Perceived impacts of Cloud Computing adoption on the role of an IT department of a higher institution in a developing country.
Abstract

Cloud computing popularity has continued to be on the increase side, and it has been significant contributory factor to the of 24/7 365 days business culture of the digital 21st century where data and data centers are accessed via the internet through any connected device, anytime and from anywhere. Higher Education Institutions (HEI) or Tertiary Education Institution (TEI) are also among organisations, medium and large, that are tapping into this trend by gradually adopting this technology to reduce their high budgets in the prevailing face of financial shortage. This has particularly made the technology attractive to TEI in developing countries, and more of them are adopting the services being offered by cloud computing. The adoption of this technology however, affects the way and manner by which IT services are being delivered traditionally by the TEI IT or ICT departments. The objective of this study therefore, is to explore the adoption of this phenomenal technology and its impact on the role of traditional IT department in one of the tertiary education institution in the South Western part of Nigeria. The TOE framework adoption model was used to explore the adoption factors, and interviews conducted within the ICT department of the institution as part of the empirical findings process. In contrary to popular belief, no member of the IT staff has lost his or her job yet based on the adoption despite the impact on the skills and culture in service delivery of the department. IT staffs were encouraged to adapt to the change as quickly as possible with trainings given, and the ICT, thus the HEI have value added as most of the services are now available on a 24-hour basis to users, even while off campus and far remote, a dream very difficult and near impossible in the days of full traditional IT services delivery.

Keywords
Cloud Computing, Adoption, Impacts, ICT department, Tertiary Education Institution, Qualitative Research, Semi-structured interviews.
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List of Abbreviation

- IT: Information Technology
- SaaS: Software as a Service
- IaaS: Infrastructure as a Service
- PaaS: Platform as a Service
- NIST: National Institute of Standards and Technology
- ICT: Information and Communications Technology
- ERP: Enterprise Resource Planning
- TEI: Tertiary Education Institution (Same meaning as HEI)
- HEI: Higher Education Institution
- SLA: Service Level Agreement
- CC: Cloud or Cloud Computing
- IS: Information Systems
- SME: Small and Medium Enterprise
1. Introduction

Cloud computing is a phenomenon that is considered by many, to be a major development of the decade in computing (Rajaraman, 2014) as it significantly contributes to increase in the processing power and speed capacity of the modern computers, storages and data throughput of the internet. The term has been around since the earlier part of the 2000, but not entirely new as a technology. It actually was believed to have been introduced in the 1960s according to Rajaraman (2014), and Al-lawati and Al-badi, (2016). It is a term that simply defines the storing and accessing of data through the internet rather than the traditional way of the local storage device – popularly known as the hard drive, which was costly and rigid in nature, as it was difficult to instantly expand or reduce the computing resources as per individual’s need” (RashmiBhadani. 2014). Therefore, as technology emerges and evolves, with competitiveness ever growing in various business environments, it is quite understandable that companies and organisations are seeking highly efficient and better effective information and communication technology (ICT) solutions at lower costs while still maximising profit.

This revolutionary concept, as part of the rapid technological advancements in enterprise technology have changed substantially, the very nature of organisations, and created new opportunities for different business practises (Aleem, and Sprott, 2012). As non-profit making organisations, tertiary institutions equally referred to as higher education institutions, like colleges and universities, are as very much affected. While its presumed cost benefits are the first and initial center of focus by higher education institutes, the supports and services provided by the IT or ICT departments for educational, research and development activities, as well as the model of operating and providing these services, have also been influenced by the advent of this technology as it diffuses across industries (Okai et al, 2014, Fagbola, 2015, Pardesh, 2014).

As the broadband revolution continues to spread across the sub-Saharan Africa, as part of developing economies, internet access and consequently cloud computing is expected to be taken beyond their “infant stage” (Kshetri 2010) given that access and usage has steadily risen from 0.78% at the beginning of the millennium to 20.71% in 2014 (Nyirenda-Jere and Biru, 2015). In respect of cloud adoption, small and medium enterprises (SMEs) in Nigeria are already being viewed as among the earlier adopters of the technology. As a matter of fact, by 2012 MTN Africa, which is only one of the major organisations that are advocate cloud computing in Nigeria, has launched a pilot cloud service project targeting SMEs in six African countries; Cameroon, Cote d’Ivoire, Ghana, Nigeria, Uganda and South Africa (V VenturesAfrica, 2019). In 2016 MTN Business”unveiled a new cloud delivery platform in Nigeria, which will enable SMEs access cloud services with greater ease” (Techcabal, 2019).Leveraging on this ubiquitous network accessed technology for the advantages and opportunities it offers, about 82% of Nigerian Universities therefore, have at the least started using cloud email services as opposed to traditional dedicated in-house mail even by 2015 (Fagbola, 2015). Online databases, Microsoft Dynamics CRM online, oracle coherence, educationERP.net, Microsoft, and virtual computing laboratories are among of other applications that have been accessed via the ”cloud” by one university or the other in Nigeria (Fagbola, 2015).

While there are numbers of studies that have been done focussing on the benefits of this technological innovation (Johnston et al, 2016), cloud computing, not much seemed to have been done in respect of the changes that the advancements brought to various businesses
and/or organisational department roles, especially the IT or ICT departments, processes, workflows and employees responsibilities in the context higher education institutions in developing countries in Africa. A university in Nigeria, as an organisation therefore will be explored in respect of the impact of this technology on the role of its key related department – The university IT services.

1.1 Research Setting

Educational system in Nigeria is divided into four stages; kindergarten, primary education, secondary education and tertiary education. Kindergarten is an optional pre-school age (between 3 and 6 years) stage, while primary school leads to secondary school education at the end of which students sit the pre-requisite exams and obtain certificates for furthering to a post-secondary or higher education stage – known as the “tertiary education institutions” in Nigeria. These are colleges of education, polytechnics and universities. This study therefore, will refer to the post-secondary education as “Higher Education” institution (HEI) or “Tertiary Education” institution (TEI) interchangeably. It is also worth a note that universities in Nigeria comprises private and public (or government) owned (Wikipedia, 2019).

Cloud computing is used differently and in different contexts by individuals, organisations, government agencies and academic institutions. This study explores its adoption and impact on the role of IT department as service provider to an higher educational Institution in the South Western part of Nigeria. It is a university with close to 25,000 students, including open and distance learning, about 3,000 administrative staff and 41 academic departments spread across 7 faculties.

The Information and Communication Technology (ICT) center, otherwise known as IT department provides computer services to users, students and researchers across all departments as its primary function. Interviews were conducted with IT professionals in the department according to their area of professional activities.

1.2 Purpose Statement and Research Questions

This research work is purposed at exploring the impact of adopting cloud computing on businesses and society, specifically on an IT department in a tertiary education institution. It will examine the effect this revolutionary phenomenon, cloud computing, has on the role and operations of an IT department of a university in Nigeria.

The research question that the study will be aimed to explore is:

- What are the perceived impacts of adopting cloud computing on an IT department and its role as service provider to a tertiary institution in a developing country?

1.3 Topic Justification

The use of cloud computing changes considerably, the way IT services are used, and thus unsurprisingly impacts the IT departments in various organisations, shifting the roles and responsibilities of IT employees from maintenance and configuration of information systems to other tasks that are in better demands (Al-lawati and Al-badi, 2016). Dutta et al., (2013) however, highlighted concerns raised by a number of authors in respect of significant organisational change that accompanies adoption of the technology, which may include but
not limited to changes in business processes including data security, refining of IT roles, downsizing of IT department etc. as highlighted further in their work.

While the technical aspect of this innovative technology have been described and commented on at length in many studies, Marston et al. (2011) emphasised an equally urgent need for understanding the business-related issues surrounding it. The authors, Marston et al., (2011) suggested the impact of cloud computing on IT departments of organisations have not been sufficiently investigated, despite the obvious evidences of the impact it has on the information systems structures in organisations. It is therefore, the intent of this research to bring some understanding into how the adoption of this technology could possibly impact the role of an IT department, specifically of a higher education institution, thus filling some of those business-related issues (Marston et al. 2011) gaps and contributing to cloud computing adoption body of knowledge.

Moreover, studies specific on this topic in the context of developing countries higher education institutions like Nigerian universities (as large organisations) seemed to be scarcely found. This thus serve as the motivation to focus this study on exploring the adoption of cloud computing, and the extent of the impact the adoption has on the function, responsibilities, operations, trainings, resources etc. of the Information Technology (IT) Department (or ICT department) of a tertiary education institution in a developing country.

1.4 Scope and Limitations

The scope of the study is to have an insight into the impact Cloud Computing poses to the role of a typical IT department of an organisation, either in a public tertiary institution or private business in a developing economy like Nigeria. It will ponder on the effect of this revolutionary phenomenon on staff as well as the department and the university as an organisation.

In order to answer the research question, a good understanding of cloud computing and factors surrounding its adoption are required, as well as analysing work that have already been done by other researchers in the area. This analysis however may not be sufficient, as organisations operate in different environment and the technology adoption moves at fast but different pace.

Likewise, some limitations could be associated with this study. The number of staff in the IT department that could be made available as participants in the research was very limited due to time and availability factors. Only seven individuals could be available as participants in the research, which could be considered as small in terms of sampling. Another limitation, which is a known drawback of qualitative research methodology, is the issue of generalisability. In contract with quantitative methodologies, generalisability, validity and reliability, are not of much imperatives in qualitative interpretive researches, since the concern is an understanding and interpretation of individual cases. This assertion supported that qualitative research studies context sensitive and complex in IS practices, thus many researchers do not believe it is possible to generalise with it (Conboy, Fitzgerald, and Mathiassen, 2012). In essence, the conclusion cannot be generalised and therefore may require further research in the field and in different contexts in order so that better understanding on the implications of the adoption cloud computing technology may be acquired.
1.5 Thesis Organization

The rest of the thesis is organized as follows: Chapter 2 deals with the reviewing of the literature related for known studies or similar topic that has previously been carried out. It also examines various model that are related to new technology adoption, out of which TOE framework was found to be suitable for the study. In chapter 3, the philosophical assumptions guiding the research setting is described, as well as the methodological approach chosen for the study. This is followed by methods of data collection description, and then the interview procedure. The data analysis is presented after this, along with validity, reliability and ethical considerations. Chapter 4 presents the empirical findings, describes the themes (concepts) identified, with all the findings discussed in chapter 5. Finally, chapter 6 presents the conclusions, contribution, and suggestions for future research.
2. Review of the Literature/Theoretical framework

Cloud computing was likened to the Greek myths that “tell of creatures plucked from the surface of the Earth and enshrined as constellations in the night sky” (Hayes, 2008). This is a very interestingly composed metaphor for this great IT phenomenon by Hayes, who went on further that, as the data and programs being migrated up from desktop PCs and corporate server rooms to “the compute cloud”, cloud computing, on-demand computing, software-as-a-service, the internet-as-a-platform, or whatever name it is called, the bottom line is that there is a shift in the geography of computation. This shift, this change, affecting all levels of computational ecosystems, from casual users to software developers, IT managers and even hardware manufacturers is no longer a prediction as asserted by Hayes (2008) but a contemporary reality.

