CLOUD COMPUTING AND ITS EFFECT ON PERFORMANCE EXCELLENCE AT HIGHER EDUCATION INSTITUTIONS IN   EGYPT (AN ANALYTICAL STUDY)

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Abstract

This period is marked by current financial crisis and challenges related to many growing needs. Consequently, universities are facing problems in providing necessary information technology (IT) support for fulfilling excellence in performance. More specifically, the best practices of Cloud Computing need to be considered within higher education institutions. Therefore, the current study aimed at investigating cloud computing, in terms of: (1) definition; (2) its most important principles; (3) models; and (4) benefits of its use to fulfill performance excellence in higher education institutions. This involves shedding light on cloud computing models and the possibility of its use in higher education institutions, and exploring the effect of using cloud computing in achieving performance excellence there. Additionally, the study aimed at clarifying the challenges and obstacles that face cloud computing. To reach these objectives, the researchers employed a qualitative research methodology for collecting and analyzing data. The study concluded some results, most important of which are: (1) there is a significant relationship between cloud computing and excellence of performance as cloud computing mainly aims at achieving tasks quickly with the least effort and cost. Personnel, customers, innovation and leadership are the core elements to achieve excellence in higher education institutions, and are major components of cloud computing. These positive results support the use of Cloud-Computing solutions in universities and improving knowledge in this field and providing a practical guide adaptable to the university structure.

Keywords: Cloud computing, excellence of performance, higher education.

Introduction
Research Problem

Higher education was acknowledged in time as one of the pillars of society development. Through the partnerships between universities, government and industry, researchers and students have proven their contribution to the transformation of society and the entire world economy (Lazowska et al., 2008). The tendency observed during the last few years within the higher education level (Mircea, 2010; Bozzelli, 2009), is the universities' transition to research universities and ongoing update of the IT (Information Technology) infrastructure as foundation for educational activities and academicresearch. With the evolution of technology, the number of services which migrate from traditional form to the online form grows as well. Accordingly, the universities must perform changes in order to be service oriented and in order to fulfill excellence in performance, and this will not be achieved unless higher education institutions do their best to apply modern trends in IT services, such as cloud computing.

Cloud Computing is an exciting technological breakthrough and a compelling discipline that has already exhibited profound implications on how we work, collaborate and share knowledge. Remarkably, this happens regardless of the geographical and temporal space in which knowledge seekers and knowledge providers physically exist .Srinivasan and Getov (2011) report that Cloud Computing represents a fundamental shift in the delivery of information technology (IT) services that have permanently changed the computing landscape. The main idea behind Cloud Computing is to consolidate and manage computing resources in higher education institutions, make them available to users anywhere and move maintenance and operational management burdens away from the enterprise to a third party.

Thus, the study deals with cloud computing and its effect on performance excellence at higher education institutions. In order to investigate the topic in more depth, researchers employed qualitative analysis.

The evolution of cloud computing

The advent of Computing revolutionized post-industrial society and Cloud Computing shows signs of revolutionizing the information society. Cloud Computing has been very often portrayed and perceived as a new technology but it is also widely accepted as evolution of technologies such as client server architecture, World Wide Web, and networking. Some even call it mainframe 2.0.

In 1960s mainframes were used for computing and transaction processing with users accessing the computing resources through 'dumb

terminals'. 1980s saw the advent of protocols for networking and client server architecture. "The ability to connect users to computing and data resources via standardized networks emerged as a key enabler of cloud computing" (The Defense Science Board).

The World Wide Web and the Internet followed in the 1990s along with enablers such as web browsers. The decade also saw the emergence of application service providers, offering software packages as service over the internet.

"Cloud computing has been enabled by the availability of broadband networks and inexpensive end-user devices, as well as commodity computing nodes that can be simply interconnected and controlled, and virtualization to provide the appearance of isolating processes that share computers" (The Defense Science Board).

Given the evolutionary nature of Cloud Computing, it could mean different things and thus it is prudent to pay attention to definition of Cloud Computing. "Cloud Computing is a model for enabling 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 cloud provider interaction" (Information Technology Laboratory - National Institute of Standards and Technology, 2004).

Cloud computing definition

Doelitzscher et al. (2011) report that despite the wide popularity of Cloud Computing, it is very difficult to provide a standardized clear definition for it. In fact, the definition of Cloud Computing, at best, can be described as imprecise and fuzzy as the edges of the cirrus clouds in the sky. On top, there is no standardized definition for its components as related to their roles. Kim (2009) defined Cloud Computing as "being able to access lies, data, programs and third party services from a web browser via the Internet that are hosted by a third-party provider" and "paying only for the computing resources and services you used".

