Exploring the Potential of Clouds to Facilitate the Adoption of Blended Learning in Tanzania

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ABSTRACT

The past few years has witnessed the rapid development and adoption of various forms of Blended Learning (BL) in Higher Learning Institutions (HLIs) in Tanzania. Many institutions have procured various ICT technologies such Learning Management Systems, video conferencing, and multimedia facilities to complement face-to-face, and distance learning. However, BL delivery still faces several challenges such as cost of acquiring and managing ICT infrastructures, slow internet speeds, and inadequate competent technical staff. The recent emergence of cloud computing have a potential to alleviate these challenges as well as making teaching and learning more efficiently. Nonetheless, the adoption of cloud services to embrace BL in HLIs in Tanzania is still very low. This paper explores how HLIs in Tanzania can make use of cloud services to facilitate adoption of BL and alleviate existing challenges. The paper also proposes strategies on how to migrate BL services into the cloud as well as deployment options for small or new institution, and established institutions. This work contributes towards helping higher education in Tanzania to understand cloud services and to make plans for successful migration of computing services into clouds.

KEYWORDS:

Blended Learning; Cloud computing; eLearning; ICT infrastructure; developing countries

1. INTRODUCTION

The past decade has seen the tremendous development of Information and Communication Technologies (ICT) and the internet in Tanzania. For example, the recent rollout of SEACOM marine cable increased internet speed up to 155Mbps as well reducing telecommunication costs by 95% (Swarts & Wachira, 2010). This has been further amplified by the government decision to exempt all value added tax to ICT equipment (Sife, Lwoga, & Sanga, 2007). As a result, the price of ICT equipment has gone down and has become affordable to majority of Tanzanians. These developments have heightened the need for Higher Learning Institutions (HLIs) to utilize their potential so as to improve the quality of, and widen access to education. Naturally, institutions have been using various technologies such as video conferencing, Learning Management Systems (LMSs), the internet, and other related technologies to complement face-to-face delivery to create the most efficient learning environment. Such kind of combination is what is called Blended Learning (BL).

According to Garrison and Kanuka (2004), BL is "the thoughtful integration of classroom face-to-face learning experiences with online learning experiences" (p.96). The main goal of BL is to provide an effective and efficient learning experience taking best of both instructional worlds: face-to-face, and online delivery (Kumar, 2012). HLIs in Tanzania have chosen BL delivery due to several benefits it offers. First, BL enables instructors to use variety of instructional techniques due to availability of various technologies to archive effective learning outcome (Vaughan, 2007). Second, it provides learners with greater flexibility of time to study regardless of work commitments, or distance limitations (Glogowska, Young, Lockyer, & Moule, 2011; Ho, Lu, & Thurmaier, 2006; Kumar, 2012). More importantly, even those learners described as "hard to reach" has been able to study various courses offered in BL mode.

As a result of BL benefits, obviously, HLIs in Tanzania have been investing significantly to procure, and maintain various technologies in order to complement face-to-face delivery. A study conducted by Munguatosha, Muyinda, and Lubega (2011) revealed that, 80.2% of HLIs in Tanzania were using various LMSs by end of 2011 (78% Moodle, and 2.5% Blackboard). In addition to LMSs, Lwoga (2012) found other institutions using audiotapes, CDROMs, videotapes, video conferencing, and other related technologies. Initially, institutions were procuring ICT solutions to complement on-campus face-to-face delivery. Recently, however, some institutions have started combining ICT solutions with distance learning. For example, Open University of Tanzania (OUT) which has been running pure distance learning using correspondence and face-to-face for years, has recently started to combining face-to-face with ICT solutions. Similarly, University of Dar es Salaam (UDSM), introduced BL courses that are offered outside University campus via three established learning centers in Mwanza, Arusha, and Dar Es Salaam in 2008 (Mtebe, Dachi, & Raphael, 2011).

Indeed, BL is finding its way in Tanzania educational institutions. Nonetheless, there still several challenges that hinders HLIs to widely adopt and benefit from BL delivery. These challenges include the cost of acquiring, managing, and maintaining ICT infrastructure (Lwoga, 2012; Ssekakubo, Suleman, & Marsden, 2011; Unwin et al., 2010), high cost of bandwidth, inadequate of competent technical staff (Lwoga, 2012; Tedre, Ngumbuke, & Kemppainen, 2010), and lack of eLearning policies (Lwoga, 2012). Nonetheless, the recent emergence of cloud computing provide an opportunity for HLIs to alleviate these challenges by effectively utilizing the potential of cloud services.

