

# Challenges and Benefits of Implementing Cloud Based E-Learning in Developing Countries

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## ABSTRACT

*Cloud computing is used to provide reliable computing environments and highly scalable resources that can make them accessible to users. Cloud based e-learning offers the real concept of e-learning where the users can access the information at any time and place using any computer technology devices. This paper focuses on the concept and architecture of cloud computing. It highlights the state of the art on the utilization of learning technologies in Libya as well as in other developing countries. The challenges and benefits of implementing cloud based e-learning in developing countries will also be discussed in this paper for the improvement of teaching and learning in higher education institutions in developing countries.*

**Field of Research:** *Cloud Computing, E-Learning, Cloud Based E-Learning, Online-learning, Developing Countries, Challenges, Benefits.*

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## 1. Introduction

Libya is a developing country that is located in North Africa. It is the fourth largest country in Africa and the majority of the country is covered by the Sahara desert. Libya offers free education for everyone from the elementary school to post-graduate studies. The first nine years known as the basic education are made compulsory for all children. Currently, higher education is offered in universities, and higher vocational institutes including teacher training institutes; polytechnic institutes, and higher education institutes for technical, industrial and agricultural sciences.

## 2. Basic Concept and Architecture of Cloud Computing

Cloud computing provides the ability to access and manipulate various information resources stored on remote servers. One way to think of cloud computing is to consider the use of email services such as Yahoo, Gmail, and Hotmail. These email services take care of housing all of the hardware and software that the necessary to support personal accounts. When the users want to access their emails with the Internet access, they just need to log in to email client via any web browsers.

Cloud computing is Internet-based computing. Cloud computing provides resources, software, and information to computers and other devices on demand .There are various definitions of cloud computing. The most widely accepted definition of cloud computing is defined by The National Institute of Standards and Technology (NIST) (Mell & Grance, 2011). *“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 service provider interaction”.*

Cloud computing consist of three types of services where depending on the needs, the clients can choose one or more services. Those three services are:

**Infrastructure as a Service [IaaS]** All the required hardware is provided by cloud service providers and the clients deal with their application software, such as servers, net technology, storage or computation, as well as basic characteristics such as operating systems and virtualization of hardware resources.

**Platform as a Service [PaaS]** Cloud computing provides infrastructure to the clients and more. PaaS is a set of software and infrastructure with all the stuff that a developer needs to build applications, such as programming software or database software, having an indirect access to the IaaS services and, consequently, to the infrastructure.

**Software as a Service [SaaS]** Clients are able to access software applications over the internet. The applications are hosted in “the cloud” and can be used for a wide range of tasks for both individuals and organizations.

### 3. Cloud Computing Deployment Model

Cloud computing has four different deployment modes (Alghali, et al., 2013). Those modes are:

**Private Cloud** is cloud platform witch minted for specific clients. It can be managed internally by internet IT or externally by a third party. This main feature avoids many security issues but may be expensive for small organizations.

**Public cloud** is the most common model of cloud computing to many clients . IaaS, PaaS and SaaS are provided by a third party provider. Constructed using pooled shared physical resources, and accessible over a public network such as the internet.

**Community cloud** is when some clients with similar needs share an external private cloud. The platform of the cloud would be provided by a supplier but only the clients in same community would be able to access the cloud.

**Hybrid cloud or enterprise cloud** consists of both in-house providers and third party providers where part of the cloud is private and only accessible internally and the other part is public and can be accessed externally.

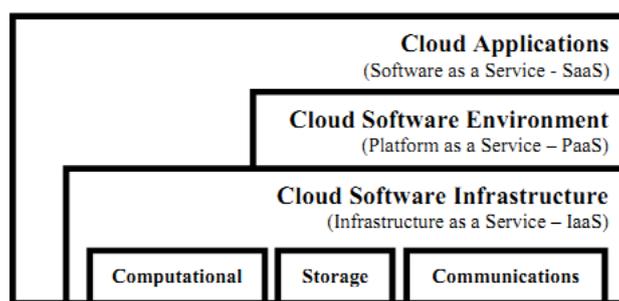


Figure 1 Cloud computing model (Al-Jumeily, et al., 2010).