Mell and Grance (2011) defined Cloud Computing as" 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".

The difficulty in reaching a clear-cut definition of Cloud Computing may be attributed to either its origination from many different network architectures or due to the vast services that it provides. Regarding its origin, Youseff et al. (2008) postulate that Cloud Computing inherits its concepts from peer-to-peer architecture, autonomic computing, virtualization and

service-oriented architecture (SOA). While Aymerich et al. (2008) state that the nascence of Cloud Computing as a new distributed computing paradigm a subset of grid computing technologies, which itself is an extension of cluster computing. Fox (2009) concludes that Cloud Computing is an extension of the client – server architecture introduced in the 1980s. Ironically, Kumar and Hsiang Lu (2010) report that Cloud Computing differs from client – server in the adoption of virtualization.

Cloud computing principles

Das (2013) argues that cloud computing has five key principles:

(1) Shared resources (including applications, processors, storage and databases);

(2) on-demand (users retrieve and use cloud information resources from the cloud);

(3) Elasticity, flexibility and scalability (clouds are receptive to user needs);

(4) Networked access (wide accessibility); and

(5) Metering use (involve payments and storage efficiency).

Literature offers many Cloud Computing definitions. These definitions cover a spectrum of perspectives and come in various degrees of detail. Gartner's definition of cloud mentions scalability, elasticity, and delivery as service. Forrester's definition indicates abstraction, scalability, hosting and billing. IDC has likened Cloud Computing to emerging IT model, and mentions real-time delivery over the Internet. Communications of ACM differentiates between public and private clouds, and presents the view that cloud is datacentered hardware and software. NIST offers a detailed definition that talks about different types of computing resources, characteristics of Cloud Computing, and associated service modes and deployment models.

NIST: Cloud Computing is a model for enabling 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 cloud provider interaction (Information Technology Laboratory - National Institute of Standards and Technology, 2004).

Cloud Computing Benefits

There are Some benefits of cloud computing which are listed below:

Reduced Cost

There are a number of reasons to attribute Cloud technology with lower costs. The billing model is pay as per usage; the infrastructure is not

purchased thus lowering maintenance. Initial expense and recurring expenses are much lower than traditional computing.

Increased Storage

With the massive Infrastructure that is offered by Cloud providers today, storage & maintenance of large volumes of data is a reality. Sudden workload spikes are also managed effectively & efficiently, since the cloud can scale dynamically.

Flexibility

This is an extremely important characteristic. With enterprises having to adapt, even more rapidly, to changing business conditions, speed to deliver is critical. Cloud computing stresses on getting applications to market very quickly, by using the most appropriate building blocks necessary for deployment.

Cloud computing models

There are three primary service models. First, Software as a Service (SaaS),

Second, Platform as a Service (PaaS) provides supply tools and an enabling environment to universities to build, test, install and embrace their own software and web-based applications in the cloud.

Third, Infrastructure as a Service (IaaS) also referred to as Hardware as a Service (HaaS) that provides storage and computing services on many servers with an on-demand and "pay per use" formula. The other storage devices include Data Center, Bandwidth, Private Line Access, Servers and Server Room, Firewall and Storage space.

These models of cloud computing help institutions to perform tasks in an easy way with less effort. Thus, the performance is done in an excellent way.
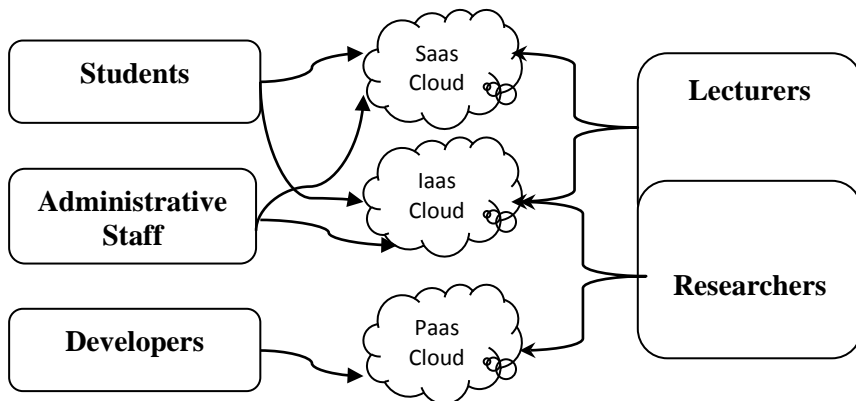

Fig 1: Simplified structure of the main user of IT services in a university using cloud computing models.