Cloud computing involves hosting ICT infrastructure, software applications, and other computing services into cloud servers and being accessed via the internet. The institutions can only pay for services based on usage the same way as utility services, such as water, electricity, gas, and telephony (Buyya, Yeo, Venugopal, Broberg, & Brandic, 2009; Carroll, Merwe, & Kotzé, 2011). By migrating BL services into the cloud, institutions will no longer be required to procure and host ICT infrastructure in their premises. As a result, they will reduce the cost associated with hardware purchase, software licensing and updating, electric power, cooling, and salaries for IT support staff

(Carroll et al., 2011; Koch, Assuncao, & Netto, 2012; Mircea & Andreescu, 2011; Mokhtar, Ali, Al-Sharafi, & Aborujilah, 2013; Sultan, 2010).

As many institutions in developing countries facing financial limitations in both teaching and research activities, obviously, cloud computing will contribute significantly towards reducing ICT investment cost required to establish and run BL courses. This will facilitate wider adoption of BL courses in many institutions in Tanzania. However, the decision to migrate BL computing services into the cloud depends on institutional awareness of the benefits well as challenges associated with cloud services. Many people, and institutions in Tanzania are not totally aware of the benefits and challenges of cloud computing, and that is the main motivation of writing this article.

Accordingly, this paper makes three important contributions to the growing body of knowledge that support institutions to adopt and use cloud services:

- Explores how HLIs in Tanzania can effectively utilize cloud services to facilitate adoption of BL courses,
- Presents cloud adoption strategy for BL, and
- Proposes cloud deployment options for BL services in HLIs.

2. A CLOSE LOOK AT CLOUD COMPUTING

The National Institute for Standards and Technology (NIST) defines cloud computing as "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" (Mell & Grance, 2011, p.2). The idea behind cloud computing is to enable clients (e.g., users, or institutions) to access computing resources via the internet and pay per use as utilities; the same way users normally pay water, electricity and related services.

2.1. Cloud computing service models

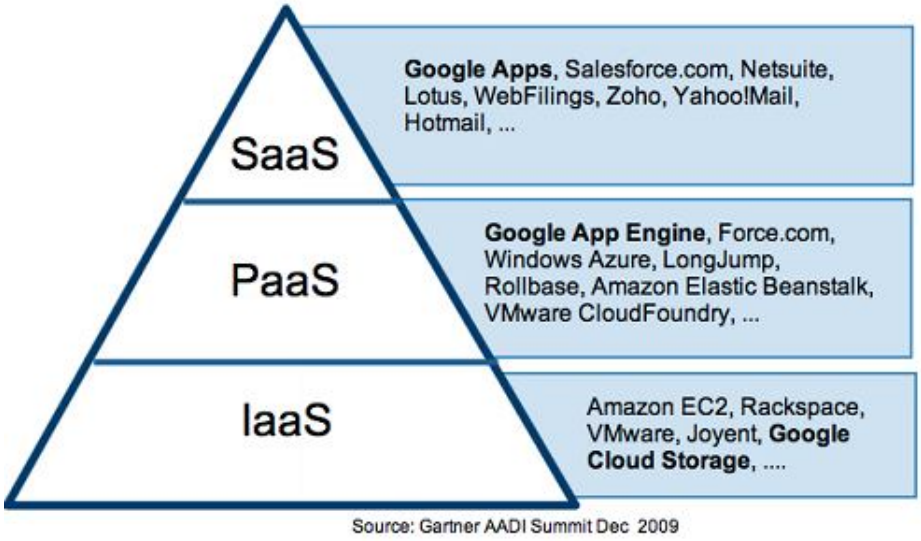
The cloud computing is divided into three service models/layers namely: Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS). SaaS means the software or application runs on provider's servers (cloud) and users interact with it via internet (Mathew, 2012; Mokhtar et al., 2013). Therefore, users do not need to install software applications in their computers to access computing services. Google Apps such as Gmail, YouTube, and others are typical example of SaaS model (Babar & Chauhan, 2011). For example, institutions can use Gmail for students and staff instead of university email system. Many SaaS applications are available at little or no cost (Khmelevsky & Voytenko, 2010).