## 4. Utilization of Learning Technologies in Developing Countries

### 4.1 The utilization of learning technologies in Libya

According to the United Nation’s Human Development, Libya has the highest rate of literacy in the ranks of the Arab world that the standard of living, social security, health care and other factors for development .The Libya population in 2012 was 5,613,380. Internet users as of 30-June-2012 stood

at 954,275, or 17.0 % of the population. As of 31-Dec-2012, the country had 781,700 Facebook users, or 13.9% penetration (internetworldstats, 2013)

The implementation and use of Information and Communications Technology (ICT) in Libya education is still in an early stage as access to the tools of information and communication technology in many areas such as government services and commerce are still lagging behind (UNICCO, 2009).

There are 108 higher education institutions in Libya, including 12 government universities and another 96 government funded institutes that provide education in the areas of administration and management, technology, creative art, and teacher development. The universities such as Sebha University, Tripoli University, Benghazi University and Academy of Postgraduate Studies and Economic Research have their basic ICT infrastructure such as computers, Internet access, and a local area network. The most of higher education institutions have their website, study and exams system, admission and registration system. All schools in Libya have been equipped with computer labs in order to eliminate computer illiteracy. In addition, computer usage has been added to the primary school curriculum starting from the fifth year (Hamdy, 2007).

There were some attempts to use technologies in education. For example, since 2008 Libya has launched an electronic system for viewing secondary education examinations result. Furthermore, some pilot projects to apply e-learning have also started in primary schools. The Ireland-based Riverdeep has developed a successful e-Learning pilot project covering six schools in Tripoli where Mediterranean Coast for Information Technology Company [MCIT] designed and provided the entire (Rhema & Miliszewska, 2011). In addition, distance education is provided by Libyan Open Universities [LOPs] which offer the opportunity to study at home. The curriculum is conveyed by written and audiovisual material to the students, the students are required to attend the exams in the end of each semester.

In addition, there is project to create the Libyan Higher Education and Research Network [LHERN]. The aim of this project is to build Local Area Networks [LANs] in all 149 faculties belonging to various university campuses and institutes. These Local Area Networks connected to each other to be a Wide Area Network [WAN] for all higher educational institutions in Libya. The project foresees to be creation of a national ICT resource centre for educators, and the automation of university management systems through ICT such as digital libraries/portals of educational resources, student information systems, university procedures and financial operations (Hamdy, 2007). Unfortunately the project suspend during the last uprising. However, the new Libyan government is now working hard to provide technological infrastructure to all universities as soon as possible. The United Nations Development Program [UNDP] and the United Nations Educational Scientific and Cultural Organization [UNESCO] provides Libya significant opportunity to recover the education system, and reconstruct Libya education system after the recent uprising. They work together in hand with the Libyan Ministry of Education to ensure appropriate and timely implementation of the information and communication technology strategy.

It is clear to everyone in Libya the limiting of internet access. Libya Telecom & Technology LTT is the state-owned company and still the country's only internet services provider. However, the recent

uprising disrupted Libya's telecommunications sector, reconstruction efforts are underway (libyaherald, 2014).

Libya is looking to Egypt to form ICT policy and regulations, the two countries plan to cooperate to strengthen Libya's ICT infrastructure and environment areas of cooperation include cyber security and the development of a regulatory environment, as well as human capacity building and equitable access to modern technologies such as the Internet (AllAfrica, 2014).

#### **4.2 The utilization of learning technologies in Egypt**

Egypt has a relatively high rate of illiteracy. Over 28% of the Egyptian population is illiterate, with higher rates for women 37%. Thus to deal with this serious problem, the Ministries of Education and Higher Education [MCIT] has taken a number of steps to use ICT Africa (Internet World Stats, 2014). However, the development of Egypt's education system became a national priority given the importance of education to be development and progress in all fields. Thus, MCIT has adopted various strategies and initiatives over the years supporting educational development.

The MCIT has established the ICT for Illiteracy Eradication [ICT4IE] program to produce e-content for teaching Arabic words and characters and elementary mathematics, delivered by IT Clubs, the Internet and CDs. In addition, MCIT has established Training of Trainers programs in 15 governorates to serve the rising demand for basic literacy training. Also since 2008, MCIT has used the ICT4IE course to eradicate illiteracy in 10,000 people annually in the 10 governorates with the highest rates of illiteracy (World Summit Award, 2014) also to overcome local traditions that restrict women's movements outside the home, a new solution was created in the form of the tabluter. The tabluter is a customized ergonomic single CPU that runs for four independent users. It is used as a mobile education lab in individual homes, promoting literacy through interactive software.

A Project for providing 10 vocational schools with ICT infrastructure, e-curricula and human resources capacity building, this project will establish E-learning center to serve vocational students and teachers as well as students from surrounding communities. The center will be operated in cooperation with the Italian Istituto Don Bosco. This pilot project has been established as a model of vocational education and training that can be replicated domestically and internationally.

