

Cloud computing adoption in Higher Education Institutions of Malawi: An exploratory study

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Abstract

This paper analysed adoption of cloud computing in Higher Education Institutions (HEIs) in the context of a developing country. The study explored how context of HEIs in dimensions of technology, organisation and environmental may affect adoption of cloud computing. Technology, Organisation and Environment (TOE) was used as a theoretical lens in the study. Qualitative and quantitative data was used to analyse two cases of public HEIs in Malawi. The results showed that cloud computing could mitigate some of the challenges of HEIs. There were concerns of top management support, potential security risks and inadequate legal frameworks that may affect HEIs when adopting cloud computing. The HEIs were in the early stages for adopting cloud computing. The insights from the study highlight the opportunities and challenges that can inform managers when adopting cloud computing in HEIs.

Keywords: Cloud computing; Higher Education Institutions; Technology Organisation Environment, Malawi

IJCIR Reference Format:

Makoza, F. (2016). Cloud computing adoption in Higher Education Institutions of Malawi: An exploratory study. *Journal of Computing and ICT Research*, 9, Issue.2 pp 37- 54. <http://ijcir.mak.ac.ug/volume9-issue2/article4.pdf>

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© International Journal of Computing and ICT Research 2008.

International Journal of Computing and ICT Research, ISSN 1818-1139 (Print), ISSN 1996-1065 (Online), Vol.9, Issue 2, pp. 36-53, December 2015.

1. INTRODUCTION

Higher Education Institutions (HEIs) are public or private organisations that provide programmes to individuals who have completed high school or secondary school and their programmes may include undergraduate and postgraduate courses; and training courses for skills development (Dunga, 2013; Hall & Thomas, 2005). HEIs focus on teaching, learning and research. The HEIs have gained prominence in government development agendas because of their roles in supporting culture and socio-economic development (Cross & Adam, 2007; Sarkar, 2012). In addition, HEIs are supporting employment readiness and creation, business development and innovation, global competitiveness and research which inform public policies and government decisions (Ercan, 2010; Sultan, 2010; Tashkandi & Al-Jabri, 2015). Consequently, the roles of HEIs have been aligned with government policies and programmes of developing countries (Kamei, 2015; Sarkar, 2012).

Despite their crucial roles in supporting culture and socio-economic development, HEIs in developing countries operate under resource constrained environments that hinder effective delivery of their services (Gombachika & Kanjo, 2008; Mathew, 2012; Sarkar, 2012). Some of the challenges are lack of space to meet the high demand of higher education, limited teaching materials and resources such as books, journals and libraries, high administrative costs and difficulties in managing large population of learners against small number of high calibre teachers (Gital & Zambuk, 2011; Kanjo, 2008). At the same time, there is growing interest to invest ICTs in HEIs and to improve the delivery of services (Britto, 2012; Kamei, 2015; Sarkar, 2012). Cloud computing has emerged as a technology that can remedy some of the challenges in HEIs in developing countries (Kihara & Gichoya, 2014; Sultan, 2010). Hence, it is important to understand how prepared are the HEIs in developing countries to adopt cloud computing.

There is a growing body of literature on cloud computing and the studies have focused on security requirements, future expectations and business models (Buyya, Yeo, Venugopa, Broberg & Brandic, 2009; Grossman et al., 2009; Misra & Mondal, 2010). Technology, organisation and environment factors for cloud computing have also been explored (Mircea & Andreescu, 2011; Tashkandi & Al-Jabri, 2015). However, the study supports the claim that adoption of cloud computing varies according to contexts (Low, Chen & Wu, 2011). This implies that adoption in developed world (Europe, USA and Canada), where most of the studies on cloud computing have been conducted, may be different from developing countries. The context of developing countries has its own challenges that are different from developed countries. Hence, there is a need to explore the adoption of cloud computing in the context of developing countries (Kshetri, 2011). This study aims to contribute towards literature on cloud computing adoption studies in the context of developing countries.

The study was guided by the research question: How do the context of HEIs in dimensions of technology, organisation and environment affect adoption of cloud computing? To answer this question, the study used technology, organisation and environment (TOE) framework as a theoretical lens to understand the context of HEIs in adoption of cloud computing (Low, Chen & Wu, 2011). TOE was considered appropriate because it can support a wider scope of understanding technology adoption and include organisational features and its external environment (Ghezzi, Rangone & Balocco, 2013). The case of Malawi was analysed because it represented a low-income economy in Africa (UNDP, 2014). The higher education subsector of the country is underdeveloped partly due to more focus on primary and secondary education. The government has revised the Education strategic plan to promote HEIs (Dunga, 2013). This presents an opportune time to assess preparedness of HEIs in adoption of information technologies.

The rest of the document is structured as follows. Section 2 presents the background to the study. Section 3 summarises the theoretical background to the study. Section 4 outlines the research methodology. Section 5 presents the results of data analysis. Section 6 discusses the results and conclusions from the study.