Similarly, PaaS enables users to access development platform and tools through APIs which support a specific set of programming languages (Babar & Chauhan, 2011). PaaS basically aims to help developers who want to create, test, and deploy software applications on provider's servers via internet without installing them locally (Hosam, Tayeb, Alghatani, & El-seoud, 2013; Mokhtar et al., 2013). Google Application Engine, and Microsoft Azure are good example of such platform.

Google App Engine allows a user to run web applications written using the Python programming language while Microsoft Azure supports a comprehensive collection of proprietary development tools and protocols which consists of Live Services, Microsoft .NET Services, Microsoft SQL Services, Microsoft SharePoint Services, and Microsoft Dynamics CRM Services (Buyya et al., 2009).

The third cloud computing layer is IaaS. This layer enables users to manage processing, computing services, storage, networks, and are able to configure the cloud servers similar to the ordinary physical servers (Mell & Grance, 2011). It also provides users with ability to control operating systems, storage, and other network components. This model enables users to get rid of problems of purchasing the latest technology, maintenance, upgrading of software and software licenses (Mokhtar et al., 2013). The cloud computing layers are shown in Figure 1.

Figure 1: Cloud computing layers



2.2. Cloud computing deployment models

The cloud computing can be deployed in four different ways: private cloud, public cloud, community cloud, and hybrid cloud. A public cloud is where cloud infrastructure is made available to several users/clients and this infrastructure is owned by a cloud service provider (Carroll et al., 2011; Mokhtar et al., 2013). Companies such as Google, Amazon, Microsoft, and others provide several public cloud services. The private cloud is where cloud infrastructure is operated solely for particular organization with services made available for internal users (Babar & Chauhan, 2011; Bansal, Singh, & Kumar, 2012). Normally, the private cloud is managed by an IT department within an organization or commissioned to a service provider or a third party organization but all services are dedicated to that organization.

Another cloud computing deployment model is the community cloud. This model enables several organizations with shared interests, such as with agreed and common mission, and security requirements to control and share cloud infrastructure (Carroll et al., 2011; Mokhtar et al., 2013).

The community cloud may be managed by one of the organization or by a third party organization. The last type of cloud computing deployment is the so called hybrid cloud. This is a mix of two or more cloud models (Mokhtar et al., 2013). Normally, organizations which adopt private deployment model aims to expand its services by outsourcing services with less security and legal requirements to public cloud providers to create a hybrid cloud. For example, organization might use public cloud basic business applications such as email and their private cloud for storing sensitive data such as financial data (Bansal et al., 2012).

3. CLOUD COMPUTING IN HIGHER EDUCATION

The adoption of cloud computing to embrace education is growing very fast, more and more institutions are migrating their computing services into the cloud. This is further facilitated by existence of cloud service providers that provide several cloud services for free or at a discount rate to educational institutions (Alshuwaier, Alshwaier, & Areshey, 2012; Bansal et al., 2012; Mokhtar et al., 2013). Typical examples of such cloud service providers are: Microsoft, Google, IBM, and Amazon. They have established special packages to provide institutions with access to ICT infrastructure, software, platforms, and other educational services hosted in their clouds.

For example, Google educational package consists of collection of web-based messaging (e.g., Gmail, Google Talk, and Google Calendar), productivity and collaboration tools (Google Docs: text files, spreadsheet, presentation, and form creation and sharing), Google Video, and Google sites. This package is offered at totally zero cost to unlimited users without advertisements (Chandra & Malaya, 2012; Herrick, 2009). Apart from educational package, Google have two commercial packages: Standard Edition, and Premier Edition. The Standard Edition is free with a minimum of 50 users, while Premier Edition costs 50 US$ / account / year with 25 GB space for each e-mail (Herrick, 2009).

Similarly, Microsoft package (called Live@edu) is available to educational institutions at no cost (Chandra & Borah, 2012). The Live@edu suite consists of Microsoft Office, Windows Live SkyDrive, Windows Live Spaces, Microsoft SharedView Beta, Microsoft Outlook Live, Windows Live Messenger, and Windows Live Alerts. Microsoft has also introduced cloud computing services for commercial purposes: the Azure; which provides developers with on-demand compute and storage to host, scale, and manage internet or cloud applications (Sultan, 2010). Apart from Google and Microsoft, there are other companies that offer several cloud services to education institutions. For example, IBM established “IBM Cloud Academy” that provide access to Virtual Computing Lab (VCL) solution that enables institutions to access and use free software and host their applications in their cloud infrastructure.

