



**THE IMPACT OF CLOUD COMPUTING ON THE ROLE OF AN IT
DEPARTMENT: A CASE STUDY OF A HIGHER EDUCATION
INSTITUTION IN THE WESTERN CAPE**

by

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ABSTRACT

Information and communication technologies are moving fast. Consequently, organisations must be aware of this evolution and adapt to take full advantage of the benefits offered by these technologies. Cloud computing is a new concept of accessing data centers and various computing resources via the internet through any devices and from anywhere. Large organizations, such as Higher Education Institutions (HEI), are gradually adopting cloud computing to reduce their very high budgets. In emerging countries, more and more HEIs are adopting the services offered by cloud computing, more precisely in South Africa in the Western Cape. However, cloud computing affects the way IT services are delivered by traditional HEI IT departments. Thus the objective of this study is to explore the impact of cloud computing on the role of the IT department of HEIs, using a case study. To fulfil this objective, interviews were conducted within the IT department of an HEI, including the IT staff, and it was found that cloud computing affects the role of the IT department by changing the roles and responsibilities of some IT staff, as well as the focus of certain posts in the department. In addition, cloud computing also affects the department's culture. Fortunately, no IT staff have lost their posts. Other results show that training and certification were necessary for the IT to adapt to the changes. Cloud computing adds value to the IT department because it offers a daily 24-hour service as opposed to the traditional IT department.

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DEDICATION

I dedicate this work to my beloved mother

Table of Contents

DECLARATION.....	II
ABSTRACT	III
ACKNOWLEDGEMENTS	IV
DEDICATION	V
CHAPTER 1: INTRODUCTION	1
1.1 Introduction.....	1
1.2 Background of the study	1
1.3 Statement of the research problem	2
1.4 Research aims and objectives	2
1.4.1 Research aims	2
1.5 Research Question	3
1.5.1 Research Sub-Questions.....	3
1.6 Research Objectives	3
1.7 Chapter Summary.....	3
CHAPTER 2: LITERATURE REVIEW	4
2.1 Introduction.....	4
2.2 Definition of cloud computing.....	4
2.3 Cloud computing services.....	6
Table 01: Cloud computing Services and main services providers	8
2.4 Cloud computing main characteristics.....	8
2.5 Cloud computing deployment models.....	9

2.6	Cloud computing benefits	9
2.7	Cloud computing challenges and concerns.....	11
2.8	Traditional role of IT service department in HEI	14
2.9	Cloud computing utilization in higher education	16
2.10	Users perception of cloud computing	18
2.11	Cloud computing impact in organization's IT department	19
2.12	Cloud computing impact in HEI.....	20
2.13	Optimal way of managing cloud computing impact on tertiary institution IT department 23	
2.14	Chapter Summary.....	24
CHAPTER 3 RESEARCH DESIGN AND METHODOLOGY		25
3.1	Introduction.....	25
3.2	Research assumptions.....	25
3.2	Research paradigms.....	26
3.3.1	Positivism	26
3.3.2	Interpretivism.....	27
3.3.3	Interpretive paradigm application to this study	27
3.4	The research design	27
3.5	Research methodology	29
3.5.1	Quantitative methodology	29
3.5.2	Qualitative methodology.....	29
3.6	Case study: Research strategy.....	30
3.7	The sampling design	30
3.8	The data collection	31
3.9	The data analysis	31

3.10	Trustworthiness, Validity and reliability.....	32
3.11	Ethical considerations	34
3.12	Chapter Summary.....	35
CHAPTER 4 FINDINGS AND DISCUSSION		36
4.1	Introduction.....	36
4.2	Empirical setting.....	36
4.3	Participants description.....	36
4.4	IT department role in the HEI before introducing cloud computing.....	37
4.5	Cloud computing influence on the IT department of HEI	39
4.6	Cloud computing impact on IT department staff skills.....	42
4.7	Managerial, technical skills and new expertise resulting from the introduction of cloud computing.....	44
4.8	IT department staff members affected by the introduction of cloud computing within the IT department.....	46
4.9	Training and new certifications needed in the IT department after the introduction of cloud computing.....	48
4.10	Business value added by the IT department after the cloud computing adoption	49
4.11	Findings	51
4.12	Answer to the research questions	52
4.13	Chapter Summary.....	53
CHAPTER 5: CONCLUSION AND RECOMMENDATIONS.....		54
5.1	Introduction.....	54
5.2	Revisited research objectives	54
5.3	Contributions of the study	54