2. BACKGRROUND TO THE STUDY

2.1. Defining cloud computing

Cloud computing is a style of computing in which massive scalable IT-related capabilities that are provided as a service to external structures using internet technologies (Ercan, 2010). Cloud computing as a technology is premised on the convergence of virtualisation, utility computing and software services which can be accessed via the Internet. The technology has led organisations to reconsider new ways of using IT resources in supporting their business processes. Organisations have the opportunity to utilise external providers and on-demand services using highly scalable infrastructure which is accessible over the Internet. In addition, the on-demand services can be accessed through shared computing resources such as networks, servers, storage, applications and services (Ercan, 2010; Khmelevsky & Voytenko, 2010). Cloud computing services can be categorised into Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) (Low, Chen & Wu, 2011). Table 1 summarises the description of cloud computing services.

Table 1: Summary of cloud computing services

Service	Description	Examples
SaaS	Software applications are provided by the applications service providers as rental over the Internet. Organisations may save on ICT infrastructure investment	Salesforce.com CRM Google Apps Oracle Siebel Microsoft BPOS
PaaS	Virtual platform provides computing, database and storage functions over the Internet	Google App Engine Microsoft Azure
IaaS	Organisations outsource IT infrastructure used for operations such as storage, hardware, servers, network components to a provider rather than running or maintaining the services in house	Amazon.com AWS SunNetwork.com IBM Blue Cloud Verizon CaaS

As summarised in Table 1, HEIs have options to select cloud computing services which meet their needs. Different from older models of computing, cloud computing meets the requirements such as elasticity, multi-tenancy, economics, abstraction, scalability and broad network access (Arasaratnam, 2011). HEIs have the opportunity to adopt different types of data and information cloud that suits their requirements.

There are four types of deployment models of cloud computing: public, private, community and hybrid. In public cloud deployment, the IT services are hosted outside the organisation or IT department. In a private cloud, the IT services are deployed within the organisation but individual business units pay the IT department for using standardised services in line with change back mechanisms of the organisation. Community cloud model supports sharing of infrastructure among many organisations utilising the

networked IT resources and each organisation has specific shared goals and missions. Hybrid cloud consists of infrastructure which has two or more cloud e.g. public, private and community cloud (Arasaratnam, 2011; Mathew, 2012).

2.2. Potential benefits and limitations of cloud computing

Services for cloud computing may be suitable for HEIs and these may include cloud hosting, data storage, infrastructure and software services. HEIs may use virtual services hosted in a cloud e.g. email, contact list, calendars, file storage, sharing of documents and creating websites (Ercan, 2010; Mathew, 2012). The benefits of adopting cloud computing in context of HEIs are better access to infrastructure and content (24 hours and 7 days a week), pay as you go option for services, minimal cost on maintenance and upgrades, freeing up internal resources, improved reliability and flexibility (Low, Chen & Wu, 2011; Khmelevsky & Voytenko, 2010).

There are also limitations of cloud computing and these include potential loss of control for IT services to the organisation, security challenges over data and applications, legal issues regarding jurisdiction of contract if services are located outside the country, issues of service level agreements, speed and internet infrastructure can also affect the services, organisational support and some applications may not run on cloud infrastructure and issues of intellectual property rights (Ercan, 2010; Low, Chen & Wu, 2011; Mathew, 2012).

2.3. Cloud computing in HEIs of developing countries

Developing countries are described as economies with constraints in resources and lacking basic infrastructure such as roads networks, electricity, access to clean water, schools, health facilities and have high levels unemployment (Malapile & Keengwe, 2014). Cloud computing may be perceived as an antidote to some of the problems of the HEIs in developing countries. There is a growing body of literature that shows that HEIs in the context of African countries have started adopting cloud computing. For instance, National University of Rwanda and Kigali Institute of Education in Rwanda, University of Nairobi and Kenyan Methodist University in Kenya and University of Mauritius (Kihara & Gichoya, 2014; Sultan, 2010). Similarly, Mero and Mwangoka (2014) noted the advantages and challenges of cloud computing in HEIs in Tanzania. A study conducted in South Africa highlight issues of security in the adoption of cloud computing in HEIs (van der Schyff & Krauss, 2014). Some of the cloud computing services that have been adopted in HEIs are Google Cloud services which include Gmail, Google Talk, Calendar, Google Docs and Google spreadsheets. The services are reducing IT costs and improving services in the organisations. Despite growing number of HEIs adopting cloud computing in developing countries, there is still need to understand contextual issues which may vary from country to country (Low, Chen & Wu, 2011; Kshetri, 2011). The following section summarises the context of the study.

2.4. HEIs in context of Malawi

Higher Education Institutions (HEIs) in Malawi comprise of Universities, tertiary institutions and private institutions (Gombachika & Kanjo, 2008; Hall & Thomas, 2005). This study focused on universities as most of these use ICTs. The HEIs offer different programmes and some programmes require use of ICTs. The public universities are funded by government and also rely on funding from external sources e.g. private sector organisations and international development agencies. Private universities are financed independently from the government. Table 2 summarises the list of universities and areas of focus.