In any case, Rajaraman (2014) reminded us that the phrase “cloud” was coined from the common practice of enclosing a group of computers connected to the Internet in a cloud-like boundary in most computer literature.

2.1 Definition of cloud computing

As noted by other study literature, one of the biggest issues with the concept of cloud computing is that, there is no universally accepted definition (Aleem and Sprott, 2012), and in some instances has been narrowly defined as a form of utility computing where virtual servers are made available to businesses for carrying various activities. The term has also been defined using a broader view of where anything that is beyond the perimeter of firewall is considered to be in the cloud (Rittinghouse and Ransome, 2010).

Most papers however largely adopt or expatiated more on The US National Institute of Standards and Technology (NIST), definition of cloud computing “as a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction” (Mell, and Grance, 2011).

NIST went further that the model of cloud computing composed of five essential characteristics, three service models, and four deployment models. These five essential Characteristics are: On-demand self-service, Broad network access, Resource pooling, Rapid elasticity and Measured service.

The service models referred to by NIST, include Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS), while the four deployment models are Private cloud, Community cloud, Public cloud and Hybrid cloud. These models are depicted in figure 1 below:
The ramifications of the models however, is that cloud computing makes it easier for organisations to spring up and utilise IT resources and services as may be required by their businesses with possibility of not really investing in IT infrastructure themselves.

2.2 The essential characteristics cloud computing

As in the model depicted above, the US National Institute of Standards and Technology (NIST) proposed five characteristics required for cloud computing as:

**On-demand self-service:** This refers to the expectations of Cloud computing consumers for on-demand, instant access to resources. Customers must be able to request, customise, pay and use services without any human interaction (Mell and Grance 2011).

**Broad network access:** This technically refers to the internet. Skiba (2011) buttressed this inference by referring to Educause’s 7 Things You Should Know which stated cloud computing to be “the delivery of a scalable IT resources over the internet, as opposed to hosting and operating those resources locally, such as on a college or university network” (2009).

In other words, data stored and used in a home or office network does not indicate cloud computing. To employ cloud computing, the data need to be accessed over the internet or in the least, synchronised with information over the internet - as the main philosophy behind cloud computing

**Resource pooling:** This means that Cloud customers are able to use a multi-tenant model that consists of merged computing resources. A variety of physical and virtual resources could be dynamically assigned and re-assigned as per customer demand, and independent on geographical location. These resources could include storage, processing, memory, and network bandwidth (Mell and Grance 2011).

**Rapid elasticity:** This refers to cloud provider being able to rapidly and elastically provision services. In other words, the consumer is provided with a wide variety of resources that can be changed in any quantity at any time (Mell and Grance 2011).
**Measured service:** Cloud services usually operate on a pay-per-use basis as a business model that allows their systems to leverage resource use (Skiba 2011).

2.3 Service models

According to Armbrust et al. (2009) “Cloud computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the data centers that provide those services.” These services are offered in three models:

- **IaaS:** Infrastructure as a Service
- **PaaS:** Platform as a Service
- **SaaS:** Software as a Service

**Infrastructure as a Service:** IaaS, for Infrastructure as a Service indicates that an organization or consumer does not need to own servers, hardware, or network capacity to operate the necessary service. Skiba (2011) cited an instance of a client, such as a university or an individual consumer, having access to these infrastructure and pay on a per-access basis. Examples are Amazon’s EC2 and GoGrid.

**Platform as a Service:** This model enables consumers to use the cloud infrastructure for the installation of base software so as to build new or upgrade existing applications (Arutyunov, 2012), using programming languages, libraries, services, and tools supported by the provider. The consumers do not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly configuration settings for the application-hosting environment (Fagbola, 2016).

**Software as a Service:** In a cloud computing environment, software does not run on desktops or local servers, but on web based server with shared virtual resources (Mell and Grance, 2011), offered by this service model (SaaS). Software and applications are provided by the cloud service hosts and made accessible over the Internet. This is model seems to be the most engaged in cloud computing. As an example, an higher education institution such as a university provides access to Gmail, instead of having their own email system for students (Skiba, 2011). In this category are also applications like CRM (customer relations software) software from salesforce.com, Google and Google apps etc. Hayes (2008) while explaining *Enterprise computing in the cloud* echoed this fact that software for major business applications that used to be run on corporate servers, are now being offered as on-demand in the cloud.
2.4 Cloud computing deployment models

Cloud computing services are generally deployed in four models; the public cloud, private cloud, community cloud, and hybrid cloud.

Public cloud: As the name implies, institutions or consumers have access to a public service on a pay-as-you-use basis (Skiba, 2011). Google, Microsoft Azure, Amazon Elastic Cloud (EC2) and Vodacom hosted exchange are some public clouds.

Private cloud: In contrast to public, private cloud model has the infrastructure for the exclusive use of the organisation. It may however, be owned, managed and operated by the organization, a third party or some combination of them, and may exist on or off premises. It is opinionated in one of the literatures that a combination of shared services models and private clouds could enable like-minded education or research organizations use a shared cloud infrastructure or single institutions can take advantage of specific cloud technologies such as virtualization-enabled self-provisioning of application environments (Oracle, 2011 cited in Fagbola, 2016).

Community cloud: This deployment model is used by different organisations that have common interests. The NIST describes it as a cloud infrastructure that “is provisioned for exclusive use by a specific community of consumers from organizations that have shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be owned, managed, and operated by one or more of the organizations in the community, a third party, or some combination of them, and it may exist on or off premises” (Mell and Grance, 2011).

Hybrid cloud: The cloud infrastructure composes of two or more of the other cloud computing models; private, public or community in this model. Armburst et al 2010, describe such model also as surge computing in an instance where the public cloud handles the extra tasks that cannot be readily run in an organisation private cloud due to temporarily heavy workloads.
2.5 Benefits of adopting cloud computing

It is an understatement to say that Information and Communication Technologies (ICT) are powerful enabling tools. These tools are shaping and changing all aspect of our lives since the advent of computers to this present day and will continue to do so for the future to come. Cloud computing, with no doubt and one of IBM researches also identified, is among the recent chieftains of these “game-changing business enablers” (Berman et al., 2012).

As part of the change, educational systems are being reformed, introducing new methods of teaching and conducting research as well as provisioning of facilities for online learning, teaching and research collaboration. It is potentially a representation of equalizing strategy for developing countries (Fagbola, 2016). Thus, Cloud computing, as one of the most significant developments in the ICT world could be seen as a “jewel in the crown” by the developing countries as a mean to the “equalizing strategy” (Fagbola, 2016), especially in the educational sector. The developing world must exploit the opportunities afforded by cloud computing, Kshetri (2010), greatly advised.

While there are quite a number of obvious benefits offered by cloud computing and highlighted in the literature reviewed, Skiba (2011) however specifically emphasised economies of scale, no capital expenditures, and on-demand services as three primary reasons higher education institutions are considering the use of cloud computing. The author elaborated further that the “obvious uses are the ability to share documents, edit collaboratively, and effectively manage versions of documents, presentations, media sources for online courses, syllabi, publications, and research datasets”. In addition and as one of the core businesses of tertiary (higher) education institutions, it offers them the ability to conduct large-scale research studies, using unique computational software for analyses (Skiba 2011).

In addition to the obvious cost benefit advantage of cloud computing, the ability to increase data execution time is another main reason that entices organisations to opt for the cloud. The case of processing 17,481 pages of data (account of Hilary Clinton as first lady) on 200 Amazon (EC2) cloud network to allow searchable text and images by Washington Post is an evidence of the capability of cloud model, as cited by Aleem and Sprott (2012).

Furthermore, increase in end-user productivity and collaboration is one other great business driver in adopting cloud computing. Workers and users access to the internet and various interconnected devices have greatly increased and consequently their ability to access and use software when and wherever it is available as a service. Obviously, web-based interfaces have enabled applications to become better in standardisation. They are now easier to understand and give the software applications users more confidence and willingness to use them (Hugos and Hulitzky 2011).

Green IT is another “buzz words” in the 21st IT world. Organisations are expected to respond to the climate and environmental concerns in various ways, including of course, efficiently use of energy. We are in an age organisations are seeking to “burnish their green credentials”(2011), large IT organisation that are aspiring to reduce their carbon footprint are therefore naturally enticed by cloud computing. Migrating to the cloud will not only allow organisation to reduce their IT infrastructure, but since it is much less costly to transport computing services than energy, it will also lead to smarter use of energy (Marston, 2011).

Data storage management (backups) is another most cited one. As a matter of fact, Arutyunov (2012) mentioned a kind of new model in addition to the main ones proposed by NIST
namely Data-as-a-Service (DaaS). It is a model, according to the author, in which users are provided with disk space on which they primarily use in storing their data. This essentially could technically mean purely data backup area. Cloud vendors now offer low cost cloud storage such as DropZone, Mozy etc , (Aleem and Sprott 2012), a service which many organisations, at a first glance, would find very much worth considering taking.

Other benefits include patch management, which is a core activity performed by the IT department of organisations, to avoid vulnerabilities being exploited, disaster recovery and data archiving. These are but few of the direct and/or indirect benefits of this great computing innovation.

2.6 Challenges to cloud computing adoption

Despite all the benefits, Cloud computing and its adoption into enterprise, do pose some risks as any IT enterprise solution. Dutta et al.’s (2013) research paper acknowledged that the adoption of cloud computing comes with a wide range of potential issues and primarily brought some of the known ones to the fore. They categorised the possible associated issues as Organisational risks (OGR), Operational risks (OPR), Technical risks (TR) and Legal risks (LR). According to Rittinghouse and Ransome (2010), lack of compliance to the SLA (Service Level Agreements) by cloud service providers is another reason behind the slow rate of adoption cloud.