The support and involvement of these companies in educational field has attracted dozens of institutions all over the world to enhance both on campus, distance, and blended learning. In fact, there are already several successfully deployments of cloud services in education in US, UK, Asia, and Africa. Some few examples of such institutions in the US are: North Carolina State University (Chandra & Borah, 2012; Mokhtar et al., 2013), Colorado State University (Herrick, 2009), University of California, and Washington State University (Sultan, 2010). In the UK, some

examples of institutions are: Leeds Metropolitan University, the University of Glamorgan, the University of Aberdeen, and the University of Westminster, just to mention few.

Likewise, cloud services have found its way in African institutions. Several institutions have started adopting various cloud services to reduce ICT investment costs as well as making teaching and learning more efficiently. For example, over 30 institutions across Africa have partnered with Google to use Google cloud services (Obi, 2012). The partnership includes grants, technical, consulting, and training. These institutions include University of Pretoria (South Africa), University of Ibadan (Nigeria), University of Mauritius (Mauritius), and University of Ghana (Ghana). In East Africa, for example, some of these institutions which have partnered with Google are: National University of Rwanda, the Kigali Institute for Education, the Kigali Institute for Science and Technology, and the University of Nairobi (Wanjiku, 2009). Other institutions include the United States International University, the Kenyan Methodist University, and the Makerere University Business School (MUBS). Interestingly, todate none of these institutions reported in the literature come from Tanzania. Clearly, intensive awareness is needed to HLIs in order to realize the benefits of cloud services in education.

4. ADVANTAGES OF CLOUDS FOR BLENDED LEARNING IN TANZANIA

4.1. Reduction of ICT investment cost

The cost of acquiring, managing, and maintaining ICT infrastructure has been a major factor that hinders HLIs to adopt BL in developing countries like Tanzania (Lwoga, 2012; Ssekakubo et al., 2011; Unwin et al., 2010). Institutions spend significant amount of resources to procure and maintain ICT infrastructure in order to deliver BL courses. However, hosting BL services into the cloud can reduce ICT investment cost associated computer servers needed to run BL courses. This cost reduction will be realized due to the fact that ICT infrastructure needed to run BL courses will no longer need to be procured by an individual institution; rather, they will be hosted in the cloud based servers. Furthermore, maintenance and support cost will be burdened to cloud service provider.

The cost reduction has been demonstrated by Florida Atlantic University which reduced IT costs by at least U.S. $600,000 by migrating Blackboard LMS into the cloud (Chandra & Borah, 2012). Likewise, the Wake Community College reduced by nearly 50 percent of Total Cost of Ownership (TCO) through migrating traditional ICT infrastructure into the cloud (Rindos et al., 2009). Clearly, similar benefits can be reaped if cloud computing is adopted in BL implementation in Tanzania.

4.2. Support and maintenance included

In order to implement BL courses, institutions have to invest resources to provide reliable support and maintain computer servers, associated accessories, and software. These include software upgrading, virus protection, and performance maintenance. In many institutions, this is done in-house by employed technical staff. However, institutions will be able to reduce support and

maintain costs by hosting BL services into the cloud (Chandra & Malaya, 2012; Khmelevsky & Voytenko, 2010). Additionally, the burden of hiring staff, and management of hardware with its accessories will be moved to cloud service provider. Similar benefits was demonstrated by the North Carolina State University which reduced the number of IT staff from 15 to 3 employees with full working schedule by migrating its computing services into the cloud (Chandra & Borah, 2012).

4.3. Accessibility and reliability of BL services

Unreliable power supply in developing countries is described as one of the main factor that hinders institutions to adopt and widen BL courses (Tedre et al., 2010; Unwin et al., 2010). In many parts of the country, electricity unpredictably switches on and off which affects servers that hosts BL services especially those hosted in-house. Nonetheless, cloud servers are available 24/7, and are not affected by any power outrage. In case of service breakdown due to some technical reasons, most of providers have dedicated telephone to support end-users all the time. For example, Google provides 24/7 telephone support for both education and premier packages (Alshuwaier et al., 2012; Herrick, 2009). According to Buyya et al. (2009), providers such as Amazon, Google, Salesforce, IBM, Microsoft, and Sun Microsystems have established new data centers in various locations around the world to provide redundancy and ensure reliability in case of site failures

4.4. Pay-per-use cost structure

Many HLIs running BL courses normally pay for computing services even if they are not using them. In most cases, companies charge flat rates per year regardless if services are used or not. In many education institutions, several IT services are required intensively only in a short period due to the structure of teaching semesters (Truong, Pham, Thoai, & Dustdar, 2012). Therefore, when students are on vacation, computing services are normally not used. Therefore, institutions incur unnecessary costs for services that are not using at all. With cloud computing, institutions will gain significant savings due to the fact that institutions will pay for only services they have used similar ways as already done for other utilities such water, electricity, and other related services (Buyya et al., 2009).