Table 2: Summary of universities in Malawi

Type	Name of University	Year established	Academic focus
Public	University of Malawi	1965	
	• Chancellor College	1965	Pure & social science
	• Malawi Polytechnic	1965	Applied science
	• Kamuzu College of Nursing	1979	Nursing
	• College of Medicine	1992	Medicine
	Bunda College of Agriculture/Lilongwe University of Agriculture & Natural Resources	1965/2011	Agriculture & natural resources
	Mzuzu University	1998	Education
	Malawi University of Science and Technology	2012	Applied science
Private	African Bible College	1988	Biblical studies
	Share world University	2001	Management
	Livingstonia University	2003	Education
	Catholic University	2005	Social science
	Blantyre International University	2008	Management
	Exploits University	2010	Management
	Adventist University	2011	Management
	Skyway University	2012	Management

As illustrated in Table 2, the old universities in Malawi are public funded and form part of HEIs. The public universities focuses on diverse academic programmes which include pure and applied sciences. These programmes require advanced technologies for teaching and research. Hence, the public universities require more resources to investment in science programs. There has been an increase in private universities in the last 15 years. The private universities focuses on disciplines that do not require high investment in technologies. This partly explains the reasons why the country faces challenges of human capacity in science and technology disciplines because there are few private universities that are offering science programs (Dunga, 2013; Nampota, Thompson & Wikeley, 2009).

2.5. Challenges for HEIs in Malawi

HEIs in Malawi, like other HEIs in low-income status economies, are confronted with challenges resulting in poor quality of teaching, learning and limited research output. Some of the problems related to ICTs are inadequate bandwidth, lack of hardware and software resources, lack of IT strategies within the institutions, limited awareness of ICTs and skills among the members of the staff in the organisations (Gombachika & Kanjo, 2008). There are also socio-economic challenges in Malawi which indirectly affect the adoption and use of ICTs in HEIs. These are the poor economic performance which affects foreign direct investment,

weak internal management of systems and inappropriate governing structures within the institutions. Another challenge is the lack of power supply in rural areas, unreliable power supply (frequent blackouts) and vandalism of ICT infrastructure which affects operations of ICT services providers and users (Gombachika & Kanjo, 2008; Kanjo, 2008).

Despite these challenges, the government of Malawi has interest to promoting the use of ICTs in HEIs (Dunga, 2013). The government through Ministry of Education, Science and Technology has developed the Higher education sector strategic plan (2008 to 2017) to develop HEIs in the country. The strategic plan outline addresses issues of technology in HEIs. The expectations of government is that ICT investments in the economic sectors including education may transform the country to become a knowledge and information based economy. The commitment of Government to promote ICTs in education is demonstrated in national ICT policy declarations. The policy advocates development of human capital and support use ICTs in education:

“ICT shall be integrated in education system at all levels in order: to improve both access to and the quality of education, improve management of education system and improve ICT literacy” (National ICT policy, 2009:10)

This implies that there is political will and commitment from government to promote the application and use of ICTs in education. The policy also supports the creation an environment that supports the application and use of ICTs in the economic sectors including education, telecommunications, finance and transport. Hence, national ICT policy may affect the development of external environment for the HEIs. The external environment of an organisation is important in adoption of new technologies (D’Costa-Alphonso & Lane, 2010).

3. THEORETICAL BACKGROUND TO THE STUDY

Technology adoption and diffusion studies can be categorised into technology and social shaping characteristics (Corrales & Westhoff, 2006). Technology Organisational Environment (TOE) emerged as a framework that addresses the limitations of explaining adoption and diffusion of innovation theories for technologies in organisations (Hsu, Kraemer & Dunkle, 2006; Low, Chen & Wu, 2011). TOE was developed to analyse IT adoption in organisations focusing technological, organisational and environmental contexts (Tornatzky & Fleischer, 1990). The three constructs are summarised subsequent subsections.

3.1. Technological context

Technological context is a combination of internal and external factors that affects an organisation in adopting new technologies (Hsu, Kraemer & Dunkle, 2006). The technological context also relates to the readiness of an organisation to adopt IT infrastructure in three perspectives: IT Technical infrastructure, IT human capability and IT managerial capability (Molla, Cooper & Pittayachawan, 2011). IT technical infrastructure includes networks, systems and applications that support cloud computing. It is crucial to consider the existing ICT infrastructure when adopting new technologies. Competent IT human resources are vital for implementation and supporting of cloud computing (Wang, Fu & Duan, 2011). In addition, relative advantages may influence the adoption of new technologies. In this context, relative advantages are the perceived benefits that may be derived from the adoption of technology e.g. cloud computing in HEIs (Sultan, 2010). In some cases, organisations may not be able to adopt and implement new technologies due to the complexity of technology. This may be attributed to lack of confidence in using the new technologies (Buyya et al., 2009).