Organisational risks (OGR): Adoption of cloud could significantly impact various aspects of an organisation, such as IT governance, compliance to industrial regulations, in-house IT experts and IT planning. Okai et al 2014 pinpoints organisations concern, including higher education institutes, about the security and confidentiality of data stored in the cloud. Privacy is a big issue in our contemporary information age, of which cloud computing is also in the center.

Operational risks (OPR): Significant changes accompany the adoption of cloud computing into an organisation whose IT and business operations, prior the adoption of the technology, were purely internal. There could be increasing hidden costs due to non-transparent operating models in the cloud, Cloud applications may become temporarily unavailable or out-of-service, and inadequate user training/knowledge on cloud services and usage may become apparent, to mention but few. Daily business and IT operations might thus come under an increased risk (Dutta et al.’s 2013).

Technical risks (TR): Cloud infrastructure is complex. Therefore, an organisation with inherent IT deficiencies could experience a heightened risk to their service during the adoption process. Issues like possible Denial-of-Service (DoS) attacks in the cloud environment, performance of cloud applications being dependent on continuous internet availability, network speed, database size, inadequacy in data integration etc are among technical concerns in adopting cloud computing. Cloud users experience security threats both from outside and inside the cloud, and organisations worry about whether cloud computing services will have adequate availability (Armbrust etal 2010).

Legal risks (LR): Organisation data could be located anywhere across the globe in cloud computing. Therefore, legal and jurisdiction issues could pose reasons for concern. Okai etal (2014) raised the point clearly that legal issues an organisation could find itself in an unwanted legal disputes that can run into years due to laws surrounding location where data
are stored. Bringing it back to the higher education, Lakehead university, Canada, was cited as an example of an institution facing legal issues due to the adoption of Google’s public cloud – Google being an American company (Okai et al., 2014).

2.7 The traditional role of IT departments in TEIs

In Alias et al.’s (2016) opinion, IT staff in the Universities IT department should be the ones to solely rely upon on solving users IT related issues and service rendering. The referred users of the services, in a university community, rendered by the IT department are students, developers, researchers, staff and lecturers (Sultan, 2010).

According to Brandabur (2013) and Monroy et al. (2014), a typical IT department would provide the services that include:

- Maintaining computers and laptops
- Managing the storage space, servers and databases
- Maintaining emails and printers,
- Administering the contents of web pages, data, networks, multimedia design and production,
- Maintaining “enterprise resource planning” (ERP) applications, such as finance, human resources, payroll and marketing.
- IT department would also design, implement, and maintain a disaster recovery plan.

The above are likewise applicable to university IT department therefore creating same challenges, especially on delivery time and budget, for instance, in a situation where they may need to develop some bespoke applications.

![Figure 3: Main IT services users in a typical university (Sultan, 2010)](source: Adapted from Sultan (2010))

In a higher or tertiary educational institution, such as the university, providing virtual environment and good specialised teaching software is a very major service of the IT department, as depicted in figure 3 above. Students are expected to get familiar with new technologies and be connected with their various devices.

Equally important and fundamental are services provided to the researchers, who generate enormous amount of data and thus need tools to manage and produce information. They may
need to collaborate with counterparts across disciplines and industries worldwide. The IT department makes such provision as providing researchers and students the required innovative services and technology that keep them remaining competitive (Dumas, 2016).

Another very important function of the IT department is the implementation and coordination of IT governance. IT governance ensures that “the enterprise’s IT sustains and extends the organization’s strategies and objectives.” (IT Governance Institute cited on planview, 2019).

Ironically, with cloud computing, this key function along with others is among of those that will be subjected to transformation, as posited and discussed by Vithayathil (2017), raising the challenging question to this traditional IT department notion on the need to address what additional services or value-added attributes to IT services it can offer better than or not available from cloud vendors, as organisations, small and large, including the tertiary(higher) education institutions(TEIs) of course, are adopting cloud services at a rapid rate.

2.8 Use of cloud computing in higher education

Cloud computing has become widely popular in higher education worldwide, just as it is in other sectors of economy and industries, and various cloud services are being engaged by many universities and other educational institutions (Alam, 2013 and Munjal, 2015).

As part of these cloud services used by higher education institution such as universities are email applications such as Microsoft 365 from Microsoft and Gmail from Google, Amazon Web Services (AWS) from Amazon and some ERP applications. The fact that some of these services are offered free of charge to educational institutions make them particularly appealing (Educause, 2012). According to Sultan (2010), University of Westminster saved about 1 million dollars on the migration its email Outlook to Gmail. This was made possible from partial savings from installations, licensing and servers’ maintenance. In a similar positive case, large number of students is able to use needed storage space on Amazon servers once University of California implemented the Amazon Web Service for one of its courses (Sultan, 2010).

Munjal (2015) further advised universities to take the advantage and opportunity offered by cloud computing and adapt the technology to their existing models to facilitate the work and services provided to staff and students at reduced IT cost. Cloud computing provides a virtual learning environment, a learning management system and e-learning platform, therefore, offering lower cost and an environment of collaboration amongst researchers and students (Dumas, 2016).

Figure 4 below showed cloud computing infrastructure model as proposed by Ercan (2010). In the model, computing resources (processors, memories, storage space and bandwidth) are offered and controlled by the cloud service provider on a pay-as-used basis instead of the traditional IT department.
Muhammad and Abdulrahman (2015) however proposed another model of using cloud computing in eLearning in HEIs as depicted in figure 5. In this model, the eLearning system is managed and maintained by the cloud service provider rather than being hosted by the traditional IT service department of the HEIs. Members of the university community can access systems via any internet enabled devices through cloud computing services such as Saas, PaaS and IaaS.

In either model, it could be seen that some of the key functions of the IT department in TEIs can be moved to cloud provider, thus creating uncertainty around the role of the IT department particularly, in this context.
2.9 Impact of cloud computing adoption on IT departments of organisations

According to Brooks (2015) the role of the IT services department and IT staff has greatly been changed by the advent of cloud computing. In light of this, organisations have had to redefine the role of IT department and staff, down-size the department and change their business processes (Dutta et al., 2016). Cloud computing will reduce significantly a number of roles in the IT department, while giving rise for the need for others like cloud technology qualified engineers (Bedrossian et al., 2014).

Commonly, the IT has four main functions; system development, IT services, application management, network and infrastructure (Alias et al, 2016). The development, control and supports of IT services are usually managed by the IT department of large organisations, such as universities, themselves. This authority will obviously be shifted to the supplier of cloud computing services, once introduced into the environment. This transfer of authority modifies the role and responsibility of the IT departments, and will need to adapt to such change (Vithayathil, 2017)

However, if an organisation only adopts the SaaS model of the cloud computing, it can still obtain other IT services in-house as it would in a traditional IT department setting. This view is supported by Al-lawati and Al-badi (2016), by submitting that the impact of cloud computing on IT departments differs from bank to bank, as it is dependent on the type of services adopted and engaged. They further explained that this could be due to various reasons like security and Service Level Agreement (SLA).

Another perspective of view is that of Choudhary et al. (2016), that IT department role should be more focussed on the value that cloud services adds within the organisation. It is suggested that the role of the IT department should be to ensure that IT staff contribute to make better cloud based services in response to organisations’ needs as opposed to resolving tasks on the premises, as some job positions such as systems support, administrator, and even IT infrastructure staff reduces in number or even cease to exist, following a full adoption of cloud based services (Choudhary et al. 2016).

Choudhary et al. (2016) further submitted that factors, such as cloud quality of service offered, vendor pricing models and competitive environment also play significant part in the impact of cloud computing on the organisational structure of the IT department. Depending on whether cloud computing is adopted or not, these factors determine whether or not the IT department become a cost or profit center.

Furthermore, cloud computing adoption by Tertiary Education Institutions, varies from one to another and dependent on the type of cloud services needed. Colleges and Universities are advised to think through very well the way their IT units are staffed, as computing in the cloud requires a radical change in the way IT services are used (Bedrossian et al., 2014 and Carraway et al. 2015). For instance, the University of California (Berkeley, United States) on implementing cloud computing service for the management of its IT infrastructure had only two IT professionals lost their jobs after four years despite the changes in the IT department, whereas in the case of the University of North Carolina the IT service department staff got down in number from 15 to 3 while the remaining staff, working on full-time basis went on supporting cloud services infrastructure (Deloitte, 2013 and, Mircea and Andreescu, 2011).
HEIs are also developing cloud strategies in assisting different campuses with the adoption of cloud computing and the transfer of the technology (Brooks, 2015). Several factors influence the role of IT in the TEI, as well as the adoption and success of cloud computing. In any case, the impact of cloud computing on IT departments differs from one organisation to another.

Monroy et al (2012) encouraged universities to see cloud computing as an opportunity, and not an option. The technology and its adoption however will have direct impact on the IT service departments and staff of institutions (Berman, 2015), as would on any organisation. The IT department and its staff will have to play a new role which requires additional knowledge in new domains, such as services management, communication and customer relationships (Berman, 2015). Dutal et al (2016) advised that proper and adequate training should be provided to the IT staff as well as the users on how to use, configure and maintain applications that support cloud computing.

In addition, HEIs must develop a change management program that can help IT staff understand the impact of cloud computing within their environment and adapt as easily as possible to the change. Time and resources to explore the technologies also need to be well considered (Carraway et al, 2015). Each institution will have to address career paths and the people side of change. Possible career paths for those mostly affected by cloud adoptions might include System Administrators or Developers becoming DevOps Engineers, or Product or Layer Specific Engineer and evolve into Cloud Engineers who can work up and down the stack managing a greater level of abstraction (Bedrossian et al, 2014).

The end user impact must definitely be considered. In most cases, users must be connected to the internet for cloud services to work; few others may prefer to work offline. In any case, the portability and interoperability of data and information in the cloud has different concerns: How much data can be stored? How fast and frequently can data be moved? Different users’ needs and scenarios need to be catered for, with necessary trainings and awareness given.

