution is helping companies transform their businesses to better engage and stay connected with customers, suppliers, and employees. The Internet and its related services create an interactive working environment for users. Through the Internet, effective collaboration becomes possible whenever, wherever, and with whomever. Cloud computing emerges as a rapidly evolving technology that more and more companies are willing to adopt in order to improve collaboration. While the list of the uses of cloud computing is not exhaustive, it certainly gives incentives to use the cloud when compared to more traditional alternatives to increase IT infrastructure flexibility. Advantages like increased IT infrastructure flexibility, computational power, using an existing infrastructure on a pay-per-use as well as leverage on big data analytics, better information visibility, and cost effectiveness of a disaster recovery make cloud a viable choice for many companies.

CCT is a major development in IT and has a huge potential in delivering real business benefits to companies. This study concluded that cloud computing introduces challenges and new possibilities in many aspects of Internet architecture, protocols, services, and applications. The technology will affect many people in the organization and has significant impact on IT investment and costs. Furthermore, this study identified security as the main stumbling block for wider cloud adoption. As discussed in this paper, cloud computing systems and services are also major targets for cyber attackers. These vulnerabilities point to the importance of protecting cloud platforms, infrastructures, hosted applications, and information data, and create demand for much higher-level cloud security management and centralized management of security in cloud environments. Other primary concerns of IT managers are compatibility of the cloud with companies' policy, IS development environment, and business needs. Implemented properly, the technology has the real potential to enable accuracy, reliability, service enhancement, and cost reduction. The challenge for IT experts today is to understand the role of cloud computing and to develop strategies that exploit its potential. They should complete the prerequisites (the three phases of cloud service adoption strategy) before making the technology decisions required for successful, service-centered cloud computing strategies.

ISSN: 1543-5962-Printed Copy ISSN: 1941-6679-On-line Copy

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ISSN: 1543-5962-Printed Copy ISSN: 1941-6679-On-line Copy

Categories	Advantages	Applications & Services
Test & Development	• Can lower IT barriers to innovation - Faster release of new features • Provides readily available environments tailored for your startup needs at your fingertips • Automated provisioning of physical and virtualized resources • Improves agility to respond to user requirements on an ongoing basis	• Facebook and YouTube • Enables companies to try innovations at a lower cost without any long-term commitment • Proov: provides a Pilot-as-a-Service platform - startups can showcase innovative technology solutions & easily run multiple 'Proof of Concepts' at once, on a cloud-based testing environment
Big Data Analytics	• Ability to tap into vast quantities of both structured and unstructured data to harness the benefit of extracting business value • Lower upfront costs	• Retailers and suppliers are now extracting information derived from consumers' buying patterns to target their advertising and marketing campaigns • Social networking platforms are now collecting visitors information for analytics on behavioral patterns • Big data is used to improve agriculture • Big data technologies are used to help developers debug their apps that run on the cloud • Popular big data technologies: Hadoop,

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		Apache Spark and Lattice data
File storage	• Possibility of storing your files and accessing, storing and retrieving them from any web-enabled interface • Provides high availability, speed, scalability, and security for your environment • Paying for the amount of storage you are actually consuming	• Google Docs • Dropbox • Genbook- A cloud-based scheduling system • Amazon S3- Enterprise cloud storage solutions • Minio – Cloud storage designed for developers and cloud apps • Amazon Snowmobile – Assists enterprises to move data to Amazon Web Services Platform
Disaster recovery	• Provides for a faster recovery from a mesh of different physical locations at a much lower cost that the traditional IT approach	• Zerto: Disaster recovery and business continuity software specifically for visualized data centers and cloud environments

Table 4: Common Use Of CCT- Part I

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Categories	Advantages	Applications & Services
Backup	• Enables user to automatically dispatch data to any location across the wire without compromising security, availability, or capacity	• Rubrik- It helps companies easily back-up, archive and retrieve files instantly from the cloud
Networks	• Enables fast and inexpensive wide area network • Provides enterprises advanced ways to use their infrastructure more efficiently	• Cato Networks: enables a company to connect each branch office, data center, and HQ, along with its mobile users directly to the cloud
Supply Chain	• Accurate and timely asset tracking • Enhanced visibility along the supply chain • Speedy information retrieval and sharing • Lean manufacturing practices • Customer orientation • Large-scale transformation: Forces companies with traditional supply chains to reinvent themselves • Strategic view in supply chain management	• Supply chain planning • Supply chain integration • Accurate and timely asset tracking • Speed to market for new products and services • e-supply chain portal • Unique identification and trace technologies

Table 4 (continued): Common Use Of CCT- Part II

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