3.2. Organisation context

Organisational context are factors regarding the organisation in terms of size, scope, formalisation, centralisation, management structure and skills for personnel (Low, Chen & Wu, 2011; Tornatzky & Fleischer, 1990). Top management is crucial in supporting the adoption of new technologies and providing

vision and commitment (Wang, Fu & Duan, 2011). Management is also responsible for approval of the investment in new technologies and ensures that other resources are available in using the new technologies. The size of the organisation may also have an influence on the adoption of new technologies. For instance, large organisations are flexible and able to take risks in adopting new technologies (Pan & Jang, 2008). Human resources with competent skills to implement and use new technologies are vital for the success of new technologies in an organisation.

3.3. Environmental context

Environmental context concentrates on the context of the organisation in relation to industry, its competitors and government policy and vision (Low, Chen & Wu, 2011). Technology often changes resulting in organisations to adopt new technologies to remain competitive. Competition with rival organisations may also lead to an organisation to consider adoption of new technologies. For instance, adoption of cloud computing offers the opportunity for the organisation to understand its environment (Misra & Mondal, 2010). Organisations that rely on other firms may also consider the need to adopt new technologies as a way for dealing with pressure from the partner firms (Chong & Ooi, 2008).

TOE framework (Low, Chen & Wu, 2011) can be used to examine adoption of cloud computing in HEIs in the context of developing countries. The framework has constructs that may explain context issues that may affect adoption of cloud computing in HEIs. However, the framework does not address the issues related to the role of government and regulations. The government is vital in supporting the introduction of new technologies and ensuring that regulations are put in place to protect the consumers and organisations (D’Costa-Alphonso & Lane, 2010).

Table 3: Summary of TOE framework (D’Costa-Alphonso & Lane, 2010)

Context		
Technology	Organisational	Environment
• Relative advantage	• Management support	• Competition
• Complexity	• Organisation size	• Pressure from partners
• Compatibility	• Technology readiness	• Regulatory compliance

As summarised in Table 3, the role of government and regulations under regulatory compliance is suggested in the framework. Governments in developing countries may lead in attracting direct foreign investment of ICT infrastructure. In addition, the government may facilitate the enactment of laws that support the implementation of new technologies and protect the interests of organisations and consumers (Gholami, Lee, & Heshmati, 2006).

3.4. Levels of technology adoption

Cloud computing, like any another technological innovation, undergoes through a set of stages for maturity (Rogers, 1995). The diffusion of innovation curve may be used to explain the maturity level of cloud computing over a period of time in organisations. The diffusion of innovation curve has five stages namely: innovators, early adopters, early majority, late majority and laggards (Moore & Benbasat, 1991; Rogers, 1995). These are summarised as follows:

- **Innovators:** organisations or people who are interested in the technology and have positive attitude towards the new technology
- **Early adopters:** organisations or people with interest in the new technology and are willing to take risks in adopting the new technology
- **Early majority:** majority of organisations and people who are pragmatists and focus on the process model for the new technology

- **Late majority:** organisations or people with more or less sceptical on the new technology and have negative attitudes towards the new technology
- **Laggards:** organisations or people with extreme negative attitudes towards the new technology and often do not think of adopting the new technology like the mainstream.

It is necessary to note that the different levels of adoption for cloud computing in the context of HEIs. The adoption levels are not the same especially in the context of developing countries where cloud computing is relatively new (Sultan, 2010). Understanding of the maturity level may also support top management and IT managers to select appropriate services of cloud computing in the HEIs. IT Managers may understand the innovation phases in which the new technology will take and plan for change management.

4. RESEARCH METHODOLOGY

4.1. Research approach

The study was exploratory in nature with the aim of gaining an understanding of context of HEIs in adoption of cloud computing. Cloud computing was a relatively new in the context of HEIs in Malawi. The study employed case study “to generate an in-depth, multi-faced understanding of complex issues in its real-life context” (Crowe et al., 2011). Case study approach was appropriate because it supported understanding of cloud computing adoption in context of HEIs through the meaning that participants assigned to technical, organisation and environment factors (Walsham, 1995). Two HEIs were analysed to compare their settings in preparedness of adopting cloud computing. Common and contrasting patterns in data related to technology, organisation and environment were highlighted (Baxter & Jack, 2008).

4.2. Data collection and analysis

Case study approach supported multiple data collection of secondary data. Qualitative and partly quantitative data was collected for the study (Yin, 2003). Open-ended questionnaires were used to collect data on the factors that may influence adoption of cloud computing. Purposeful sampling was used to select the respondents for the study. The 15 HEIs (recall Table 2) were requested to participate in the study and only two were willing to participate in the study. The IT Managers from the two HEIs responded to the open-ended questionnaires to elicit their views on adoption of cloud computing in their organisations. The author also corresponded with the participants via email as a follow for the questionnaires. In addition, reports on the ICT context for the country were sourced from websites from international development organisations and policy documents from the two organisations were used. The multiple sources of data were used due to the limited number of respondents to the study and to supplement the data for the study (Palinkas et al., 2013; Sandelowski, 1995). Table 4 summarises the documents that were used in the study.