Proper procedures must be in place for ensuring the security of University information and complying with all necessary regulations. Appropriate technical and legal safeguards could be achieved by developing and applying stringent data classification and security standards. Bedrossian et al, (2014) advised further that University counsel and procurement services be involved in all cloud service agreements relating to the institution, regardless of whether payment is involved or not.

Finally and in same vein, technologists and technical managers need receive education on the cost models of cloud computing and the impacts their actions may have (Bedrossian et al. 2014). For IT organisations to move toward a cloud-based services environment, they need to rely on good project management skills that can ensure that the technology adoption being is well vetted and the implementation is according to the need and requirement of the institution (Carraway et al. 2015).

2.10 Theories used in Technology adoption

Based on the review of previous researches and researchers’ findings, indications are clear that there are various factors that influence the adoption of cloud computing technology into or by an enterprise. These factors are identified into three context groups, namely; technological, organisation and environmental context. In light of this, the Technological,
Organisational, Environmental (TOE) framework (Tornatzky and Fleischer, 1990; Low, Chen and Wu, 2011) will be used in doing this research that concerns Cloud Computing adoption. As found and highlighted by Senyo et al (2018) in their research note, most of previous research studies “did not use frameworks” but “utilised simulation and experiments”. However, there are numbers of theories and framework on which research studies in technology adoption are based and used in some of the research articles considered. These theories include but not limited to Technology Adoption Models (TAM, TAM2, TAM3), Diffusion of Innovation (DOI), Resource Based-View (RBV), Grounded Theory, Migration Theory, Theory of Reasoned Action (TRA), and Technology Organization and Environment framework (TOE) (Senyo et al 2018, Lai, 2017). Among these theoretical frameworks though, only DOI and TOE have organisational level views well considered.

Basically, “Diffusion of Innovations” (DOI) theory, proposed by Rogers (1995) explicates the “process by which an innovation is communicated through certain channels over time among the members of a social system” (Rogers, 1995, p. 5 cited by Lai, 2017). It is a theory that concerns “with the way that a new technological innovation, progresses from creation to use” (Hsu, Ray and Li-Hsieh, 2014), and which identified the internal and external characteristics of organisation, and the individual characteristics of employees as drivers innovation (Rogers, 1995).

Hsu et al (2014) while acknowledging Roger’s model categorising of Technology and organisation in parallel, emphasised the significance of the new component added by Tornatazky and Fleisher – Environmental context. The authors explained further that the environment context is that stage on which organisation conduct their businesses – their industry, competitors, and dealings with government.

The Technology-Organization-Environment framework (TOE) therefore, is consistent with Diffussion Of innovation (DOI) theory, taking cloud computing as a technological innovation being “diffused” into the IT department of a university, an organisation and a social system, in an environmental context of the general policies surrounding ICT in the Nigerian educational sector. The fact that TOE framework captures all these features of technology, organisation and environment contexts therefore makes it not too surprising that it is more favoured in usage in research studies that explains innovation adoption in an organisation.

2.11 TOE framework

“The TOE framework as originally presented, and later adapted in IT adoption studies, provides a useful analytical framework that can be used for studying the adoption and assimilation of different types of IT innovation.” (Oliveira and Martins 2011)

In the course of developing TOE framework, Tornatzky and Fleischer (1990) came up with three identified dimensions or context groups; Technological, Organisational, and Environmental. The technological context refers to internal and external technologies as they influence the organisation. Organisational context looks into several considerable factors regarding the organisation that could affect the technology adoption, including “centralisation, formalisation, and complexity of managerial structure and the quality of human resources” (Low, Chen and Wu 2011), of the organisation. Finally, environmental context has to do with the industry the organisation belongs to and pressure within, trust, government policy and support (Lee et al, 2016).
The TOE framework model (Tornatzky and Fleischer 1990) adapted by Low, Chen and Wu (2011), is as shown in the figure below:

Figure 6: TOE framework model
Source: Adapted from Low, Chen and Wu (2011)

i) Technology context
The TOE model, as adapted by Low, Chen and Wu (2011), advocates – relative advantage, complexity and compatibility – as the three technological predictors of Cloud computing adoption. Relative advantage was defined by Rogers (1983) as degree to which a technological factor is perceived as providing greater benefit to an organisation (firm) (Rogers, 1983). It is only just reasonable that organisation take into consideration the advantages that an innovation offers before adopting it.
Understandably, new technologies takes some time to be understood by users, implementing Cloud computing therefore, could take some long and slow processes due to its complexity. Compatibility, on the other hand, refers to the degree to which the new technology fits with the existing values, previous practices and needs an organisation (Rogers, 1983).

ii) Organisational context
Organisational context also proposes three attributes - top management support, firm (organisation) size and technological readiness. As true for most, if not all projects, top management support is critical in providing the resources needed to adopt a new technology (Lin and Lee, 2005; Wang et al., 2010 cited in Low, Chen and Wu 2011). Likewise, the size of the firm has been found to play a major part in the adoption of a technology (Pan and Jang, 2008 cited in Low, Chen and Wu 2011).
The technological readiness refers to the existing infrastructure and IT human resources of the organisation, as they influence the adoption of new technology (Kuan and Chau, 2001; To and Ngai, 2006; Oliveira and Martins, 2010; Pan and Jang, 2008; Wang et al., 2010; Zhu et al., 2006 cited in Low, Chen and Wu 2011). As shown in some previous studies, firm with a higher level of IT capability tends to be more likely to adopt new technology ((Kamal, 2006; Kuan and Chau, 2001 cited in Hsu, Ray and Li-Hsieh, 2014). Technology readiness indicates people’s propensity to embrace and use new technologies for accomplishing goals in home life and at work (Parasuraman and Colby, 2001 cited in Lai, 2017).

iii) Environmental context
Low, Chen and Wu (2011), suggests that competitive and trading partners pressure are the key factors to consider in the environmental context postulated by TOE model. These two factors refer to the pressure from both competitors and partners within the industry that makes the organisation remain relevant, current and adopt new technologies (Low, Chen and Wu 2011; Oliveira and Martins 2011).

Based on the above, and as likewise acknowledged by Low, Chen and Wu (2011), that several studies found the TOE framework more complete and used same in explaining diffusion at organisation’s level (Hsu et al, 2014). This same model Technology-Organisation-Environment, developed by Tornatzky and Fleischer (1990) to analyse IT adoption by organisations will also be used in carrying out this study.
3. Methodology

3.1 Methodological tradition

Embedded within researches of any type are different philosophical assumptions (paradigms) about the world, the way it is viewed, how we are to study, understand and acquire knowledge about it. These have in turn led to different strategies of inquiry (methodologies) and ways of approaching how empirical materials are gathered and analysed (methods). Agostinho (2005) put these together based on Denzin and Lincoln who stated that “Strategies of inquiry put paradigms of interpretation into motion” and also “connect the researcher to specific methods of collecting and analysing empirical materials” (2000).

Scotland (2012) elaborated on research paradigm further with Guba and Lincon’s summarised characteristics of paradigm:

Ontology – What is reality?
Epistemology – How do we know something about reality?
Methodology – How do we go about finding it out?

Guiding these philosophical worldviews characteristics of ontology and epistemology are theoretical perspectives, three of which are commonly applicable to Information Systems worldviews, namely; positivism, interpretivism, and critical. Interpretivism however, is adopted as the philosophical assumption for this study from these theoretical perspectives. As further explained by Scotland (2012), interpretivism is of the view that reality is subjective and dependent on individual’s experience. It is a methodology that is concerned with understanding phenomena from individual’s perspective (Creswell, 2009, p. 8). These assertions dictated my choice of this paradigm in studying and understanding cloud computing phenomenon in the social construct of the research setting.

3.2 Methodological approach

Knowledge and meaningful reality are constructed in and out of interaction between humans and their world and are developed and transmitted in a social context. Therefore, individuals participating in a social world can only understand it from their own point of view (Crotty, 1998, p. 42, cited in Scotland, 2012). This is the perspective from interpretive angle. It is a perspective directed at understanding phenomenon from the experience of people participating in it, investigating interaction among them as well as the historical and cultural context in which they inhabit (Creswell, 2009, p. 8, cited in Scotland, 2012).

Therefore, since the goal of this study is to understand and explore the factors influencing and impact of adopting a phenomenon, cloud computing, in the social context of an IT department of a university where the participants are the staff, a qualitative approach using textual data is most appropriate. Quantitative approach, as opposed to qualitative, quantifies textual data, and thus may lead to the loss of this goal.

3.3 Methods of Data Collection

Regardless of study approach, quantitative or qualitative, a key decision for a researcher to make is method of data collection. As Levy (2015) explained the choice of the appropriate data collection methods in research is usually guided by the research philosophy and
methodology, as well as a number of logistical considerations. Additionally Conboy, Fitzgerald, and Mathiassen (2012) brought this well into information system by stating that “IS qualitative research aims to empirically investigate a variety of phenomena concerning IS through qualitative data from a variety of sources, such as interviews, observations, design efforts, interventions, and archival materials”. The exploratory nature of qualitative research makes it very useful, especially when the research is about gaining an understanding of underlying reasons, opinions and motivations.

This study therefore used semi-structured interviews with open-ended questions as the empirical method for data collection in order to understand the context and help in answering the research question. Seven interviews were conducted in the course of April, 2019. Two of the interviews took place on the main campus of the higher education institution in Nigeria, two re-arranged for off-campus, while the rest three were done over WhatsApp video phone call. The average duration of the interviews was 45 minutes with the longest being 70 minutes. The number of interviews conducted was guided by data saturation principle to ensure adequacy and quality to support the study. The interviews were then transcribed on paper and/or notes taken, for analysis purposes.

3.3.1 Interview Procedure

The interviews were conducted based on a set of questions identified while reviewing the literature. The questions aimed at exploring and getting as much information as possible on the adoption and use of cloud computing by the tertiary institution and how the adoption of the technology has had effect on the IT staff and the IT department generally. They were conducted in English language, and in less formal manner; which means the actual questions asked each participant depended on the course the interview was taking and responses given.

At the beginning of each interview, participants were presented with the aim of the research and given explanation about confidentiality, and their rights as volunteered participants. The consent form was then issued to each of the participant for signing.

Table 1 below shows codes assigned to each of the participants, and their job positions, so as not to reveal their names, as they have all asked for strict confidentiality.