4.5. Increased storage space

For successful implementation of BL courses, students and instructors need to store and share learning resources through various media. Essentially, with increasing number students registering for BL courses, clearly, many institutions are struggling to provide enough and reliable storage space. This problem has been further amplified by emergence of multimedia learning resources such as video, audio, and animations which indeed require substantial amount of storage space. It is not uncommon for institutions in Tanzania to have some policies that limit users from storing certain amount of disk space. However, this problem can easily be weaved by migrating BL services into the cloud. Many companies provide massive storage space at a very low cost, or at zero cost for education institutions. For example, Google provides 15 gigabytes (GB) storage space per user for free (as of 2013) while Microsoft provides up to 25GB per user through Live@edu

package for education. This is significant amount of storage space that can easily be used to enhance BL delivery by HLIs in Tanzania.

4.6. Access to high performance computing facilities

Many institutions in Tanzania, like in many developing countries do not have high computing facilities for research and teaching especially for simulations, analysis of computation models, and similar research. Furthermore, students studying science courses such as computer science lack tools and environment to develop, test, and compile their programs and models. With existing financial limitations in many institutions in Tanzania, procuring high performance facilities is almost impossible. According to Truong et al. (2012), due to financial constraints, investment for research facilities is normally prioritized after teaching facilities.

However, the adoption of cloud services has the potential to alleviate this problem. For example, computer science students can use Google App Engine, Amazon Hadoop or similar PaaS to develop, test and implement their computer programming (Truong et al., 2012). Additionally, the emergence of Virtual Computing Lab (VCL) has enabled the high performance computational facilities for research and teaching possible. Many institutions such as North Carolina State University, and University of Pretoria are among of few institutions have been using VCL for research. For instance, University of Pretoria uses VCL from IBM to enable students access and use the next-generation medical research to test the development of drugs, which are expected to cure serious illnesses unique to Africa (Kshetri, 2010). Clearly, institutions in Tanzania can use these cloud services to research and high performance computations to embrace BL delivery.

4.7. The cloud is already here

Cloud computing is not a new concept in HLIs in Tanzania. Students, staff and other users are already using various cloud services for personal purposes. For example, majority of social networking applications such as Facebook, Twitter, YouTube, and Flickr are based on cloud platforms provided by leading public cloud providers such Google, and Amazon (Babar & Chauhan, 2011). Likewise, students and staff already use Google cloud services such as Gmail, GoogleDrive, YouTube, and related services from other providers. Therefore, migrating existing BL services into the cloud will not be something new to institution community. In fact, students and staff expect to gain same benefits in academic activities through these cloud services as they do in their day to day activities.

5. CLOUD ADOPTION STRATEGY FOR BLENDED LEARNING

To date, there are dozens of cloud providers in the market that offers numerous kinds of cloud services both commercial and non-commercial use. In this case, it is important for institutions to develop a strategy that will provide a smooth migration of BL services into the clouds. The developed strategy should take into account the real institutional needs and the overall institutional strategy (Mircea & Andreescu, 2011).

Mircea and Andreescu (2011) suggested five stages for migrating strategy towards cloud as indicated in Figure 2. The stages are:

a. **Developing the knowledge base** about cloud computing through attending seminars, workshops as well as conducting discussions with the suppliers and consulting the most recent researches in the field.
b. **Evaluating the present stage of the institution** from the point of view of the IT needs, structure and usage. This stage will help the institution to understand which data, services, processes and applications that may be migrated or need to be maintained within the institution.
c. **Experimenting the cloud computing solutions** which can be done gradually as pilot test projects, and thereafter scaling it to all users in the institution.
d. **Choosing the cloud computing solution**. At this stage, institutions are required to conduct thorough evaluation to compare cloud service providers' capabilities, licensing mechanisms, and pricing models in order to make sustainable choices. The choice will also depend on cloud deployment options.
e. **Implementation and management** of the cloud computing solution.