Table 4: Summary of documents analysed in the study

Document	Description	ID
Malawi National ICT policy (2009)	Government of Malawi vision and mission on ICT development and Education	DOC-1
E-Readiness Index Report (2014)	Details on indicators for assessing how the country is ready to adopt and use ICTs	DOC-2
HEI Reforms Report (1995)	Historical background of the public universities	DOC-3
HEI Strategic Plan 2012-2017 (2012)	Development plans of public funded universities	DOC-4

Data from the open-ended questionnaires and reports was analysed using thematic analysis (Braun & Clarke, 2006). The two sets of data of data were compared to validate the opinions presented the open-ended questionnaires. The following steps were used in the analysis of the qualitative data:

- **Familiarisation with data:** reading and re-reading of data to note the ideas
- **Generating initial codes:** reading and noting interesting features of the data as codes
- **Searching for themes:** collating themes in the data that is relevant to each code
- **Reviewing themes:** checking themes if they correspond to categories
- **Defining and naming themes:** refining themes to come up with a story line
- **Producing a report:** writing the report and highlighting extracts from the data to answer the research questions and objectives

The process was iterative and data qualitative software (Atlas.ti version 7) was used to manage the data. Member checking was applied to validate the results. An experienced researcher checked the summary of the results of data analysis.

4.3. Profile of the cases

The study compared to two cases of HEIs and are represented as HEI-1 and HEI-2. At the time of the study, HEI-1 had a population between 2,500 to 3,000 IT users while HEI-2 had 2,000 to 25000 IT users. Both institutions have IT Departments responsible for IT services for the organisations. The responsibilities for the departments include maintaining hardware and software, supporting IT services users: academic staff, learners and administrative staff. The IT Department for HEI-2 also provides services in computer training, website development and hosting and enterprise systems development to organisations outside the organisation.

5. SUMMARY OF RESULTS

This section presents the finding of the data analysis. The results are presented beginning with results of technological context, followed by organisation context and environmental context of cloud adoption.

5.1. Technological context

The level of technology development of a country relates to technology adoption in HEIs. The participants indicated their opinions on the technological development of the country as an environment in which their institutions were operating. The focus was on adoption of cloud computing in their organisations. This was assessed based on a Likert scale of 1 to 7 (See Figure 1). The respondents were also asked to elaborate on their choices. Respondent of HEI-1 selected preferences that indicated the country had strength in areas of internet connectivity, IT labour market, political stability and services of network providers.

As illustrated in Figure 1, laws and government policies were perceived as average, and participation in e-Government was considered low. Respondent of HEI-2 chose the preferences that highlighted average IT labour market and participation in laws and government policies were perceived average. Political stability was neutral while participation in e-Government was perceived to be average. There were differences in perceptions on Internet connectivity and services for network providers were low.

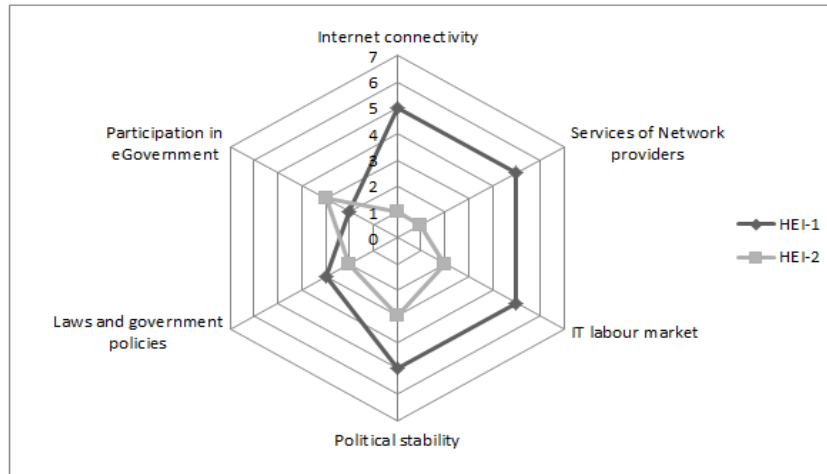


Figure 1: Summary perception on environment for cloud computing

The results from the two HEIs showed considerable variations. The results were compared with the e-Readiness index rankings (See Figure 2). The score for laws and government policies were similar with the value for the political and regulatory environment.