Egypt's fundamental effort focuses on training programs to build its ICT capacity. Thus, there are many public and private organizations with a variety of international partners to provide training programs in different areas to meet the market demand for qualified personnel. Specialized training agencies, where qualify accredited academic degrees programs include: CSADP, MCSD, MCSE, LAN Administrator, Linux Administrator, UNIX Administrator, Web Development, Programming Languages, and Soft Skills. Another specialized training agency is the National Telecommunications Institute [NTI], which is a center for telecommunications systems, technologies, policies and management. The number of trainees at NTI by the end of December 2010 amounted to 40,770. The total number of International Computer Driving License (ICDL) certified trainees reached 520,120 trainees at the end of December 2010.

In September 2005, the Ministry of Higher Education prepared a preliminary study the project of the Egyptian e-Learning University [EELU].The University started its educational activities in October 2009, in two programs: Business administration, Computer and Information Technology. In October

2010, the E-Learning program was included, which gives the degree of a Graduate Diploma in these disciplines. The University signed several collaboration agreements with Ain Shams, Tanta and Assiut Universities. In addition, EELU has started cooperating with European universities in Italy and France. In February 2011, the University opened the Continuing Learning Center [CLC], which offers professional training courses to a wide variety of different Egyptian society sectors (EELU, 2014).

In 2004 the Ministry of Communications and Information Technology [MCIT] founded the e-learning Competence Centre [ELCC] cooperates with Cisco Systems, ELCC is Egypt's organization in e-Learning with a successful of developing and delivering a wide array of state-of-the art e-Learning courses, web communications and e-content; setting and disseminating the quality standards of e-learning. In 2010, ELCC established a network of 700 academies spread on Egypt and delivering training courses for almost 60,000 trainees and 3,000 instructors.

#### 4.3 Comparison of Learning Technologies in Libya and Egypt

In general, Egypt has high levels of integration of ICT-assisted instruction and the essential infrastructure, including basic hardware [i.e. computers] and Internet connectivity than Libya .In Libya, the implementation and use of ICT in education often lags behind with other social and economic spheres, including communications, employment and commerce.

In fact, both countries have tried to implement and use of ICT in their primary and secondary education systems by providing the essential infrastructure, including basic hardware [i.e. computers] and Internet connectivity. However, there are some challenges prevent of using ICT. In many developing countries, children and youth learn more about how to use various ICT tools informally outside of the school system. For example, the youth efficiently used mobile devices and the Internet to communicate during the Arab Spring. Thus, there is need to clear strategy, set priorities and take advantage of the ICT opportunities to improve the teaching and learning processes.

#### 5. Challenges of E-Learning

Many universities and educational institutions have set up portals to offer an e-learning environment to support conventional teaching approach or as a teaching medium for long-distance (Sahu & Singhal, 2002). However, there are several challenges face education institutions in developing countries as they seek to implement the e-learning. E-learning most often is transferred from the developed world to developing world (Goi & Ng, 2008). Thus we need to know what the challenges in developed world are. Therefore to address these issues there is a need to identify e-learning challenges using all potential challenges in literature review. There are 24 challenges belong to six categories as in the following table:

Table [1]. Challenges of e-learning

List of Challenges	Researcher[s]
<b>Financial</b>	
Infrastructure cost	Bates Tony (2008), Anuwa, & Datuk (2004).(((4)))
Support cost	Bates Tony (2008), Kamba (2009).
Technologies Funding	Frimpon (2012), Al-Adwan & Smedley (2012).
<b>Individual</b>	
Awareness	Anuwar & Datuk (2004).