<table>
<thead>
<tr>
<th>Participant Code</th>
<th>Job position</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>ICT User Support</td>
</tr>
<tr>
<td>P2</td>
<td>Integrated System and Facilities (Formerly System Administrator )</td>
</tr>
<tr>
<td>P3</td>
<td>Network Administrator and support</td>
</tr>
<tr>
<td>P4</td>
<td>IT Technician</td>
</tr>
<tr>
<td>P5</td>
<td>Senior analyst - Web and programming</td>
</tr>
<tr>
<td>P6</td>
<td>E-learning platform supervisor</td>
</tr>
<tr>
<td>P7</td>
<td>Assistant head ICT center</td>
</tr>
</tbody>
</table>

3.4 Data analysis

Qualitative data are expressed in words - such as derived for instance, interviews, written open-ended questions and pictures - and cannot be analysed using statistical method by the researcher to give meaning to the data. Therefore another method of analysis is used, “the
three C’s’” approach (*codes, categories, concepts*), as described by Lichtman (2013). The following process was then performed using this technique as depicted the figure 7:

![Figure 7: Data analysis process](Source: Adapted from Lichtman (2013))

1. **Initial coding:** The transcripts participants’ interview responses were broken into parts, and labelled with codes. This process generated and initially long coding list, so as to rule out bias.

2. **Revisiting and adjusting of the coding labels.** As new interviews were being conducted with new data becoming available, all labels were revisited and compared with one another. The aim of this exercise was to remove duplicates and identify the most useful data for further analysis. The results of coding are attached as A.3.

3. **Initial categorisation.** In the course of coding processing, the main categories were identified by bringing similar labels together, aligning them with the research question with the aim to answering them and ensuring the coding labelling categorisations also give a reflection of them.

4. **Evaluation and modification of the categories.** Identifying the categories in an all along enables adjustment and modification of the course the subsequent interviews would take in other to ensure all questions are covered and enough data were gathered.

5. **Initial themes.** Themes are patterns in data sets, which are connected to the research questions, to give insights to the problem topic. The more interviews were conducted and analysed, the clearer the emerging patterns were becoming and getting repeated. Moving from categories to concept was a key step in answering the research question.

6. **Evaluation of themes.** Once the amount of data generated and gathered in the course of the Interviews were saturated and the emerging themes satisfactory, the themes were then reordered so as to avoid redundancy and come up with a concise list.

### 3.5 Generalisability, Validity and Reliability

In contract with quantitative methodologies, generalisability, validity and reliability, are not of much imperatives in qualitative interpretive researches, since the concern is an understanding and interpretation of individual cases. This assertion supported that qualitative research studies context sensitive and complexity in IS practices, thus many researchers do not believe it is possible to generalise with it (Conboy, Fitzgerald, and Mathiassen, 2012). In essence, the conclusion cannot be generalised and therefore may require further researches in
the field and in different contexts, so that better understanding on the implications of the adoption of cloud computing technology may be acquired.

Validity concerns with the extent to which an empirical measure adequately reflects the real meaning of the concept under consideration, while reliability is about whether a particular technique, if and when applied repeatedly to the same object would yield the same result each and every time (Babbie pp.150 and 153). However, as this is a qualitative study, the validity of the research focuses on showing the arguments are well founded, and not necessarily whether or not it is generalizable onto a larger group. Validity is in two perspectives: internal and external. The internal validated checks whether the data collected reflect the reality. Some of the interview questions have been designed in a way that they cross check one another and highlight participants’ responses that seem conflicting.

External validity involves generalising the observations collected in respect of other objects and/or contexts. In other words, the sample used must be targeted at and be a representation of the problem. This is addressed by giving detailed description of the participants and settings in its specific context.

Reliability is much of estimation in qualitative research, by comparing the results of various researchers, when there are several, and from the work done on the encoded raw data. The evaluation of the reliability of the research (reliability of the research results) is based on establishing and verifying that the different operations of a research can be repeated with the same results by different researchers (Drucker-Godard et al., 1999).

3.6 Ethical consideration

Ethics in research is about adhering to certain moral principles throughout the live of the research process, in terms of planning, conducting, as well as reporting. While IS research is a bit different from other forms of social sciences research, nearly same ethical principles are applicable, especially to the human subjects who are participating in the research. Gaining informed consent of individuals involved, upholding confidentiality with no deception, and being fair to all as much as possible are the generally accepted ethical principles expected to be followed (Mingers, and Walsham, 2010).

Consent of volunteered participating individuals and as required from the IT department were sought during the course of the research as in the consent form (Appendix A.2) Participation, of course was voluntary with the right to withdraw or not give answer(s) to question(s) that may be posed during participation (interviewing). The interview guide is attached as appendix A.1.
4. Empirical Findings

This chapter presents the empirical findings. Six themes emerged from the thematic data analysis of the interviews as follow:

1. Change in IT staff responsibilities
2. Changes in focus and skills
3. Changes to processes
4. Complexity and compatibility
5. Cost Advantage vs. budgeting
6. 24/7 support model

The six evaluated themes came about from the seven categories identified as result of revisiting and re-analysing the seventy eight codes generated from the processed seven interviews conducted. The codes and categories generated from each interview are shown in appendix A.3 and A.4 respectively, while Table 11 as appendix A.5 depicts the themes (Concepts), Categories and the Condensed finally processed Codes.

The themes are described below in no particular order while quotes are used to highlight the participants’ thoughts and opinions. The participants are rather referred to by their participating codes, P1, P2 to P7 than their names for the sake of the agreed confidentiality.

Theme 1: Change in IT staff responsibilities

Data extracted from the interviews show that the role of the IT department before cloud computing was to provide IT services to users, such as staff, students and researchers (Sultan 2010). Interviewee P2 confirmed the findings in the literature review:

“ICT department used to provide all needed services to staff and students before cloud computing”

Participant P4 also talked in the past given the impression of a change in what his section used to look after:

“Well... my area is much of an enabler service. We looked after all the hosted virtual and physical infrastructure in the data center, acting as back-end to some services such as emails. We don’t do networking though ...the team is different from ours.”

In similar manner, participant P6 mentioned that:

“...eLearning platform used to be hosted by the ICT department but has now been moved to the cloud. The maintenance of the operating systems and applications, including updates, were then the responsibility of the IT department”.

He expressed his thoughts further on how IT staffs (ICT department) responsibilities have changed by adding that:

“Now that our email systems have been moved to cloud office 365, we don’t have to worry much about mailbox sizes and most of other email services”.
“As matter of fact various people are affected as we move the cloud at different level, especially the system administrators and desktop support. It dependent on which service is next on focus”

While participant P3 seemed not to be feeling the impact of the changes directly yet, by saying:

“As part of the big team, my section provides connectivity between services, the internet and other campuses to the main one. …no much impact on the IT network staff”

Participant P6 however, poked further into more possible changes and expectations from the staff and department:

“All staffs are likely to be affected in the future anyway. For now it’s mostly members who use physical hardware but are now directly moved to virtualization. IT Staff who support users on shared drive and emails services are also affected. Focus is more on service delivery now rather than supporting physical machines.”

It would appear that most IT staff are affected by the adoption of cloud computing and thus the creating an overall change in responsibilities of the ICT department. Few staff like those in networking section as participant P4 however, seemed not yet affected.

Theme 2: Changes in focus and skills

Responses from participant P2 show that new skills are required when he commented that:

“Cloud computing surely requires re-skilling as an IT staff. It’s like any new technology …comes with opportunities and challenges”.

The same staff can be re-skilled and still perform role in different area. As a lead, interviewee P7 observed as follows:

“Hardware support is the most affected skill for now as things are moved to the cloud. Then skills about managing and prioritising of network traffic to avoid bandwidth issues. Policy based network prioritisation of bandwidth utilisation and layered security are few of the skills staff are being trained and encouraged to have now. Generally I wouldn’t say cloud reduce the skills or IT staff so far, though position may change as staff re-skill.”

One of the respondents, P1 explained the expected change in focus:

“The direction is towards cloud computing, so is the skill set focus. Administering the services rather than the hardware itself is now more expected. This could be seen in recent skill requirement …it’s a bit more complex from HR perspective. Emphasis is on people re-skilling anyway…as in same people but doing different jobs.

As part of some new technical and managerial skills highlighted by some of the interviewees, Technicians need to understand and attend to users with email-related problems in the cloud.

Interviewee P7 commented:
“There is a big shift in the management of infrastructures, in respect of managing them in the virtualised in the cloud. Well, I wouldn’t say very new skills but a learning curve in relation to the product knowledge.”

He elaborated further:

“More of soft and project management skills are needed though as plans come up to adopt cloud the more. Moving the email to cloud office 365 is a big relief about mailbox sizes and email related issues; however values added by the cloud also need to be managed.”

“Trainings are also being organised on cloud technology such as Microsoft Azure, Office 365 and SLA management, with certification in the subject matter encouraged.”

All participants, one way or the other, acknowledged top management support for the adoption, especially in the so much concerning area to them – trainings and opportunities to re-skill in order to continue to fit in in the changed environment.

Participant P7 as the closest to the top management among the interviewees, emphasized:

“The adoption wouldn’t have been possible without the buy-in of the top management. This is a new technology that its delivery could be service disruptive. Top management support is definitely crucial, with valid business case presented and approved before a finger could be lifted on the projects.”

Despite participant P3 earlier remark that the network section is not directly affected, he still mentioned that:

“...We need to get more skills on security side though.”

Interviewee P5 opinionated that:

She further added, “So far the technologies being adopted meet the needs of the users, and we are given the resources to learn and deliver, we are happy”.

The positive notion being given about trainings and re-skilling was however tainted by participant P7 when he mentioned that:

“Staffs are being re-trained for new skills needed though ... We can only talk of people losing job in the event that they can’t re-skill.”

Participants seemed to appreciate the managements’ given opportunities and time to re-skill, in line with the adopted technology, but Participants like P7 also gave tacit indication of limitations that lead can eventually lead to job losses.

Theme 3: Changes in processes

Participants showed, from the data collect from them, that there have been changes in their operational processes. Participant P3 mentioned concern that:
“We don’t have control over performance tweaking any longer as the service stacks are outsourced. Everything is now about the signed up SLA. Bottlenecks do happen. Bottlenecks performance issues do happen sometime when connecting to cloud services.”