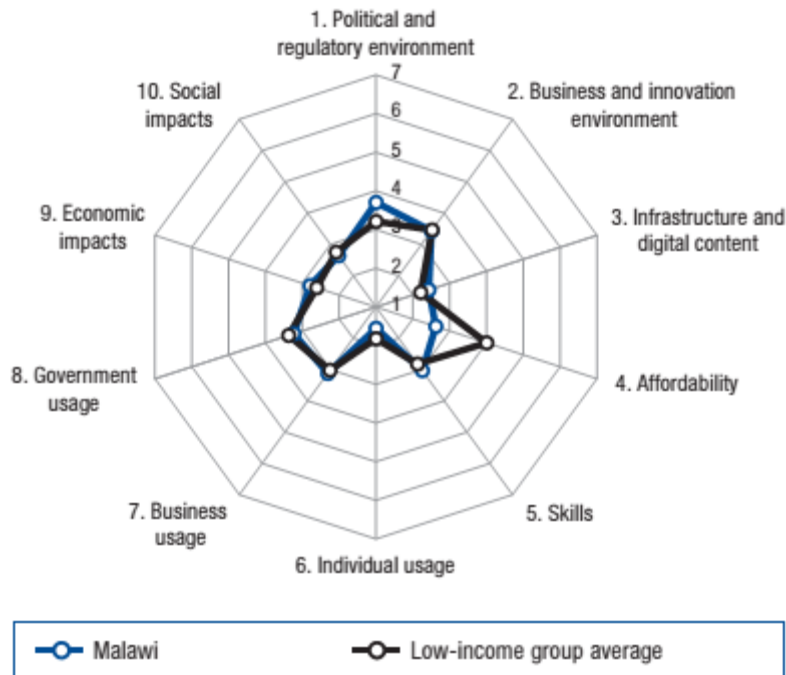


Figure 2: e-Readiness Index score for Malawi (Global IT Report, 2014)

Although the results for the e-Readiness index may reflect the results the country as a whole, they may highlight to some extent the environment in which HEIs operate in relation to cloud computing adoption. Other areas that were relevant to cloud computing adoption in e-Readiness index are business and innovation environment, skills, business usage of IT and economic impact which were relatedly low as compared to the average of other low-income countries.

5.1.1. Approach to cloud computing

The three modes of cloud computing can be applied to HEIs depending on the needs of the institutions. The respondents chose the approach of cloud computing which they perceived to be suitable for their organisation. The Respondent of HEI-1 indicated that PaaS was suitable for the organisation. In following up the reasons for the selecting PaaS, the respondent highlighted that the option of PaaS had advantages for effective management of hardware and software:

“As IT platforms are always changing this would be automatic for us. We will not struggle to procure machines and software to suit the new environment” (HEI-RESP-1).

As indicated in the statement, the respondent perceived using PaaS approach the organisation may save on acquiring new hardware and software when there are changes to the organisation’s IT services. This was consistent with the challenges of the cost for acquiring ICT highlighted in the plans for the public funded HEIs: *“Expensive ICT equipment and support services”* (DOC-4). This implies that cost was one of the factors that may be considered when adopting new technologies. The respondent of HEI-2 selected IaaS as suitable for their organisation and the main reason for selecting this approach was easy management of services: *“(…) it would be so much easier if the whole infrastructure is offered as a cloud service”* (HEI-RESP-2). Table 5 summarises the approaches to cloud computing for the two organisations.

Table 5: Summary of preferred approaches to Cloud computing for HEI

Approach to Cloud computing	HEI-1	HEI-2
Software as service (SaaS)		
Infrastructure as a service (IaaS)		✓
Platform as a service (PaaS)	✓	

It was perceived that Platform as a service was suitable for HEI-1 while Infrastructure as a service was appropriate for HEI-2. The differences in the preferences of the approaches may be attributed to the IT services needs for the organisations. The approaches to cloud computing also determine the type of IT services that could be deployed in the organisations. IT services for storage, networks and hardware are related to the approaches for cloud computing and could be acquired on demand. From the responses, it was clear that the approaches to cloud computing may depend on the benefits that HEIs may derive from the services in each approach.

5.1.2. Models for cloud computing

Cloud computing can be deployed using private, public, community and hybrid cloud models. The respondents selected the type of deployment model of cloud computing which could be suitable for their organisations. The respondent of HEI-1 indicated that hybrid approach was more suitable for the organisation because *“it should also give me a chance to do my own things while getting along with others”* (HEI-RESP-1). Similarly, the respondent of HEI-2 selected hybrid approach in the deployment of cloud computing for the organisation: *“no harm in having a private cloud and public cloud for various functions”* (HEI-RESP-2). The hybrid model was perceived to provide flexibility in combining the features for private and public cloud.

5.2. Organisational context

Management plays an important role in the adoption of new technologies in an organisation. The respondents were asked to describe the perceptions of top management support in the adoption of cloud computing. The respondent of HEI-1 stated that there was limited support for adoption of cloud computing and that it may fail as noted in the following statement: *“very little support with an expectation that it will fail and they will prove a point it’s not worth it”* (HEI-RESP-1). This implied that management in the organisations were not ready to support adoption of cloud computing. Some of the reasons for the may be issues of awareness of cloud computing as noted by the IT manager for HEI-2 in the following statement: *“not many know about cloud computing”* (HEI-RESP-1). This was consistent with the challenges outlined in the strategic plans for public funded universities (See Table 6). This may mean that top management supporting is crucial in adoption of new technologies in HEIs.