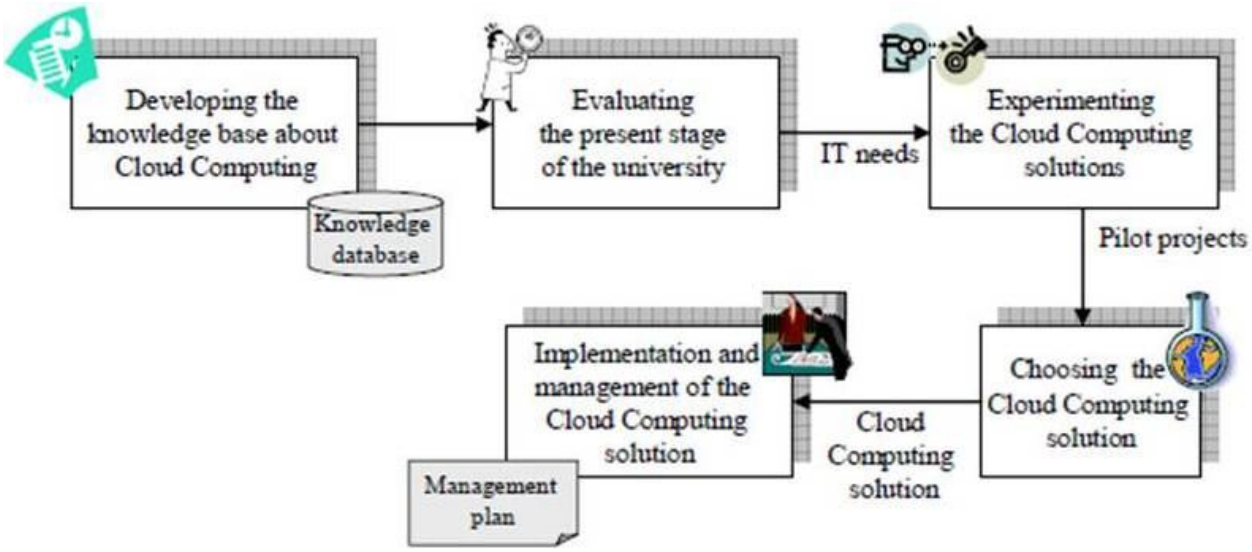


Figure 2: Cloud Strategy in Higher Education *Source: Adopted from (Mircea & Andreescu, 2011)*

6. PROPOSED CLOUD DEPLOYMENT OPTIONS FOR BLENDED LEARNING IN HIGHER EDUCATION IN TANZANIA

In this sub-section, two deployment options for BL services are proposed: for small or new institution, and for established institution. The choice of which option to adopt, will obviously depend on a well-developed cloud adoption strategy. Additionally, it will also vary from institution to institution depending on cost constraints, security and privacy requirements, number of users, competence of internal IT staff, and institutional policies.

6.1. Option 1: Small or new institutions

Many small or new institutions normally do not have competent and dedicated in-house servers and/or staff to support their BL courses. Moreover, these institutions have limited budgets to run most of teaching and research activities. However, these institutions can still engage in BL delivery without necessarily investing on ICT infrastructures by adopting *public cloud*. With the public cloud, all ICT infrastructures such as mail servers, LMSs servers, and related network accessories will be hosted into the cloud providers. Similarly, software application that support BL delivery such as LMS, digital library, course content development tools, and multimedia tools will be accessed directly from cloud provider's servers via internet.

There are numerous companies that provide public cloud services. These companies include Microsoft, Google, IBM, Amazon, Salesforce.com, HP Cloud Computing, Amanda, and Zamanda and many others. The selection of the provider will depend on proposed evaluation criteria as well as institutional cloud adoption strategy. However, as pointed earlier, due to financial constraints, institutions may opt to partner with providers that offer free cloud services or at a discount and complement with commercial services.

Figure 3 shows a proposed public cloud set-up that can be adopted by HLIs to deliver BL courses. As shown in Figure 3, students, instructors, and other stakeholders will be accessing these resources via the internet. The main challenge of public model, is security and privacy concerns on confidential and valuable data such as research results, students' and employees' records, and financial data (Mircea & Andreescu, 2011; Mokhtar et al., 2013). However, institutions can migrate low risk BL services such as learning resources, timetable, emails and other learning activities, until they have developed enough capacity to deal with security issues.