Participant P1 remarked:

“There was this initial confusion about change in model of calls logging. It’s natural for users to seek assistance from the ICT department when they have any IT issue, whereas there are some of these issues that they could contact the service provider directly about”.

Change in data Security assurance process also came up as an issue. Participant P4 raised the issue that:

“One is does not really know where and how safe data kept by the service provider are. In some cases, IT staffs have to seek permission and do not have privilege access to ensure data are protected according to expectation.”

Concerns were expressed about the initial disruptions the changes in operational processes caused due to the adoption of the cloud- permission to data issues, call raising, backup and restore etc.

Theme 4: Complexity and compatibility

Despite the fact the most of the participants are technical and have prior understanding of Cloud computing technology, and even are familiar with a bedrock part of cloud computing technology, virtualization, yet they expressed the impact the complexity and compatibility issues its adoption brought along. For instance, Interviewee P4 highlighted the complexity issue:

“It’s a bit challenging during migration, with different vendors working in different manner and times”.

Another participant P2 remarked:

“Integrating different cloud services with the existing infrastructure is always complex and could be somehow challenging.”

Participant P7 also highlighted some challenges around decision-making on choice of vendors due to compatibility issues:

“A lot of considerations had to be given to finding suitable solution. Most of the vendors did not have a very clear compatibility matrix for their solutions”.

He further added:

“Anyway, most of the cloud providers seem to be making their products more compatible with flexibility in supports. Compatibility with existing infrastructure is always an issue that requires careful attention”

The size of an organisation has been expressed as a factor in a process of adopting new technology. This was also pointed out as another source of complexity issue that arose as an
indirect impact on the IT staff in a large organisation such as the institution, as expressed by participant P1:

“Perhaps it might be easier for smaller and newly established institution to move to new technology such as the cloud. My understanding here is that it’s not that straight forward for fairly large institution like ours, as we have more users to support”

Participant P1 assertion was confirmed by participant P7 by remarking that:

“I can say it’s not that easy for an established institution of our size to adopt a new technology. Investment has been made on internal hosting so we have to consider seriously what the options are before making decision about adopting any new technology.”

He went further:

“As earlier mentioned, the issue of compatibilities was looked into deeply while staff had to be given some sort of training awareness ... though the virtualization was not totally new to them.

Likewise Participant P6 mentioned the fact that the concept was not new but size of the institution contributes to the complexity of the adoption:

“While the concept of the cloud is not entirely new, yet adopting the technology into an established internal service of a big institution like ours could be a daunting task. We had to ensure resources are ready and available before a lot of decisions are made.”

The interviewees seemed to have linked the size of the institution, in this case a large organisation to the level of complexity being encountered while adopting cloud technology and the challenges of technical compatibility with the cloud products being offered by various vendors. The larger and established the organisation the complex it maybe adopting a new technology, as an inference from the findings.

Theme 5: Cost Advantage vs. budgeting

Majority of the participants expressed the opinion that perceived reduction in cost of delivering IT services was a major factor in making decision to adopt cloud computing, which though has given the institution some relative advantage over some other institution but on the other hand had some effect on their role as well – in terms of determining allocation of IT resources, priorities and budgets in institution. For example, Participant P7 hinted that:

“We also give estimation to our allocated budget and spend it in as efficiently manner as possible and we see deemed, for giving the best of service to the institution”

One of the participants P6 observed:

“...of course, outsourcing is noticeably cheaper than on-site hosting”.

He went further to buttress the assertion, that:
“Cloud services have greatly reduced the need for new physical devices or parts, a cost advantage that has given us opportunities of starting new projects. We are engaging all the service models; SaaS, IaaS and PaaS ... as they are popularly known”

Further response from P7 that was positive for the institution generally was:

“The cost advantages of the cloud have enabled us not to only keep up with other older and bigger institution but also brought some of our ambition into reality earlier than some of our counterparts. It gives opportunities to start some new projects”

“I think 24 by 7 services have enhanced more collaborative research and remote teaching than offered by some others.”

He continued:

“Buying hardware is significantly reduced, so the power consumption. What we concentrate more on now is ensuring everyone is connected safely at all time.”

Depending on perspective of view, the relative cost advantage that accompanies the adoption of cloud computing was expressed by participants.

Theme 6: 24/7 support model

Participants talked about change in supporting model that rather than they doing the actual supports for most users themselves, the cloud service providers now only do this but also do it anytime of the day or night throughout the year, a model popularly as 24 by 7 model.

The participants P6:

“Not so much from my side. The provider actually offers the services and we raise a call in most cases if there are any issues. They maintain the systems as well on 24/7 service basis.”

Interviewee P7 added:

“...the 24/7 support for services in the cloud is just a good thing. Providing services after working hours was somehow difficult for us, we get that from the service provider now”

He re-emphasised:

“The fact that we can now have 24 by 7 supports from the cloud provider for services moved is just great ...and increases productivity too.”

In some ways the fact that some other universities have been able to move to the 24/7 service model as a result of adopting cloud computing, seemed to have had some pressure on the ICT department, as for instance, participant P7 further hinted:

“The pressure was much of external ...I mean indirectly from the industry. There are a lot of private universities around now running quite well and competitively in the cloud. Each time there are noticeable issue with IT, the voice to replace the legacy service was always going higher – the remote and external programmes centers especially ...vendors as well”.
Participant P4 responded:

“Really, cloud computing is one of the buzz technologies around and I wouldn’t say there weren’t pressure, internally and externally, in terms of calls to replace old legacy services with the cloud”.

Participant added another dimension to the notes about the pressure being felt by the institution as regards the call to rather have the 24/7 running IT infrastructure in the cloud than the traditional on-premises, by remarking further that:

“Running a more energy efficient IT is another pressure these days – greener IT being another buzz word. Virtualization and the cloud evidently bring this about, at least from this end; we do not know the level of energy consumption at the other end though”
5. Discussion

This chapter provides an overview of the study and centers discussion on the themes that emerged from the interviews transcriptions and some of the previous studies or similar topics in the literature reviewed, as they relate to the aim of the study, and abide by the boundaries of the TOE framework model for technology adoption.

5.1 Empirical findings vs. literature

This section describes findings relevant to the research question "What are the perceived impacts of adopting cloud computing on an IT department and its role as service provider to a tertiary institution in a developing country?", and gives summaries in relation and comparison to the reviewed literature. Tables are used to depict comparison of empirical findings and the reviewed literature.

Theme 1: Changes in IT staff responsibilities

The role of the IT department prior the introduction of cloud computing was to provide ICT services and supports to various users working with and for the TEI, such as students, staff, researchers, lecturers and any other authorised users. They were providing services of all kind; email, e-learning, technical support, hardware and software infrastructure maintenance, networking and connecting other campuses and users of the university to the main one, as well as provision of virtual environment in teaching and research (Monroy et al., 2012; Dumas, 2016). They were also responsible for managing the databases, applications, dealing with risk management and data recovery when required. IT budgeting was also in their care (Skiba, 2011).

The introduction of cloud computing however, redefined the type and nature of work that are traditionally performed IT staff and reshaped the type IT costs within the control of the department. The hardware and technical support have significantly reduced with email services and other applications for e-learning all migrated across to the cloud, while there is some surge in connectivity and user access support. These findings are depicted table 2 below.

Table 2: Comparison of IT staff responsibilities - empirical findings and literature

<table>
<thead>
<tr>
<th>Literature Review</th>
<th>Reference</th>
<th>Empirical finding</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Maintenance of IT infrastructures.</td>
<td>Sultan, 2010</td>
<td>• Maintains Hardware infrastructure.</td>
</tr>
<tr>
<td>• User support.</td>
<td></td>
<td>• Provides user support</td>
</tr>
<tr>
<td>• Manages network and internet connectivity.</td>
<td>Monroy et al., 2012</td>
<td>• Provides networking and connectivity support between services and other campuses to the main campus.</td>
</tr>
<tr>
<td>• Do System developments.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Administration of website pages.</td>
<td>Monroy et al., 2012</td>
<td>• Database administration</td>
</tr>
<tr>
<td>• Servers and databases management.</td>
<td></td>
<td>• Data integration</td>
</tr>
<tr>
<td>• Provides virtual environment specialised in teaching and research</td>
<td>Dumas, 2016</td>
<td>• Hosts virtual and physical infrastructures</td>
</tr>
</tbody>
</table>
Theme 2: Changes in focus and skills

Meanwhile, as the introduction of cloud computing leads to a decrease in demand for traditional roles, such as desktop support, system administrators and developers, so it introduces new positions that require new skills on cloud computing and techniques, such as data integration, policy based networking and security in a virtualised cloud environment. Other new or improved skills required are services, SLA, and sharpened project management skills.

Cloud computing comes with a decrease in functions within the ICT department, such as system administrators, developers and desktop supports. There was however, no job loss in the department but great shift in focus for the exiting staff on re-skilling. The HEI encourages and gives staff room and opportunities for re-training and development, such which might not be readily obtainable in the corporate world. Microsoft AZURE cloud, Cisco Cloud and Office 365 are some of the trainings and possibly certifications that IT staff requested and encouraged to obtain.

Table 3: IT staffs focus changes - empirical findings and literature

<table>
<thead>
<tr>
<th>Literature review</th>
<th>Reference</th>
<th>Empirical findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The introduction of cloud computing do transform IT skills.</td>
<td>Brooks, 2015</td>
<td>• Cloud computing changed the focus of skills</td>
</tr>
</tbody>
</table>
| • Some IT skills have changed in focus after the introduction of cloud computing.| Al-Lawati. and Al-Badi, 2016 | • Cloud computing altered the focus of skills.  
• The expectation is more of administration of services  
• Staff re-skilling                                                                    |
| • New managerial skills arise with cloud computing adoption.                    | Carraway et al. 2015 | • Project management skills  
• Better collaboration and Team development                                             |
| • New technical skills arise with the introduction of cloud computing.          | Bedrossian et al, 2014 | • Policy based networking  
• Cloud Office 365  
• Data integration                                                                     |
| • Most staff would be affected                                                   | Brooks, 2015     | • IT staff are affected  
• Network staff are the only one not yet affected                                      |
| • IT staff, such as system administrators and desktop support are affected.      | Brooks, 2015     | • System administrators affected  
• Desktop Support affected                                                            |
| • Decrease of job positions                                                      | Brooks, 2015     | N/A                                                                                |
Theme 3: Changes to processes

Another concern that emerged during the course of the interviewing was the potential for initial internal confusion in terms of users being aware of new processes and ICT direct responsibilities. Different service models engaged in Cloud computing based on top management decision may lead to the need for making different and necessary processes in respect of supports from the cloud providers. This may initially not be clear to users and thus cause some initial internal confusion or conflict.