Table 6: Summary of Themes for organisational challenges

Challenges for ICTs	Sub-theme	Examples of statements
Human capacity	IT skills of users	<i>“Limited IT skills among some staff members and students”</i> (DOC-4)
		<i>“Under developed research and development capacity in ICT”</i> (DOC-1)
Management	Priority on ICT	<i>“Lack of prioritization in equipping colleges with ICT technologies”</i> (DOC-4)
		<i>“Prioritise ICT technologies at colleges level”</i> (DOC-4)

In attempting to overcome the challenges for awareness, it emerged that there was need for advocating cloud computing within the organisations: *“We still need to advocate it and let people know what cloud computing is. Once that is done and are oriented they will reap the fruits”* (HEI-RESP-1). This meant those with knowledge on new technologies could share their knowledge with those in management e.g. IT managers orienting management on new technologies.

Another important factor in the adoption of new technologies in the organisation is skilled staff to implement and support the new technologies. It was noted that the available skills were low to medium in the context of HEI-2 which confirmed the need for IT skills development outlined in the strategic plan of public HEIs: *“Regularly train staff and students in ICT usage in various software applications”* (DOC-4). It was highlighted that HEI-1 had already adopted cloud computing and had some skills in cloud computing. There were differences in IT skills on cloud computing in the organisations and it was necessary to consider the IT skills when adopting cloud computing.

The size of the organisations can affect the adoption of cloud computing. The two organisations were ideal to adopt cloud computing because they had a large number of users for IT services. For instance, the population of IT users in HEI-1 was between 2,500 and 3,000 while in HEI-2 was between 2,000 and 2,500. Cloud computing could support the IT Departments of HEIs in delivering IT services that would address the needs of the IT users.

The participants were asked to indicate the benefits that may be obtained from adopting cloud computing in their organisations. The respondent of HEI-1 stated that the organisation has adopted cloud computing and some of the benefits were easy management of IT services such as e-mail:

“We are already on cloud computing and our systems is no longer belaboured as it used to be. We surrendered our emails and web pages to Google. Life is easier today”
(HEI-RESP-1).

The e-mail services which used to be named in-house were now hosted on an external cloud computing service. The changes that the e-mail services were being hosted outside the organisation on a cloud surprised the IT users and had reduced the workload for managing the e-mail services for the IT Department as noted in the following statement: *“It is just starting and seems strange to many people. However, queries have reduced by 90% and life seems very easy”* (HEI-RESP-1).

Similarly, the respondent of HEI-2 observed that there were potential benefits that may be obtained from cloud computing for the organisation. One of the perceived benefits would be improvement in management of IT services:

“Management of IT would be so much easier. However, we may lose the expertise of managing various software and systems locally” (HEI-RESP-2).

As indicated in the statement, there were also factors that would affect the organisation such as loss expertise in management certain IT services. This implies that adoption of cloud computing was beneficial but there were also perceptions for negative implications to the organisations:

“Mind-set of people. The majority think negatively and could feel cloud computing is there to eavesdrop on them. I just wish they had known” (HEI-RESP-1).

“Bandwidth – very slow, expensive and unreliable” (HEI-RESP-2).

Other potential challenges that were noted included issues of slow and expensive bandwidth, negative attitudes towards cloud computing and security concerns. It was necessary to consider the benefits and challenges of cloud computing before adopting the technology.

5.3. Environmental context

Regarding the environment of higher education sector competitiveness and the potential effect of adoption of cloud computing, respondents perceived that through adoption of cloud computing their organisations may be competitive as noted in the following statement: *“Relevant cloud applications and systems may facilitate the process of developing our operations to be at par with global best practices”* (HEI-RESP-2). It was also perceived that the organisations may use systems similar to other institutions: *“with cloud computing etc. our organisation may have software services that are at par with other leading institutions”* (HEI-RESP-2). The statement imply that the organisation may be competitive with other institutions that were considered advanced in the higher education sector. The respondent of HEI-1 acknowledged that the organisation was in the early stages of adopting cloud computing but were optimistic of improving: *“We are still very far but we will reach there”* (HEI-RESP-1). The organisations were aware of the changes in their environment and willing to embrace the change. The change was not immediate but over a period of time.

Regulations set by the government may affect the environment for the adoption of cloud computing in organisations. The respondents were asked on their perceptions on the role of government in supporting an environment for the adoption of cloud computing. It was noted that the government should facilitate the reduction in cost of bandwidth and reliability of services as these were the major constraints limiting adoption of cloud computing in HEIs. The respondent of HEI-2 perceived that government should: *“Facilitate the reduction of prices for bandwidth and facilitate the implementation of reliable bandwidth providers”* (HEI-RESP-2).

Similarly, the respondent of HEI-2 noted the concerns on the role of government on its role in supporting adoption new technologies. There were doubts on the active role of government in supporting cloud computing:

“This is a dream. Government are slow and implement things which are phased out. They should wake up and move with time. What a country which does not have even an IT policy? Can such government have anything to do with cloud computing” (HEI-RESP-1).

