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‘Hey You? Get Off My Cloud’: evaluation of cloud service models for business value

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Recent reports (Harvard MBA) note that managers need to operate at the intersection of business and current technology. Most notably, ‘Strategy is not just informed by technology but powered by it’ (Accenture, 2014). The opportunity to evaluate aspects of ‘cloud service models’, as critically new systems, is therefore invaluable. Our article offers a pragmatic view of the characteristics of these technologies and a useful approach for identifying which may be most suitable in relation to the generation of business value. An example is provided of cloud service requirements within a multi-national pharmaceutical company which may be considered in other organisational contexts of interest. We conclude with lessons learned which demonstrate the most appropriate cloud enabled business models that support senior managers engaged in cloud service processes

A developing consensus of the definition of cloud computing is based on the US National Institute of Standards and Technology (Mell and Grance, 2011),

“ Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.” (Mell and Grance, 2011:p.2]

Mell and Grance (2011) also identify three core service levels (i) Platform-as-a-Service (PaaS) where the consumer can deploy onto the cloud infrastructure their own applications supported by the provider, although they do not manage the infrastructure they do have control over the applications (ii) Software-as-a-Service (SaaS) where applications can be accessed via various client devices by consumers through the cloud infrastructure, and the consumer has no control and does not manage the infrastructure delivering the software (iii) Infrastructure-as-a-Service (IaaS) where the consumer can provision processing, storage, networks and other computing resources (including operating systems and applications) and has control over these, but does not manage or control the underlying cloud infrastructure.

The benefits of cloud computing may also include (i) on-demand self-service, where a consumer can access computing capabilities automatically when required with no human interaction (ii) broad network access, where computing capabilities/services can be accessed through a range of interfaces and devices (mobile, laptop, tablets) over the network (iii) resource polling where the cloud computing provider resources (memory, processing, bandwidth, storage) are pooled to serve multiple customers dynamically assigned and re-assigned on demand, independent of location (iv) rapid elasticity where consumers can access ‘unlimited’ capabilities in any quantity and at any time through the cloud which can provision and release these, scaled inward or outward, dependent on demand (v) measured services,

where cloud systems automatically control and optimise resources using a metering capability which provides transparency to provider and consumer of the services utilised.

According to Google Trend (2012) the SaaS model is the most widely adopted model compared to IaaS and PaaS which are still relatively immature, but are projected to grow to higher levels than SaaS and PaaS respectively. Reza (2012) recommends that a service of high value to the organisation and low complexity should be immediately moved to IaaS in the Private Cloud. Services that can be improved with limited developer or limited computing resources should adopt the PaaS model. New services that are required to be implemented quickly and have an available budget and software service should look into implementing SaaS, for instance webmail, office productivity software and CRM software. While this framework provides a good foundation for evaluating the adoption of cloud computing in any organisation, one of the weaknesses of the model is that it does not provide details of the general requirements for classifying service criteria which can be applied empirically.

Case Context: the pharmaceutical sector and cloud service evaluation

The empirical data suggests that SaaS is the most popular model of cloud computing followed by IaaS and to a lesser extent PaaS. However a myriad of factors such as company size, industry (including regulations and compliance), markets, organisational strategies, budgets impact the decision for selecting the most appropriate service and it is not yet clear which of these models is the most appropriate in different contexts. The theoretical foundations for cloud service evaluation are also well documented. Armbrust et al. (2010) present three particularly compelling economic cases in favour of cloud computing that benefit organisations for business value. Firstly there is a considerable reduction in fixed costs where capital expenses are converted to operating expenses (CapEx to OpEx) or the 'pay-as-you-go' model which captures the economic benefits to the buyer. As more and more organisations are reliant on web-based applications to run their businesses, they require more computing resources to ensure they provide their services when they are required, but often cannot anticipate spikes in demand. Friendster's decline in popularity relative to its competitors (Facebook and Myspace) is widely believed to have partly resulted from user dissatisfaction with slow response times (Armbrust et al. 2010). This problem can be accommodated by cloud computing services in instances when spikes in demand fall and visitors turn away, organisations will not be lumbered with expensive resources they do not require. It is estimated that around 53% of datacentre costs relate to electricity and cooling and thus economies of scale in electricity, bandwidth, operations, staff, software and hardware can reduce costs by a factor of 5-7 (Venters and Whitely, 2012). Thus, cloud computing is, in the long run, more cost effective for organisations paying by the hour for services on demand (Armbrust et al. 2010). Other benefits include reduced demand for skilled labour especially when there is a shortage of skilled IT labour. In addition to cost savings, organisations can simplify the complexity of capital intensive IT investment, moving to a 'pay-as-you-go' model of IT expenditure which focuses re-allocation of limited resources on their core business capabilities.

Figure 1 summarises the comparative benefits and risks of the three main models of cloud computing relative to the pharmaceutical organisation but generalizable for other sectors.