Confidence	(Goi & Ng 2008), (Andersson 2008)
Culture	(Abdelraheem2006), (Pagram, P., & Pagram, J. 2006), (Bates Tony 2008).
Leadership	(Abdelraheem2006)
Motivation	(Frimpon 2012), (Andersson 2008), (Al-Adwan & Smedley 2012), Pagram, (P., & Pagram, J. 2006), (Bates Tony 2008)
<b>Knowledge Management</b>	
Content	(Abdelraheem 2006), (Frimpon 2012), (Anuwa, & Datuk 2004).
Copyright issues	(Abdelraheem2006), (Al-Adwan & Smedley 2012).
Curriculum	(Bates Tony 2008).
E-Learning Strategy	(Abdelraheem2006).
Pedagogical model	(Pagram, P., & Pagram, J. 2006).
<b>Support</b>	
ICT professionals	(Bates Tony 2008), (Kamba 2009).
Instructor competency	(Goi & Ng 2008), (Bates Tony 2008).
Skills	(Abdelraheem2006), (Kamba 2009), (Frimpon 2012), (Al-Adwan & Smedley 2012), (Pagram, P., & Pagram, J. 2006), (Bates Tony 2008).
Support for students from faculty	(Andersson 2008), Pagram, (P., & Pagram, J. 2006).
Training	(Kamba 2009), (Frimpon 2012), (Pagram, P., & Pagram, J. 2006).
<b>Technological</b>	
Infrastructure	(Dong, et al., 2009), (Abdelraheem2006), (Bates Tony 2008)
Localization	(Chuang, et al., 20011), (Andersson 2008)
Presentation and interface design	(Masud & Huang 2012), (Pagram, P., & Pagram, J. 2006).
Resource management	(Dong, et al., 2009).
Speed bandwidth	(Chuang, et al., 20011), (Kamba2009).

## 6. Benefits of Cloud Computing In Learning

The cloud computing has brought many advantages to educational institutions (Alghali, et al., 2013).

### 6.1 Support

In cloud computing, the hardware and software are in the service provider side. Thus, the maintenance of hardware and software is simplified, and there are fewer problems for the IT team.

### 6.2 Availability

Cloud computing provides a high level of resource availability. In cloud computing system can automatically detect the node failure and exclude it without affecting the users system.

### 6.3 Cost

Cloud computing gives an opportunity to reduce the amount of money spent on IT. Cloud computing reduces the cost of hardware, software, networking, storage, electricity, cooling and the space to house the hardware. Education institutions do not have to invest in expensive new computing equipment and can shift the cost to a more manageable operational expense. Cloud computing can also reduce the cost of database administration, OS upgrades, software license, frequent contracts, consulting companies, It staff, testing and new applications piloting.

#### **6.4 Performance**

Since the most of applications and processes in cloud, the user will not have any problem performance when they perform their tasks.

#### **6.5 On-Demand**

Cloud computing users have access to computing capabilities with 24 hours access to infrastructure and content and Software as needed without requiring human interaction with cloud service provider CSP.

#### **6.7 Pay per use**

Cloud computer users can access potentially unlimited resources, but they only pay for what they actually use. Users are charged using fee-for-service or advertising to promote optimization of resource use.

#### **6.8 Wide Network Access**

The resources are available over the network and can be accessed by different user's platforms. In addition, educations institutions can enhance their communication by participate with each other.

#### **6.9 Rapid Elasticity**

Services in cloud computing has the ability to scale resources both up and down on demand. To the users, the cloud appears to be infinite, and the consumer can get as much or as little computing power as they need and which be appropriated in any quantity at any time.

### **7. Challenges of Cloud Based E-Learning**

While the cloud based e-learning has many benefits for educational institutions, still there are some challenges in implementing cloud computing to e-learning technology. These challenges in cloud based e-learning technology are listed below.

#### **7.1 Privacy**

Data privacy protection in cloud computing faces many challenges such as access, storage, compliance, retention, destruction, audit and monitoring, breaches and controversy of various legal systems. Cloud computing has a vital impact on the privacy. In addition, Privacy concerns should be seen not only as a technical issue but also as a legal problem. In Cloud computing exploring this issue is quite complex because of the nature of cloud computing (Alghali, et al., 2013).

#### **7.2 Security**

Security plays a necessary condition of some e-learning materials. If the data is stored in cloud, the question of the security of this valuable data on unknown cloud servers arises.

#### **7.3 Reliability**

Reliability is a great concern for education institutions in developing countries that implement cloud computing. Most of cloud service providers in U.S and Europe may be unwilling to offer sufficient resources such as technical support, bug fixes, etc. to smaller markets in developing countries.

#### 7.4 Legal Issues

If an organization wants to take the advantage of cloud computing systems services, it has to make clear which countries are hosting its private data, and what are the country's laws that govern data (Zhou, et al., 2010).

#### 8. Conclusion

Obviously, cloud computing provides great opportunity for educational institutions in developing countries to improve their teaching and learning. Educational institutions in developing countries should take advantage of implementing cloud technologies to enhance the quality of learning. However, some of challenges of cloud based e-learning have not been solved. In fact, these issues are more complicated on developing countries. The researchers belief that, cloud computing is the next big trend for an efficient e-Learning systems. This is because of features and capability to improve traditional e-learning system from a technological and cost.

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