5.3.1	Theoretical contribution.....	54
5.3.2	Practical contribution.....	55
5.4	Limitation of the study and future research	55
5.4.1	Limitation of the study	55
5.4.2	Future research.....	56
5.4.3	Chapter Summary.....	56
	REFERENCES.....	57

CHAPTER 1: INTRODUCTION

1.1 Introduction

This chapter discusses the problem background, problem statement, study objectives, main research questions, and the research approach and methodology applied in this study. It provides a general description of the entire research study.

1.2 Background of the study

The fast evolving nature of information technology and the discovery of internet have opened new technological opportunities for companies. Consequently, the growing and competitive business environment is forcing companies to seek high-efficient and effective information and communication technology solutions at lower costs, while still making a profit.

The development of complex computer systems has led to an increased demand for larger storage space that is fast and easy to access. Nowadays, the possibilities offered to organisations by information technology and the internet are vast unlike the past when information access and system support were challenging for both users and employees (Han, 2011: 198).

Managing large amounts of data and complex systems became difficult for companies because of, among other reasons, lack of experience in effectively using information technology. However, the development of sophisticated programming technology and an increase in data sharing over the internet, associated with the low cost of internet, have contributed to the rise of the new concept of cloud computing. Cloud computing allows storage, IT infrastructures, and networks to be delivered as a service through the internet (Hussein & Khalid, 2016).

According to a study by IBM (2012), 85 % of the processing capacity remains unexploited in the environment of distributed computing, 70 % of the IT budgets are generally dedicated to the maintenance of IT infrastructure, and only 30 % to new capacities. The infrastructure must be made more dynamic so that it is possible to accelerate the deployment of the new features which companies demand. IT departments adapt their model of management more and more, and cloud computing possesses the capacity which will allow them to meet the challenges of a fast-changing market.

About 30% of all IT expenses will be spent on cloud computing technology by 2020 (Ash, 2012). Furthermore, cloud computing helps generate \$400 billion for organization and

creates more than 1.5 million new jobs worldwide (Gantz & Minton, 2015). However, despite all the benefits generated by the use of cloud computing, many concerns have been raised with regard to the issue of data security in cloud computing, cultural and organizational change (Leimeister et al., 2011:1).

According to Transactions & Systems (2016), by 2018 almost 60% of all organizations will move half of their IT infrastructure to the cloud, and cloud services will experience a significant increase. Furthermore, HEI of USA expect a cost saving of around 20% in the coming years made possible by the use of cloud computing (Vriwzduh et al., 2013).

1.3 Statement of the research problem

An effective use of cloud computing reduces stress among IT staff with respect to the maintenance of information system and configuration. Thus they can focus on their more important tasks (Al-lawati & Al-badi, 2016). Nevertheless, a number of authors have raised concerns regarding organisational change (Dutta et al., 2016) that accompanies the adoption of cloud computing.

Big organizations, such as universities, usually develop and maintain their IT system themselves. The control of IT services and their support are managed by IT departments. The introduction of cloud computing, however, shifts the authority of the IT department towards the supplier of the cloud computing services. Furthermore, Yadin (2013) affirms that the transfer of authority modifies the role and responsibility of the IT department which needs to adapt to the change.

