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# Knowledge management in the age of cloud computing and Web 2.0: Experiencing the power of disruptive innovations

Nabil Sultan*

*University Campus Suffolk, School of Business, Leadership and Enterprise, Waterfront Building, Ipswich IP4 1QJ, United Kingdom*

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ABSTRACT

Organizations, of all types, live in an increasingly dynamic world. Much of this dynamism is generated by developments or innovations in technology, especially information and communication technology (ICT). Some organizations take advantage of this dynamism and create new products and business models and thrive. Others ignore it or take a long time trying to adapt to it and struggle, often with negative consequences. Some of these innovations, to use the terminology of Christensen, are of a "disruptive" nature such as the telephone, the Web and recently cloud computing. This paper explores the innovation phenomenon of cloud computing and Web 2.0 and specifically examines their impact on organizational knowledge.



## 1. Introduction

Making the most from their knowledge has always been organizations' Holy Grail. Some of these organizations design their methods to achieve this objective and others resort to experts who possess the tools (often technological) in order to take advantage of technological advances in Information Technology (IT). The latter option often commands a great deal of commitment and tends to be employed by large organizations that have the economic means to cope with its resource implications. Hence, many of the current enterprise KM systems (KMS) were often developed for large organizations that can afford to buy them and cope with their maintenance and operations. The amount of effort required for performing activities core to KMS, such as designing taxonomies, classifying information, and monitoring functionality, according to Nunes, Annansingh, Eaglestone, and Wakefield (2006) is often disproportionate to the resource capacity of most small to medium enterprises (SMEs). Moreover, typical KMS place emphasis on predetermined workflows and rigid "information-push" approaches (Malhotra, 2005) that reflect the philosophy behind working practices in large enterprises. In contrast, SMEs rely mostly on informal person-to-person communications and people-centric operations for KM (Desouza & Awazu, 2006) that often take place in largely ad-hoc and non-standardised ways (Nunes et al., 2006).

This view is further echoed by Reichental (2011) who also adds a behavioural dimension to the challenges of enterprise KMS. He argues that it is remarkably difficult to organize information in the right manner, make it searchable, and then present it so that the most relevant responses are placed at the top of the search results (as is the case with public search engines). Internal systems, according to this author, have no such equivalent and organizational information is hardly the example of pristine structure. While unstructured content is the king of the public Web, it is often the bane of the enterprise. Such systems can also be inflexible to meet the fluctuating needs of corporate end users and executives (Kaplan, 2010).

The situation is also compounded when employees are disillusioned by the effectiveness and effort required to use KMS and may resort to old habits such as asking colleagues or improvising in the absence of guidance (thus repeating mistakes or missing best practices). In such situations, the system often fails to be adopted – or at best is used by a small proportion of the organization – and no amount of resuscitation will then be enough to bring it back to life (Reichental, 2011). This view is further shared by Kaplan (2010) who also adds that many organizations were realizing that their employees were either not prepared to share information in order to protect their jobs or too busy to funnel information into such systems.

## 2. The era of utility ICT

Since cloud computing emerged in 2007 it attracted a great deal of attention from many quarters (e.g., authors, consultants, technology analysts, companies). The more interest it attracted the more attempts were made to define it. At one point, a study by McKinsey (the global management consulting firm) found that there were 22 possible separate definitions of cloud computing. In fact,

* Tel.: +44 7810377005.
*E-mail address:* nabil.sultan@yahoo.co.uk

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no common standard or definition for cloud computing seems to exist (Grossman, 2009; Voas & Zhang, 2009).

### 2.1. Definition

However, a comprehensive and jargon-free definition of cloud computing was attempted by Sultan and Sultan (2012). According to these authors, cloud computing is a modality, that uses advances in ICTs such as virtualization and grid computing for delivering a range of ICT services through software, and virtual hardware (as opposed to physical) provisioned (by data centres owned and operated by cloud providers and/or end users) according to user demands and requirements and delivered remotely through public (e.g., Internet), private networks or a mix (i.e., hybrid) of the two delivery modes. The provided ICT services include:

- business-related computer programs (software as a service – SaaS);
- fast and almost unlimited processing capabilities and large and almost unlimited storage facilities (infrastructure as a service – IaaS);
- development tools and hosting options for clients preferring to create and manage their own Web applications (platform as a service – PaaS).