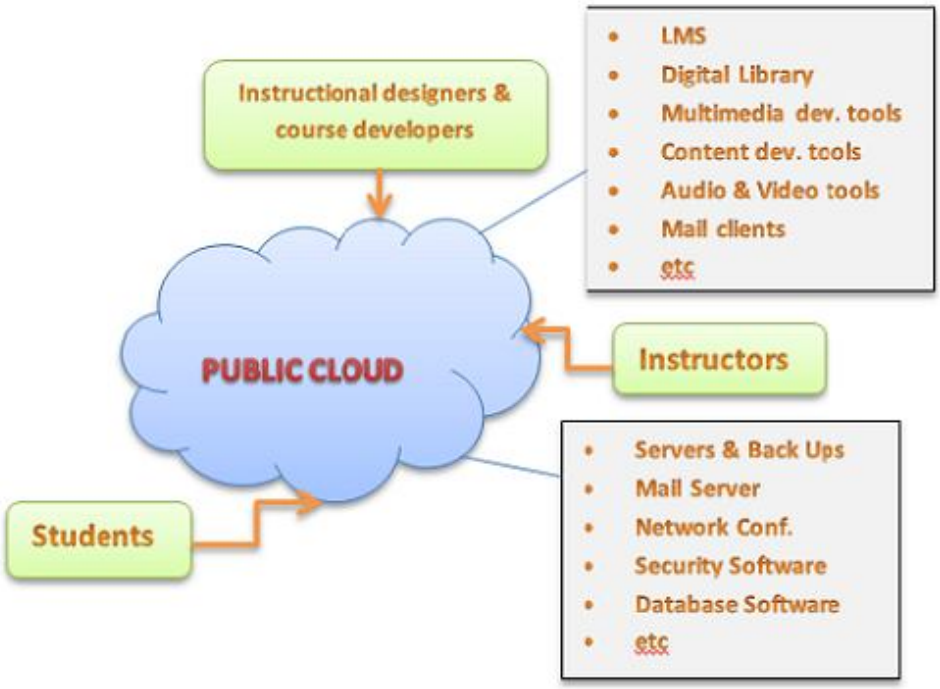


Figure 3: Proposed Public cloud option for BL delivery

6.2. Option 2: Established Institutions

The second deployment option is proposed for institutions which have already invested their own ICT infrastructures over the years, and have enough technical staff to manage such infrastructure. In addition to hosting BL services, they have procured a number of servers to host other information systems. These systems include Student Records Management Systems (SRMSs), Financial Information Systems (FISs), and Library Information Systems (LIBISs) (Lwoga, 2012; Mtebe et al., 2011; Munguatosha et al., 2011). Therefore, these institutions are recommended to combine the best of private and public cloud to create a *hybrid cloud* computing environment.

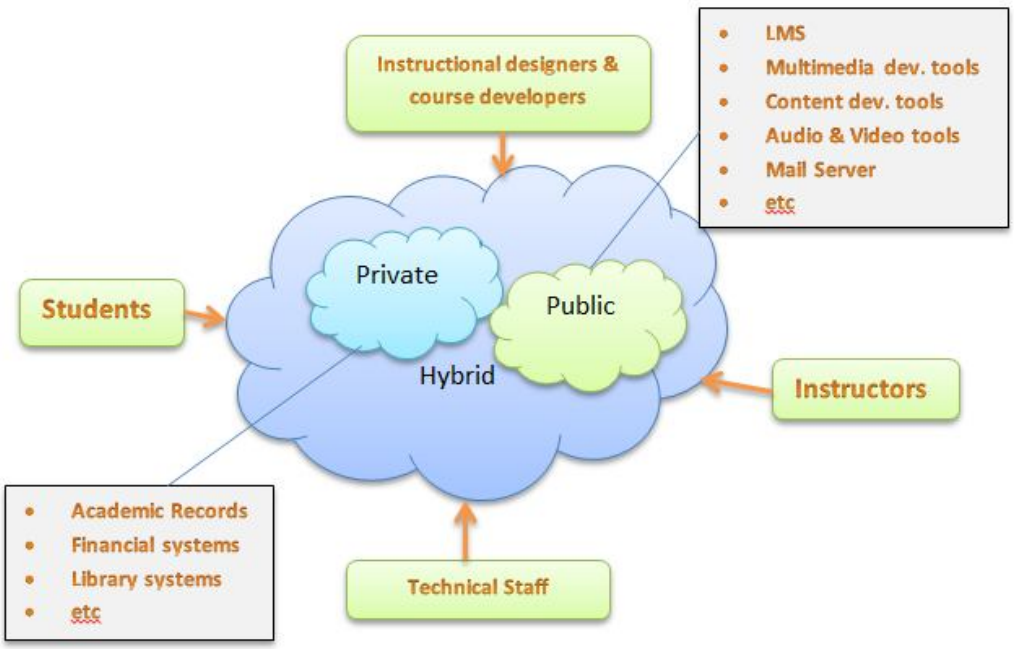
The private cloud will consist of high sensitive data such as students' academic records, financial systems, faculty records, medical records, and similar systems. By hosting these services into the