This observation was also supported in the literature reviewed and summarised in table 4 below.

Table 4: Changes to processes impact - empirical findings and literature

<table>
<thead>
<tr>
<th>Literature review</th>
<th>Reference</th>
<th>Empirical findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in business processes</td>
<td>Dutta et al., 2013</td>
<td>• Initial internal confusion</td>
</tr>
</tbody>
</table>

Theme 4: Complexity and compatibility

As needs and requirements are different leading to the need to integrate more than one solutions for cloud, the observation was made the participants that the process of the adoption was rather complex. There were quite a number of factors that needed to be considered by the managements before the technology could be considered for adoption due to this complexity. This complexity does not come in terms of technicality only but also in other manners, such as legal. Issue of data jurisdiction could be a complex one in situation where data could be anywhere in the cloud.

In same category of impacts which could also be compounded by complexity is compatibility. Participants as well as the literature reviewed revealed that these two factors play role in the adoption process as well as impacting the IT staff and thus the ICT department role.

Table 5: Complexity and compatibility - empirical findings and literature

<table>
<thead>
<tr>
<th>Literature review</th>
<th>Reference</th>
<th>Empirical findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Technical complexity and challenges</td>
<td>Dutta et al., 2013</td>
<td>• Integration complexity</td>
</tr>
<tr>
<td>• Legal complexity</td>
<td>Dumas et al., 2016</td>
<td>• Compatibility issues</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Working with different vendors</td>
</tr>
</tbody>
</table>

Theme 5: Cost Advantage vs. budgeting

Participants acknowledged one of the main reasons that organisation adopts the cloud is cost, but that also lead to a shift in control and allocation of resources as they can no longer determine this as the department used to do before cloud computing was adopted. It however was a value adding factor to the institution as revealed in the literature reviewed as well as in the course of the empirical findings.

Table 6: Cost Advantage vs. budgeting - empirical findings and literature

<table>
<thead>
<tr>
<th>Literature review</th>
<th>Reference</th>
<th>Empirical findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Cost advantage</td>
<td>Rajaraman, 2014</td>
<td>• Budget room for new projects</td>
</tr>
<tr>
<td>• SaaS, IaaS and PaaS service models</td>
<td>Mell, and Grance, 2011</td>
<td>• Mix and Match of the three known models</td>
</tr>
</tbody>
</table>
Theme 6: 24/7 support model

The 24/7 support and services that cloud computing offers users is big value adding from the HEI management and users perspective. The remote and online programmes run much better and users can now access systems from any device any time and nearly anywhere, thus giving an upward surge to the profile and efficiency of the institution.

However, there are general fear of loss of jobs by the staff, at least initially and still in a way prevails, as staff expressed some low morale and sense of uncertainty due to changes of practice and skills required to perform well in cloud. The network team however, seems not to be greatly impacted as others, as traditional positions such as network administrators still exist and being expanded.

Table 7: 24/7 support model empirical findings and literature

<table>
<thead>
<tr>
<th>Literature review</th>
<th>Reference</th>
<th>Empirical findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Possible job loss</td>
<td>Choudhary et al. 2016</td>
<td>• Decreased staff function</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• No job loss yet</td>
</tr>
</tbody>
</table>

5.2 Empirical findings vs. TOE Adoption framework

This section describes indication that the study supports the TOE framework model for new technology adoption and of course its impact on the role of an IT department of a higher education institution in a developing country, as shown in the empirical findings.

As revealed during the interviews, the HEI engages the three known service delivery models for cloud, and thus makes the setting a good one to study in respect of the framework for adoption and the impacts it brought.

5.2.1: Technology context

The first of the three contexts of the TOE framework is technology and based on three factors namely; relative advantage, complexity and compatibility (Low, Chen and Wu 2011). The comments and explanations from participants P6 and P7 declared relative advantages in terms of cost that the institution derives from adopting cloud computing, compared to others that have not, giving the institution to run new projects. However, this has indirectly affected the IT department as it did create a shift in budgeting, thus they cannot determine allocation of resources and spending on infrastructure as they used to prior the adoption.

Likewise, participants acknowledged the complexity involved in implementing cloud computing, especially in a fairly long established and large institution like theirs. This also seemed to have led to more compatibility issue as lots of “legacy” technologies have been invested on. Participants P7 again emphasized the time and efforts taken filtering information around multiple vendors and products compatibility, and thus impacting the IT department in respect of resources committed. This confirms the three factors in technology context of the TOE framework as summarised in table 8 below.

Table 8: Technology context and empirical findings

<table>
<thead>
<tr>
<th>TOE framework</th>
<th>Reference</th>
<th>Empirical findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Relative advantage</td>
<td>Rajaraman, 2014</td>
<td>• Budget room for new projects</td>
</tr>
<tr>
<td>• Complexity</td>
<td>Dutta et al. 2013</td>
<td>• Integration complexity</td>
</tr>
</tbody>
</table>
5.2.2: Organisational context

In the course of interviewing, most of the participants indicated the necessity of top management supports. One of these supports was approvals of trainings and opportunity of time to learn the new technology and adapt to the new service culture. While the support from the management was a morale booster and affirms a factor in TOE organisational context, the fact that resources were being committed and by both the management and staff to the new technology was an impact occasioned by its adoption.

Moreover the size of the institution as another factor also came up number of times during the interviews. The findings, in contract to one of the literature that firm with a higher level of IT capability tends to be more likely to adopt new technology ((Kamal, 2006; Kuan and Chau, 2001 cited in Hsu, Ray and Li-Hsieh, 2014)). Participants’ opinion suggested that smaller organisation might find adopting the technology easier than large organisation like their institution. Large organisations tend to invest or have invested in their own infrastructure, and might prefer to own their own cloud rather than from a third party. Adopting this new technology therefore in a large organisation had greater impact on implementation, and thus on the IT department. It also satisfies TOE framework adoption model that considers firm or organisation size as a factor.

Furthermore, the fact that the concept was not totally new to the ICT environment played a role in the adoption process. Participants P2 and P4 revealed during the interview that they were already familiar with virtualisation concept, as one of the bedrock of cloud computing. This fact coupled with existing infrastructure compatibility indicates technology readiness for the adoption. The technical virtualisation exposure and experience the staff have as core skills however, had to be relinquished to the cloud provider as the new provider of services, bringing along with it changes in processes, service support model etc. Table 9 shows TOE framework in respect of organisational factors and the empirical findings.

Table 9: Organisational context and empirical findings

<table>
<thead>
<tr>
<th>TOE framework</th>
<th>Reference</th>
<th>Empirical findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Top management support</td>
<td>Low, Chen and Wu, 2011</td>
<td>● Top management support crucial</td>
</tr>
<tr>
<td>● Organisation size</td>
<td>Oliveira and Martins, 2011</td>
<td>● Large size is a factor</td>
</tr>
<tr>
<td>● Technology readiness</td>
<td></td>
<td>● Many users to support</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Change in processes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Cloud concept not entirely new</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Resources ready and available</td>
</tr>
</tbody>
</table>

5.2.3: Environmental context

Lastly, the environmental context of TOE framework model was suggested to have “Competitive pressure” and “Trading partner pressure” as the two environmental in adoption of new technology like cloud computing which potentially pose some impacts on the role of a typical IT department of an higher education institution.

Competition from other organisations in same industry, in this case tertiary institutions in the educational industry puts some pressure on the institution in study in respect of its decision to
adopt the cloud solutions, as indicated in the course of the interviews by participants P4 and P7. This is due to the fact that some of the competitors and collaborating institutions, as “trading” partners, were already using cloud technology successfully. In some ways, as gathered from the findings, they also had to respond quickly to the trend, and even ahead of some others.

Participant P6 added the dimension of the rising call for more environmentally friendly IT practice, such as Green IT, as some of the external pressure the ICT departments experienced in relation to adoption of cloud computing.

These findings go along with the TOE framework model suggestion that competitive pressure and trading partners are influential factors when making decision about cloud computing adoption. Table 10 shows TOE framework in respect of environmental factors and the empirical findings.

Table 10: Environmental context and empirical findings

<table>
<thead>
<tr>
<th>TOE framework</th>
<th>Reference</th>
<th>Empirical findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Competitive pressure</td>
<td>Low, Chen and Wu, 2011.</td>
<td>• Internal and external pressure</td>
</tr>
<tr>
<td>• Trading partner pressure</td>
<td>Oliveira and Martins, 2011.</td>
<td>• Trend pressure in the industry</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pressure for Greener IT</td>
</tr>
</tbody>
</table>
6. Conclusions and future research

6.1 Conclusions

The main objective of this study was to explore adoption of cloud computing, and its impact on the role of IT department in a higher institution. In order to achieve this objective, one research question was set for answering:

- What are the perceived impacts of adopting cloud computing on an IT department and its role as service provider to a tertiary institution in a developing country?

The objective of answering the question was approached with the review of existing and related literature, providing the definition of Cloud Computing, its various types as well as characteristics. Its benefits and challenges were also reviewed. While a number of technology adoption theories were revealed in the course of reviewing previous researches on similar topics, the TOE framework (Tornatzky and Fleischer 1990) (Low, Chen and Wu 2011) however, was found to be most suitable for this study. The framework identified three main contexts for exploration namely: technological, organisational and environmental.

In order to achieve the aim of this study and answer the mentioned question, a qualitative research was conducted with seven semi-structured interviews among the employees of the ICT department of a tertiary education institution in South Western part of Nigeria.

During the course of analyzing the empirical findings six themes emerged, based on Litchman “3Cs” approach (codes, categories, concepts) namely: Change in IT staff responsibilities, Changes in focus and skills, Changes to processes, Complexity and compatibility, Cost Advantage vs. budgeting, and 24/7 support model.