Cloud Computing Model	Benefits	Risks
Infrastructure-as-a-Service (IaaS)	•Reduced capital costs •Global accessibility	•Vendor lock-in •Dependent on IaaS provider.

e.g. Amazon EC2, Zenith's Proud	•Flexibility and scalability multiple location access and on demand capacity •Standardisation of products/services •Automatic system upgrades and management •Offers full control of server infrastructure •Not restricted to "containers" or "applications"	•Data security of private/sensitive data •Local hosting data regulations •Sometimes comes with a price premium •Infrastructure offerings still being built
Platform-as-a-Service (PaaS) e.g. Google App engine; LongJump, Force.com, Wolf PaaS, Windows Azure, etc.	•Multiple platform components available • Provides Platform to deploy, test, host and maintain application in the same integrated environment •Enables multiple users concurrently using the same integrated application development environment • pay per use pricing model •Reduced capital costs •Built in scalability and elasticity for efficient management of load and usage •Enables rapid deployment of applications •Enables team-working across geographically distributed locations	•Security of data •Lack of bandwidth or network connectivity could lead to slow/no cloud access •Interface standardisation is not well defined across multiple cloud service providers •Vendor lock in •Portability when switching cloud service provider •Dependency on single Cloud provider means any outage of the hosting provider will cause outage for the platform
Software-as-a-Service (SaaS) e.g. Gmail, Facebook, SalesForce.com, Zoho CRM, etc.	•No client or server software installation or maintenance required •Shorter deployment times •Global availability •Service Level Agreement (SLA) adherence •Constant, Smaller, Upgrades •Reduced IT staff – only IT staff required to configure applications •Enables redistribution of resources: IT budget and personnel to focus on core competencies or reallocated to boost productivity •Easy to use, customise and access •Multiple offerings •Proven and successful business models	•Identity management might be problematic with multiple client users • Governance and compliance issues as physical location of the servers hosting software might not be known. •Access to software over internet increases risk of hacking and virus attacks •Cloud standards not well defined •Security of data because of multiple clients •No control over applications

Figure 1. Comparative Benefits and Risks of Cloud Computing Models.

There are also risks associated with cloud service activities, some of which have been evident from other outsourcing projects (Venters and Whitely, 2012). For instance, lack of business continuity and service availability if there are outages in cloud provision particularly if there is only one sole provider, but this could be overcome by using the ISP model of multiple network providers (Armbrust et al., 2010). Other obstacles include data lock-in which makes it difficult for users to extract or move their data, potential performance unpredictability of virtual machines (VMs) and data confidentiality and auditability which are the most often cited risks for cloud users. The mapping of these service models for the pharmaceutical case company are summarised in Figure 2.

Service Model	Characteristics	Key terms	Advantages in Pharmaceutical industry	Disadvantages and risks in Pharmaceutical industry	When to use	When not to use
IaaS	Infrastructure as a service End-user pay for OS instance Application license paid by End-user	Usually platform independent Infrastructure are shared and thus reduction in costs SLAs for the Infrastructure Pay as you use Scalability is good	Reduction in upfront costs Can be accessed from anywhere in the world Scalability on demand Standardisation Automatic system upgrades	Compliance issues Security is another major concern Vendor Lock in Availability is dependent on the service provider	Initial application development and testing Performance testing using dummy or scrambled data	Critical applications which hold production confidential data Applications with compliance requirements
PaaS	Platform as a Service Infrastructure with platform is provided by the Service Provider	Saving on platform license costs Infrastructure and Platform supported by Service Provider	Multiple platform can be offered as a service Can be treated as Integrated Env Scalability of users Lower licensing and TCO costs Rapid deployment Can be accessed over internet from anywhere in the world	Security Dependency on the network links for availability and performance Interface standardisation is not well defined Vendor lock in Dependency on single cloud provider	Possible use could be Marketing division using Salesforce force.com	Critical applications which needs to be accessed 24X7 365 days Applications holding confidential data
SaaS	Software as an Service Also referred as Application as a Service	Saving on Infrastructure, Platform and application development license and costs Shared application is used by a end used mostly using a username and password	No Client or server installation required Shorter deployment times Global availability Reduced IT staff and maintenance	Security, user and identity management Compliance issues Risk of hacking and virus attacks as Internet Browser is used for accessing the application	Possible use in divisions like sales, HR, online training, payroll etc	Applications that holds Confidential data
CaaS	Communications as a Service	Communications using a client server model Server can host anything from phone call switching to sharing online content	Reduce costs of communications	Security needs to be assessed	For IP telephony, video conference calls, Live meetings etc	NA
MaaS	Monitoring as a Service	Monitorinrg servers/platforms/applications hosted in Cloud environment	Better view of the uptime and SLA	Additional costs	Monitoring Cloud services	NA
ELaaS	Education and learning as a service	Providing online education in cloud environment	Reduce costs as no tutor is required along with room etc Same course can be run multiple times for users	lack of interaction	Online Trainings hosting and delivery	NA
BPaaS	Business-Process as a Service	BPO services offered as a Cloud service	No need to install local servers, platforms and applications for hosting Business process related applications	NA	Back office IT support etc	NA

Figure 2. Service models summary for a Pharmaceutical Company

There was a clear mandate from the case study organisation to implement cloud computing for several reasons including cost reduction, improving process efficiency and effectiveness provided by IT systems, consolidation of IT systems and to reduce IT implementation times.

In relation to lessons learned, typically in a cloud implementation planning phase for any service model, a detailed assessment of the application must be carried out with a view to understanding if the application is appropriate for migrating into the Cloud. The next stage for these candidate cloud applications is a detailed Return on Investment (ROI) and Total Cost of Ownership (TCO) to be carried out in order to understand the full cost benefits that will be achieved from the Cloud compared to the conventional IT deployments. The appropriate service model needs to be chosen and the business case should include all the key considerations including technical benefits, cost comparison, timeline reductions etc. before any analysis can be presented by the technical teams to the senior management for taking any decision.

Our article has demonstrated that the cloud has the potential to provide a whole range of different and more sophisticated service models which can be tailored to the organisation's context and service requirements. Our exploratory research showed that while there is a strong willingness from managers for the adoption of the cloud, there are several evaluation issues that need to be carefully considered further. It is also clear that managers need to invest time and resources to the challenges of new 'digital' systems for business value.

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