private cloud, institutions will be able to provide better control, security, and privacy protection of sensitive data. The cost of hosting into the cloud is far cheaper than in-house hosting. For example, the server with memory (RAM):15GB, 4 virtual cores, Outgoing bandwidth: 30, Hard drive: a least 800GB hosted by Google (https://cloud.google.com/pricing/compute-engine) is charged at US$ 381.6 per month, while Amazon through Elastic Compute Cloud (EC2) (http://aws.amazon.com/ec2/#pricing) charges at US$ 345.60 per month. These prices are based on monthly estimates of 730 hours (hours for the whole month) of service. However, all vendors have flexibility of paying for services you use, clearly, the prices will go down.

On other hand, low risk BL services as well as teaching activities which are only needed for a short time can be hosted in the public cloud (Truong et al., 2012). These BL services include LMSs, multimedia development tools, mail services, student projects, websites for faculty, news and announcements and non-sensitive research activities, and similar services. The main advantage of adopting public cloud is that, normally new technologies from developed countries are quickly available in public clouds so students can access these technologies instantly (Truong et al., 2012). Additionally, institutions may opt to partner with cloud providers that offer free services for education such Google and Microsoft.

Figure 4 shows how BL services can be shared between private and public to create a hybrid cloud. Just like in the public cloud, students, instructors and other users will access BL services via internet. This option requires institution to create a very good plan and strategies that differentiates services to be hosted in the public cloud and in private cloud.

Figure 4: Proposed Hybrid cloud option for BL delivery



7. CHALLENGES FOR ADOPTING CLOUD COMPUTING IN BLENDED LEARNING

Just like for many new innovations, the adoption of cloud computing in BL faces some challenges that need to be addressed. One of the major challenges for adopting cloud services for BL delivery is limited bandwidth in many parts of the country. Cloud computing is internet based services, obviously, if the bandwidth is insufficient it will be very difficult to deliver educational services (Laisheng & Zhengxia, 2011). However, internet access and speeds in Tanzania just like in many developing countries is improving very fast. This is due to several broadband submarine cable systems initiatives such as SEACOM cable which has been implemented in the country. These initiatives and many others demonstrate that bandwidth problems in Tanzania will no longer a problem in very near future.

Another challenge of adopting cloud services in BL is lack of control of an organization‘s assets. Normally, institutions do not feel to own and control ICT infrastructure once they are hosted into the cloud. This is because cloud infrastructure is usually not physically located in institutional premises (Mujinga & Chipangura, 2011). Managers always feel comfortable when they see physical servers hosted in their premises.

Moreover, ICT policies in many institutions in Tanzania were developed without taking into account the complexity of cloud computing. In additional of developing cloud adoption strategy, institutions will have to review their policies and rules to accommodate cloud services in BL delivery.

Finally, cloud computing is a new form of technology, clearly, many institutions in Tanzania like in many developing countries lack cloud computing experts for both technology and regulatory compliance (laws, data compliance, tax & payment, etc.). There is a need for HLIs in Tanzania to invest in capacity building especially on long term and short term training in various aspects of cloud computing.

8. CONCLUSION

Just like many ICT innovations, cloud computing can potentially improve the quality, and widen access of education. Therefore, it is becoming increasingly difficult to ignore the role of cloud services to facilitate the adoption of BL in Tanzania. This call is timely as many institutions from neighboring countries have been using cloud services in education. Therefore, there is a danger for institutions in Tanzania to be left behind in educational competitive advantage. This study is the first step towards providing information to help institutions in Tanzania to make full utilization of cloud services in BL delivery.

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