The challenges facing cloud computing

Cloud Computing introduces substantial new challenges. But, it also faces man of the same old challenges as conventional networks. In fact, the majority of these challenges are inherited formats ascendant architectures such as grid computing, client/server and the semantic web. Some of the Cloud drawbacks negatively impact KM initiatives such as security, legal issues, information overload and cultural differences, but these are not entirely insurmountable complications. Some of them could be avoided by application of KM principles such as inter-organizational knowledge sharing, coordinating Cops, content management, building trust and expert profiles.

Information security

Cloud Computing security concerns have been expressed by Khan and Malluhi (2010), Borenstein and Blake (2011), Lakshminarayanan (2010) and Ortiz (2011). The trade-off between the Cloud's openness and the need for data protection has resulted in multiple paradox and major concerns in the form of knowledge assurance, information security and privacy. Knowledge is the most valuable competitive resource; therefore, having sensitive information resides in a third-party infrastructure, and accessibility from anywhere may not be tolerable by many security and KM practitioners. Due to open common architecture and multi-tenancy, the security problem of the Cloud is a compound one because if an agent breaks into a Cloud server or application, then that will potentially expose all of the client's sensitive data. As a result, Hurbean and Fotache (2013) found that ERP, CRM and other enterprise applications are still considered mission-critical systems, so they will probably remain on-premise or migrate only to the private Cloud. However, if the security measures for the public Cloud Computing are improved to the level of traditional networks, then organizations may better control the level of tolerable risk for their sensitive information. Pursuing this logic, Zaerens and Mannonen (2012) proposed an approach for evaluation, standardization and deployment of public Cloud networks with high security environment extended from the private Cloud architecture.

Information overload

There are concerns about the disproportionality in the knowledge continuum (data, information and knowledge), where there are huge data and information chunks, i.e. big data with mere knowledge. The danger and the frustration created by information overload has been reported by Godwin (2001), Jefferson (2006) and Mohamed (2007). Furthermore, Baqir and Kathawala (2004) state that the right combination of different technologies is crucial to managing knowledge sources of a learning organization, but it leads to information overload. Cloud Computing makes it easy and fast to

produce and store a glut of information. The information overload is usually reached when the judgmental decision is negatively impacted because the amount of information available in a short time is more than the decision maker's ability to process this information. The over-abundance of information affects the quality of decision through confusion, uncertainty and stretching the time horizon available for the decision-making process.

Cultural differences

1-   There are many barriers to the deployment and usage of Cloud Computing, as one data center may span national and regional boarders and cultures. Of its own accord, Cloud Computing creates a cultural imperialism that overarches all other existing organizational cultures. As it creates lat organizations, it also collides with some cultural barriers that may emerge during knowledge brokering. Although organizations may indeed be sui generis with their own intrinsic idiosyncrasy, cultural shifts happen when such new systems are released. For that reason, Cloud Computing may hatch its own radically different culture that disrupts everyday processes, along with a new set of transparency-related issues. It also disrupts the concrete manifestation of traditional managerial practices and philosophies. The following table summarizes the main benefits and limitations of cloud computing in higher education:

Table 1: Main benefits and limitations of cloud computing in higher education

Benefits	Limitations
Access to applications from anywhere	Not all applications run in cloud
Support for teaching and learning	Risks related to data protection and security and accounts managements
Software free for pay per use	Organizational support
24 hours access to infrastructure and content	Dissemination politics, intellectual property
Opening to business environment and advanced research	Security and protection of sensitive data
Protection of the environment by using green technologies	Maturity of solutions
Increased openness of student to new technologies	Lack of confidence
Increasing functional capabilities	Standards adherence
Offline usage with further synchronization opportunities	Speed/lack of internet can affect work methods

Performance excellence in higher education institutions

In recent years the nature of managerial work has changed in many organizations. As companies found themselves trying to compete in a world market characterized by, as Tom Peters puts it, continual chaos, companies that had traditionally been the most successful competitors found themselves losing market share. They had traditionally been successful as a result of

their ability to control costs through the use of bureaucracies and economies of scale but today successful companies must be able to respond quickly and effectively to change, and evoke high levels of employee commitment to goals such as innovation and quality.