The government policy declarations highlighted that: *“ICT shall be integrated in the education systems at all levels in order to improve both the access to and the quality of education, improve management of education systems and improve ICT literacy”* (DOC-1). This meant that there was, to some extent, political commitment from government to improve the environment of ICTs in HEIs. However, there was limited engagement with the HEIs despite considering the organisations in the national ICT policy process:

“Academic institutions at all levels will play a very strategic role in the implementation of ICT policy. In particular, they will be involved in all educational matters related to teaching, research and development facilitated by and facilitating ICT in relevant fields” (DOC-1).

This implies that there were challenges of translating national ICT policy declarations into programmes and processes related to ICTs in HEIs. The government showed political will to support the development of ICT in HEIs through the policy which had implications in the external environment of HEIs. However, there is limited progress in the development and implementation of the national ICT policy. ICTs had evolved and there was a need for government to revise the policy to address the emerging issues as a result of new technologies. The process required engagement and input from policy stakeholders including representatives from the HEIs.

6. DISCUSSION AND CONCLUSION

The study attempted to answer the research question: How do the context of HEIs in dimensions of technology, organisation and environment affect adoption of cloud computing? The results showed that technology, organisation and environmental factors may affect adoption of cloud computing in HEIs. Technology factors such as internet services, network operators and availability of skills to support the new technologies may affect HEIs in adopting cloud computing. The results highlighted that to the environment of country had limitations that could support the standards for cloud computing. For example, the inability to operating ICT infrastructure and services 24 hours for the providers of cloud computing. The high cost of bandwidth and unreliable supply of electricity may inhibit HEIs to adopt cloud computing to support their services. The government was important in overcoming the challenges of high cost of services and ensuring standards of services.

The results showed that organisational factors such as top management support and IT skills could also affect the adoption of cloud computing in HEIs. There was lack of awareness of cloud computing among the members of top management. This may be attributed to lack of knowledge on cloud computing since most members of top management may not be well versed with IT technical knowledge (Hsu, Kraemer & Dunkle, 2006). From the results, it can be suggested that members of top management in HEIs should be

sensitised on potential benefits and limitations of new technologies. Top management support is crucial in providing resources for adopting new technologies in HEIs (Low, Chen & Wu, 2011).

Environmental factors that may affect HEIs in adopting cloud computing were mainly high cost of bandwidth. The participants perceived that government could support reduction of bandwidth cost. Part of the reasons for the high cost of ICT services was lack of ICT infrastructure. The national ICT policy proposed investment in ICT infrastructure of the country. Interestingly, the policy declarations indicated the need for supporting adoption of technologies in education. However, implementation of the policies was problematic. The results were consistent with similar studies that have highlighted policy issues in cloud computing adoption (Katz, Goldstein & Yanosky, 2010; Sultan, 2010; Tashkandi & Al-Jabri, 2015). Katz et al. (2010) highlight issues of lack of institutional executive support, security concerns and regulatory issues. Similarly, Mircea (2010) noted the potential for supporting learning and teaching in using cloud computing, increased functional capabilities, risk of protection and data security and lack of trust in the new technology. Sultan (2010) highlight similar potential benefits and challenges for cloud computing for HEI in Africa and Europe. From the results it is clear that cloud computing has both advantages and limitations and that the decision in adoption cloud computing should consider the potential benefits and limitations (Katz et al., 2010; Mircea, 2010). Managers should also device means on how the potentials risks associated with cloud computing can be mitigated.

Drawing from diffusion of innovation (Rogers, 1995), cloud computing for HEIs in Malawi was in the early stages. For instance, HEI-1 had adopted cloud computing for its email and webhosting systems. However, top management had perceptions that cloud computing would fail. Part of the reasons was lack of awareness of the benefits and limitations of cloud computing. According to diffusion of innovation (Moore & Benbasat, 1991) laggards have negative attitude towards new technologies. In contrast, HEI-2 had not yet adopted cloud computing and not many members of top management new about cloud computing. However, the IT Manager the perceived that cloud computing could support the organisation to achieve global best practices. To some extent, the cases showed that the two HEIs were in the early stages of adoption where people or organisations are willing to take risks in adopting the new technology (Moore & Benbasat, 1991; Rogers, 1995).

The study is cautious on making generalisations to the wider population of HEIs (Seddon & Scheepers, 2015). The study recognises the limitation for the number of participants to the study. Secondary data was used in the study to verify and supplement the primary data from the participants. The contribution of the study is the insights on the context of HEIs when adopting cloud computing (Lee & Baskerville, 2003; Walsham, 1995). The insights focused on technology, organisational and environment context of HEIs. A further, study is recommended to include a large sample.

The study suggests the following recommendations for practice: (i) awareness of cloud computing for top management and users to promote buy-in of cloud computing in HEIs (ii) awareness of benefits and the limitations of cloud computing in HEIs such as security and how to remedy the challenges (iii) promoting implementation of government ICT policies to support adoption of new technologies through advocacy and lobbying to the policy makers.

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