The answers to the impacts the technology adoption had, and still having on the role of the higher institution ICT department came through both approaches engaged - the literature reviewing and conducting empirical findings within the ICT department. It was obvious that the role of the traditional IT department has been significantly altered by the advent and adoption of cloud computing in the HEI in study, affecting directly most of the staff in the department. Another finding however was that, the institution had reacted encouragingly towards the staff in cushioning the effect of this adoption by way of re-training and giving them time to adapt to the technology and new service culture. The identified three main context of TOE framework for new technology adoption - technological, organisational and environmental – were also confirmed.

6.2 Contribution

This study contributes to the body of knowledge on cloud computing as it analysed its impact on the role of an ICT department in a tertiary education institution in the Southern Western part of Nigeria. It is a study that deviates from the purely technical aspect of the technology that seems to be the focus of most previous studies, and offers elaborated understanding into the impacts cloud computing adoption do or could have, specifically on the IT departments of TEIs. The study took a dive into the real world of HEIs as organisations, and could give researchers a springboard to take a deeper dive into investigating IT departments’ post cloud computing adoption - still within the context of developing and emerging economy countries.
The study also confirms suggested factors in TOE framework as a model worth being noted when making decision surrounding the adoption of cloud computing as a new technology to an organisation in respect of impacts such adoption might have. It also could serve as a wakeup call to both staff and the management of organisations still delivering IT services in the traditional ways that some or all the factors highlighted by study and the TOE model could prompt a change in view by top management, especially as the going gets tougher in respect of finances available for IT services delivery.

6.3 Future research

There are limitations to this study that call for further researches on the topic or as closely related as possible. One recommendation would be to see if quantitative method cloud be used in analysing the relationship between the factors influencing the adoption and the impacts on the role of IT department using a larger or multiple samples for more data that could facilitate generalisation.

Likewise, different model could be used in examining the cloud adoption influencing factors and impacts it may have on the IT department of a different industry than education. Perhaps a better understanding of the factors and possible challenges may be provided.

Another research may also consider assessing specific business value of different types of cloud computing services especially as could be beneficial to the developing countries.
References


Choudhary, V. and Vithayathil, J. 2014. The Impact of Cloud Computing: Should the IT Department Be Organized as a Cost Center or a Profit Center? [online] <https://doi.org/10.2753/MIS0742-1222300203>


Dumas et al., 2016. Determinants of the Decision to Transform Towards Cloud : An Exploratory Analysis of 225 CISCO Case Studies, 49th Hawaii International Conference on System Sciences (HICSS) Koloa, HI, USA, 5-8 January 2016. IEEE. <https://doi.org/10.1109/HICSS.2016.490>


Elo et al 2014. Qualitative Content Analysis: A Focus on Trustworthiness <https://doi.org/10.1177/2158244014522633>


A. Appendices

A.1 Interview guide

1. What are the roles of the IT department (also known as ICT or Digital services) before the adoption of cloud computing?
2. What service model of cloud computing has the institution IT Department adopted?
3. How does the introduction of cloud computing affect the skill matrix of the IT department staff?
4. What are the new technical skills required in the IT department following the adoption of cloud computing?
5. What kind of training(s) are needed in the IT department as a result of adopting cloud computing?
6. What are the new managerial skills required in the IT department as a result of adopting cloud computing?
7. What number of staff members of the IT department are affected by the adoption of cloud computing?
8. How has the IT department increased its business values to the institution as a result of cloud computing adoption?
9. How do you think the adoption of cloud services has given the institution relative advantage over others?
10. Were there any other technological factors considered that influenced the final decision of adopting cloud computing services by the institution?
11. How supportive was the top management of the institution and was this a factor in the adoption process?
12. How do you think the size of the institution influenced the adoption decision?
13. Do you think that technological readiness was also a factor when the institution took the decision to adopt Cloud services?
14. What other organisational factors were considered before the final decision to adopt Cloud services was made?
15. Did competitive pressure influence your decision to adopt cloud services in any way?
16. What other environmental factors were put into consideration before a final decision to adopt Cloud services was made?
17. How challenging a process did you see the complexity of adopting cloud computing?
A.2 Consent form

Linnaeus University, Information Systems Department.

Title of research: “Cloud computing: Factors influencing adoption and Impact on the role of IT department in an Higher Education Institution.”

You are asked to participate in a research study being conducted by Stephen Adebayo, as part of the requirement for the completion of his Master thesis at the Linnaeus University, Sweden.

You are selected as a possible participant in this study based on your key position in the institution, your knowledge of its organisation, and processes in respect of Cloud computing and/or Information Technology (IT) that can help in answering some of the research questions.

Researcher: Stephen Adebayo
Email: sa223uq@student.lnu.se

Supervisor: Konstantina Pentarchou
Email: kp222ch@lnu.se

Aim
This research aims at exploring Cloud computing: Factors influencing adoption and Impact on the role of IT department in an Higher Education Institution.

Procedure
Volunteering to participate in this study means you would be asked to do the following:

i. You will be supplied with the interview questions so that preparation may be made prior to the face-to-face interview.
ii. The interview may last up to an hour.
iii. The interviews will be recorded using a voice recorder or a mobile phone, under your permission. The meetings will take place at a site of your choice at any time suitable and convenient for you.

Potential Dangers
Your participation in this research poses no danger, while the materials of the interviews will exclusively be used for the purposes of his research.

Confidentiality
The information you give will remain confidential and be held safe. Only the researcher and his supervisor will have access to the research data. All the data of the research will be held until its completion and will be deleted afterwards. Your name will not be revealed and it will not be linked with any of the findings.

Participation and Withdrawal
Your participation in this study is voluntary. You can choose to withdraw your participation at any time, even during the interview. You can also refuse to answer any question you do not want to answer during the interview, and remain in the study.

Right to ask question
You can ask the researcher any question by contacting him before, during or after the interview.

Consent
I agree to take part in the research “Cloud computing: Factors influencing adoption and Impact on the role of IT department in an Higher Education Institution”, conducted by Stephen Adebayo.

I agree to be audio-recorded.
☐ Yes ☐ No

Date Participant Researcher

Participant interview consent form
A.3 Coding

**Interviewee 1** (ICT User Support)
1. Focus changing to cloud computing
2. Cloud computing is complex
3. Nature of user support changes
4. Contribute to user training
5. Needed training
6. Some users confused
7. Email issue call greatly reduced
8. User concerned on data location
9. Concern about backup
10. Concern about data restores
11. Changed service model
12. Office 365 training
13. Change in daily tasks

**Interviewee 2** (Integrated System and Facilities)
1. Complexity of Cloud computing
2. Compatibility issue of products
3. Legacy software
4. Legacy infrastructure
5. Prior exposure to cloud
6. Cloud is buzz word
7. Virtualisation experience
8. provided all services
9. Technologies integration
10. Re-skilling required
11. trainings for all
12. Decreased functions
13. Had to change role

**Interviewee 3** (Network Administrator and support)
1. Ensuring campuses connectivity
2. Ensuring internet connectivity
3. Additional skills
4. Network security
5. Not affected by cloud adoption yet
6. Change in processes
7. Limited performance troubleshooting
8. Dependence on provider agreed SLA

**Interviewee 4** (IT Technician)
1. Cloud technology awareness
2. Familiar with virtualization
3. Skill re-focusing
4. Technologies changing too fast
5. Cloud buzz technologies around
6. Change in processes
7. Complexity in implementation
8. Change to the infrastructure
9. Change in support model
10. Compatibility issue
11. Loss of control
12. 24/7 support from cloud provider

**Interviewee 5** (Senior analyst - Web and programming)
1. Right technologies matter
2. Re-skilling required
3. Trainings required
4. Enough time for learning curve
5. Change in processes

**Interviewee 6** (E-learning platform supervisor)
1. Cloud technology not new
2. 24/7 service great value
3. Better distance learning delivery
4. It's large institution
5. Training and re-skilling of staff
6. Vendor and SLA management

**Interviewee 7** (Assistant head ICT center)
1. Top Managements support is crucial
2. Project management skills required
3. SLA management skills
4. Top Management support staff
5. Top management support for projects
6. Adoption Complexity
7. Technology compatibility
8. IT staff need to re-focus and re-skill
9. Staff may lose job
10. Internal pressure
11. Decisions on models
12. Competitors pressure
13. Relief on email and mailbox related issues
14. Better collaboration
15. Cheaper 24/7 supports and maintenance value
16. Competitive remote and off-campus programmes
17. Off-campus service availability
18. Shifts in budgeting
19. Reduction in power consumption cost
20. Green IT trend pressure
21. Vendors management

**A.4 Categories**

1. IT department role before cloud computing adoption
2. IT department role after cloud computing adoption
3. New skills expertise requirement
4. Complexity and challenges posed
5. Changes in operational processes  
6. Advantages and value addition of cloud computing  
7. Internal and External pressure

A.5 Table 11: Themes (Concepts), Categories and the condensed Codes

<table>
<thead>
<tr>
<th>Themes</th>
<th>Categories</th>
<th>Condensed Codes</th>
</tr>
</thead>
</table>
| • Change in IT staff responsibilities | • IT department role before cloud computing adoption  
  • IT department role after cloud computing adoption | • Change in daily tasks  
  • provided all services  
  • Decreased functions  
  • Loss of control  
  • Technologies changing too fast  
  • Email issue call greatly reduced  
  • Virtualisation experience  
  • Legacy software  
  • Legacy infrastructure  
  • Change to the infrastructure  
  • Ensuring campuses connectivity  
  • Ensuring internet connectivity |
| • Changes in focus and skills  | • New skills expertise requirement | • Focus changing to cloud computing  
  • Needed training  
  • Re-skilling required  
  • Had to change role  
  • Staff may lose job  
  • Vendor and SLA management  
  • Cloud technology not new  
  • Contribute to user training  
  • Office 365 training  
  • Cloud is buzz word  
  • Enough time for learning curve  
  • Project management skills required |
| • Changes to processes        | • Changes in operational processes | • Some users confused  
  • Change in processes  
  • Concern about backup  
  • User concerned on data location  
  • Concern about data restores  
  • Dependence on provider agreed SLA  
  • Limited performance troubleshooting |
| • Complexity and              | • Complexity and challenges | • Cloud computing is complex  
  • Compatibility issue of products |

47
<table>
<thead>
<tr>
<th>Compatibility posed</th>
<th>Cost Advantage vs budgeting</th>
<th>Internal and External pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>It’s a large institution</td>
<td></td>
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