As a result, institutions began to change their approach to management and began to focus on what Lawler (1988) has labeled "High Involvement Systems." In these new systems employees were expected to assume the responsibility for performing tasks which traditionally had been considered management tasks— planning, decision making, and quality control, for ex- ample. Consequently, the number of middle level managers was reduced and many tasks which had traditionally been considered managerial tasks were delegated to employees. In addition, in order to maintain high levels of intrinsic motivation on the part of employees, the managers that remained were asked to abandon the traditional role of supervisor and assume the role of mentor. Instead of doing the planning, decision making and controlling themselves, managers were now expected to help their employees perform these tasks by acting as facilitators, coaches, and trainers.

This suggests that managers could improve their effectiveness as teachers and trainers by using a four step approach to training (Jerry M. Kopf Jerry G. Krauze, 1991):

2-   .**Show them**. At this stage, employees are shown a sample of the desired objects, behaviors, or processes, which demonstrate the concept or principle the manager wishes to introduce. Samples may be obtained from direct experience, simulated situations, or examination of documents, materials or work products. The manager should then assist the employees in identifying the kinds of information or materials needed to perform the tasks, and how it should be organized and used. At the end of this stage, the manager should direct a discussion of what the results of the behavior are, and how these results are achieved. This stage helps employees relate the training to the desired outcomes. For example, assume a manager desires to train office/administrative employees on how to use computers in the context of their jobs. Rather than beginning immediately with commands and key-strokes, the manager should first illustrate how the computer can be used to perform specific tasks. For example, the manager might illustrate the use of a spreadsheet program to prepare a report currently being prepared by hand.The manager can initiate the discussion by distributing some computer outputs. The manager could elaborate how these reports/processes were accomplished prior to computerization, indicating the time and money savings generated by computerization and the reports/processes. Then, the manager could sit down at the computer, turn it on, bring up the spread-sheet, input some data, and print out the report. Finally, the manager could

talk in general terms about what had just been don what information was needed, what inputs were required, what software was used, etc.

3-   **Tell them**. At this stage, employees should develop a step-by-step model of how to perform the task and how to achieve the desired results or outcomes. Participants should reflect upon the observations and discussion in Stage 1 and begin to form a structured model of the process involved. The trainer should focus on helping employees identify the stages of the process and what is done in each stage. Information should be provided in small chunks and new material should be tied in with previously learned information. The manager, for example, could begin with a discussion of how to turn a computer on, how to use the operating system to access the spreadsheet, how to enter data into a spreadsheet, etc. Complex tasks should be provided in discrete blocks, allowing time for the employee to go through all four stages of the learning cycle for each block. For example, employees should have a chance to see the operating system work, see what steps are involved in using the operating system, understand why they use a particular command, and have a chance to try and use the operating system before they are taught how to use the spreadsheet.

4-   **Explain it to them**. The focus of this stage should be on developing a better understanding of why a task is performed in a certain way. At the end of this stage the trainee should not follow just a set of routine instructions, but be able to deal with unique situations. In this stage, the manager should provide actual examples and situations which require employees to come up with solutions. It is important that employees begin to understand the relationships and the logic or rationale involved. The manager could select additional examples which are unusual or different and which require employees to find innovative solutions. For example, the manager might ask the employee how they would use the same data in the spreadsheet to perform different calculations or prepare a different type of report. This stage should help employees understand why they are doing something, which not only promotes a better understanding of the task, but often a more positive attitude toward the task as well.

5-   **Do It**. In this stage the person should try to perform the task themselves. People often think they understand how to perform a task, but when they try to do it they discover there are things they still don't understand. It is one thing to watch a pro tennis player serve the ball, and quite another thing to do it yourself! By actually performing the task people can discover for themselves what help they need, and the trainer can observe the trainee to see if they have misunderstood the task. This allows the trainer to provide immediate feedback and correct problems before they become bad habits. To use the spreadsheet example, the manager should select a task which can be completed through the use of a spreadsheet. By having the

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employee actually perform the task, he manager is able to verify that the employee has successfully completed the preceding three stages of earning, or if they need to back up to an earlier stage. The manager should then ask employees to identify tasks within their area of responsibility which could be completed more effectively through the use of computer spreadsheets. The goal of this stage is to encourage employees to explore the computer's capabilities and to find new applications for the computer. Not only does this improve learning, but employees can be an important source of knowledge, since they often have more up-to-date technical information and a better understanding of day-to day operations.