Cloud computing services can be provided by cloud vendors through their data centres (public clouds) and end users (i.e., client organizations) using cloud software installed on their own data centres (private clouds) or installed on their own and other cloud vendors' data centres (hybrid clouds). The authors also draw attention to "community" clouds (often touted as another possible addition to the other three modalities). These types of cloud can be provided (often by one organization) and consumed by groups of organizations in businesses or professions similar to that of the providing organization. However, according to these authors, there are little examples to demonstrate the viability of this approach (Sultan & Sultan, 2012).

### 2.2. Advantages

When it first emerged in 2007, cloud computing received a mixed reaction. While some analysts saw merits in its application, others (including highly respected IT individuals) such as Richard Stallman, creator of the GNU operating system and founder of the Free Software Foundation and Larry Ellison, founder of Oracle, regarded it as a useless business model (Hasson, 2008; Johnson, 2008). But cloud computing continued to attract many followers and increasing numbers of ICT companies embraced it and began to offer many of their services in the cloud.

Having passed the fad stage, few people now doubt the economic attractions of this new computing service paradigm. Cloud computing delivers a variety of essential software and hardware services (e.g., applications, storage, processing power, virtual servers) over the medium of the Web (i.e., the cloud) on a pay-as-you-go price structure, thus offering scalability and obviating the need to make large investments in expensive hardware and software licenses and offering organizations significant cost advantages (Leavitt, 2009; Lin, Fu, Zhu, & Dasmalchi, 2009). Continuous upgrades of software and hardware have become common (and expensive) practices in many organizations. This situation is likely to be made worse in the current economic climate following the near collapse of the world's financial systems. Cloud computing can provide many of those organizations with the opportunity to continue to take advantage of new developments in IT technologies at affordable costs.

While cloud computing seems to make economic sense, some people think this can only be achieved in the long run. Reflecting on his company's successful implementation of a SaaS solution, Doug Menafee, CTO of the Schumacher Group, a leading US emergency and hospital medicine management company, admitted that a cloud solution could be more expensive to run in the short term due to the heavy connectivity demands that require the installation of expensive high speed cables such as fiber optics. He explained that it takes a three year ROI (return on investment) period to break even and over five years to realize the economic benefits (Brooks, 2010).

### 2.3. Cloudy issues

Despite, the economic and flexibility attractions of cloud computing there are still many issues that it needs to overcome: security, vendor-lock and outages are the most problematic (Sultan & Sultan, 2012). Security is no doubt one of the main concerns for organizations contemplating the adoption of this ICT service modality. A survey of 244 chief information officers and IT executives conducted in 2008 by IDC (International Data Corporation), the market research firm, revealed that 75% of the respondents rated security as their main cloud computing concern while performance and availability were the next two concerns for 63% of the respondents (Cisco, 2009). Moreover, various governments, such as those in the European Union (EU), have privacy regulations that prohibit the transmission of some types of personal data outside the EU. This issue, however, is no longer a problem as many cloud vendors now (such as Amazon, Microsoft and others) were able to establish some of their cloud data centres in various locations across the EU region and elsewhere in the world and can offer their cloud clients the option of where they want their data to be stored.

Organizations are likely to adopt a careful approach to cloud computing. Another survey by EDUCAUSE, US-based non-profit organization that promotes the intelligent use of information technology in higher education, involving 372 of its member institutions revealed that a great proportion of the respondents with use cases that involved cloud-based services reported that data privacy and data security risks were among their top barriers to overcome (Goldstein, 2009).

Another concern is vendor-lock and outages. Currently, many cloud providers offer their services through proprietary Application Programming Interfaces (APIs). This means that organizations that sign up for the services of cloud providers will find it difficult to change cloud providers in the same as way as, for example, changing an electricity supplier.

Furthermore, failure of a cloud provider that hosts client data in its data centres can have serious repercussions for those clients who trusted their data with that provider. This issue could force potential cloud users to go for well-established and large companies that are more likely to be around for many years to come (e.g., Microsoft, Amazon, Google, IBM, Salesforce.com).

Lastly, reliability can also be a serious problem for cloud users. Many of the big cloud providers such as Salesforce.com, Amazon, Google and Microsoft saw their systems afflicted with outages which affected large scores of their customers (Clarke, 2011; Leavitt, 2009; Naughton, 2009). One of the latest such events occurred in April 2011 when Amazon's EC2 (Elastic Compute) cloud service experienced an outage when its northern Virginia data centre site was affected. Amazon attributed the incidents to a networking glitch that caused many of its storage volumes (used to store data when an EC2 instance is created) to create new backups of themselves, thus filling up Amazon's available storage capacity and kicking off a series of connectivity problems that affected many of the cloud provider's customers (Pepitone, 2011). For more stories of similar outages see Raphael (2011). Outages are not