Performance excellence models
First: the 4P excellence model

In Dahlgaard-Park and Dahlgaard (2003, 2007) a model – the "4P" excellence   model – is presented which has proven to be a good framework model to be used when educational institutions are planning to attain excellence. The model is consisting of five components which are as follow;

   Products - - Processes; and   - Leadership   -people   - Partnership

The main implication that can be drawn from this model is that excellent products and services are a result of building excellence into people, partnership and processes, and this requires a strong foundation – leadership. It is assumed that a management without such leadership will not be able to create excellence..

Peters and Austin's (1985) simplified organizational excellence model illustrates all these issues. They regarded excellence as being the result of the following four critical success factors (CSF):
- People, who practice
- Care of customers
- Constant innovation; and
- leadership

Second: Baldrige Education Criteria for Performance Excellence

While the Baldrige Award in education has captured the attention of decision makers, there has been little empirical research examining the usefulness of the award criteria to guide the actions of organizations that seek to improve performance (Goldstein and Schweikhart, 2002; Arif and Smiley, 2004).

Conclusion

Both researchers put a suggested proposal to fulfill performance excellence at higher education institutions in Egypt. The suggested proposal included its definition, philosophy, fundamentals, aims, guarantees and procedures.

The suggested proposal definition is based on a list of suggestions that handle the effect of cloud computing on fulfilling performance excellence at higher education institutions. The suggested proposal philosophy is that cloud computing leads to achieve excellence of performance.

The proposal fundamentals are: Performance excellence leads to carrying out tasks in the beat way, the cloud computing increases the performance effectiveness at institutions, persons, customers, innovation and leadership are main elements to achieve excellence, and these elements are among the basic principles of cloud computing besides to the main fundamental that Performance excellence requires using unique and distinguished situations and awareness of adopting creative solutions of complicated tasks and this is the main aim of cloud computing.

The proposed aims are: setting awareness of cloud computing importance at higher education institutions in Egypt, guiding the stakeholders to review the policies of their performance to cope up with cloud computing, in addition to finding a mechanism to activate cloud computing at all fields in university institutions.

The proposal guarantees the following outcomes: (1) making exclusive changes to information technology programs at higher education institutions; (2)training the employees of these institution on how to use cloud computing in carrying out their tasks; (3) participation of all members in each institution at the development process; and (4)ensuring that the institutions networking environment is ready for cloud computing in addition to offering the necessary financial support to activate cloud computing at higher education institutions in Egypt.

To achieve the proposed aims, the following procedures were followed: (1) reviewing the use of cloud computing at higher education institutions; (2) providing the principles and employees at higher education institutions with the Knowledge of using and applying cloud computing and the way by which they can overcome its obstacles; (3) offering the good infrastructure of cloud computing services at higher education institutions; and (4) enabling individuals to do projects and organize work via cloud computing services. The following diagram shows the suggested proposal procedures to use cloud computing in achieving performance excellence at higher education institutions:
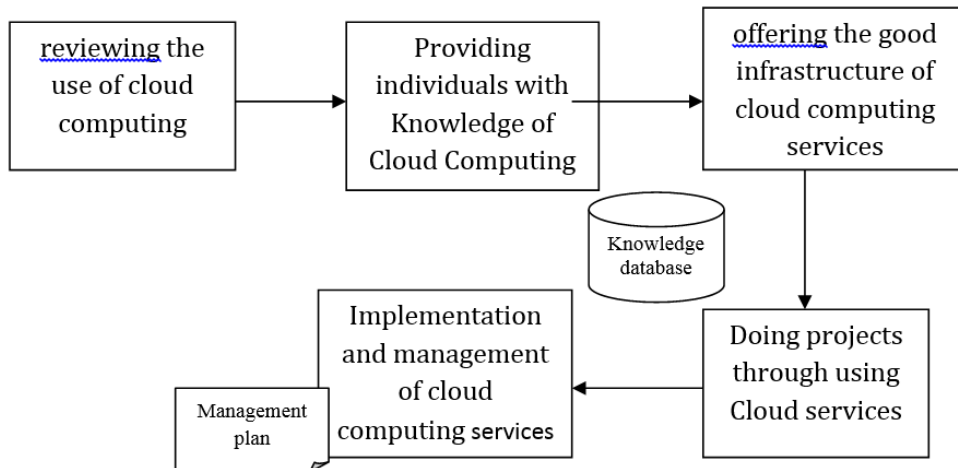
Fig 2: Implementation of Cloud Computing in Higher Education

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