A number of studies conducted into cloud computing have tended to focus on the technological aspects and less on the business perspective (Allan & Prof, 2016). The impact of cloud computing on the organisational IT department has been insufficiently investigated; whereas there is clear evidence of its impact on the structures of information systems in organisations (Marston et al., 2011). Furthermore, studies on this topic in the context of South Africa universities could not be found. Hence, this study will investigate to what extent cloud computing impacts on the role of the IT department of a higher education institution.

1.4 Research aims and objectives

1.4.1 Research aims

This research aims at exploring the impact of cloud computing on an IT department's role in a higher education institution.

1.5 Research Question

What is the impact of cloud computing on an IT department's role as service provider to a higher education institution?

1.5.1 Research Sub-Questions

- What is the role of the IT department in a tertiary institution?
- How does cloud computing impact on the role of the IT department in a tertiary institution?
- How does the IT department react to this impact?
- What is an optimal way of managing the impact of cloud computing on IT departments in a tertiary institution?

1.6 Research Objectives

The objectives of this study are to:

- explore the role of the IT department in a tertiary institution;
- investigate the impact of adopting cloud computing in a tertiary institution;
- determine how the IT department reacts to the adoption of cloud computing; and
- determine an optimal way of managing the cloud computing impact on the IT department of a tertiary institution.

1.7 Chapter Summary

This first chapter has introduced the study and illustrated the research problem, research questions and objectives. The next chapter will discuss the relevant literature on the topic and on cloud computing.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter proposes a review of the literature on cloud computing in general and particularly in HEIs. This review looks at concepts, models and paradigms of cloud computing and provides answers to the following questions raised in the previous chapter:

- What is the role of an IT service department at a HEI?
- How does cloud computing impact this role?
- How does the IT service department of a HEI react to this impact?
- What is an optimal way of managing the impact of cloud computing on the IT department of a tertiary institution?

To investigate these questions, journals, articles, books and reports have been used as a source of information. The review of the literature is structured around the following topics:

- Cloud computing definitions
- Benefits and challenges of cloud computing
- The traditional role of IT departments in HEIs
- The cloud computing impact on IT departments
- Users' perceptions of cloud computing
- Cloud computing in HEIs
- Optimal ways of managing the cloud computing impact on IT departments at tertiary. Institutions.

The recent global financial crisis has profoundly affected industries worldwide in general, and higher education institutions in particular (Bimol et al., 2014). Moreover, governmental financial support of university institutions has considerably decreased over time; thus universities are failing to provide appropriate IT support for educational research and development (Bimol et al., 2014). It has become necessary for institutions to self-finance and reduce their expenses by reducing, for instance, the costs of their IT infrastructure while still offering good services (Grajek, 2014).

2.2 Definition of cloud computing

The cloud computing concept has been used since the 2000s. There are many changes which allowed the emergence of cloud computing. Firstly, the provision of new technologies,

such as Web 2.0 and distributed computing, then the emergence of the SaaS (Software as a Service) product delivered by the cloud. Furthermore, there is the concept of virtualisation that enables the pooling of servers and, therefore, offers a simplified production start-up and a better ratio of resource usage. Cloud computing is the combination of those previous technologies but offered via the internet. The concept of cloud computing was implemented in 2002 by Amazon, an e-business leader, to absorb the heavy load of orders placed on their website at the time of Christmas. Recently, other players, such as Google and Microsoft are offering similar services.

The US National Institute of Standards and Technology (NIST) defined cloud computing as *“a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction”* (Mell & Grance, 2011:2).

Global Access Partner, (2011) defines cloud computing as *“the use of third party software applications and storage provision accessed by users over the internet”*. Organisations can use a set of IT resources and applications as a services without containing them physically inside (Dutta et al., 2016). Cloud computing services can be accessed not only via PC's but via other devices like tablets or smartphones.

Cloud computing is an evolving concept with many definitions from different industries. The University of California in Berkeley defines it as

“the illusion of infinite computing resource available on demand, the elimination of up-front commitments by cloud computing users, and the ability to pay for use of computing resources on a short term basis as needed”.

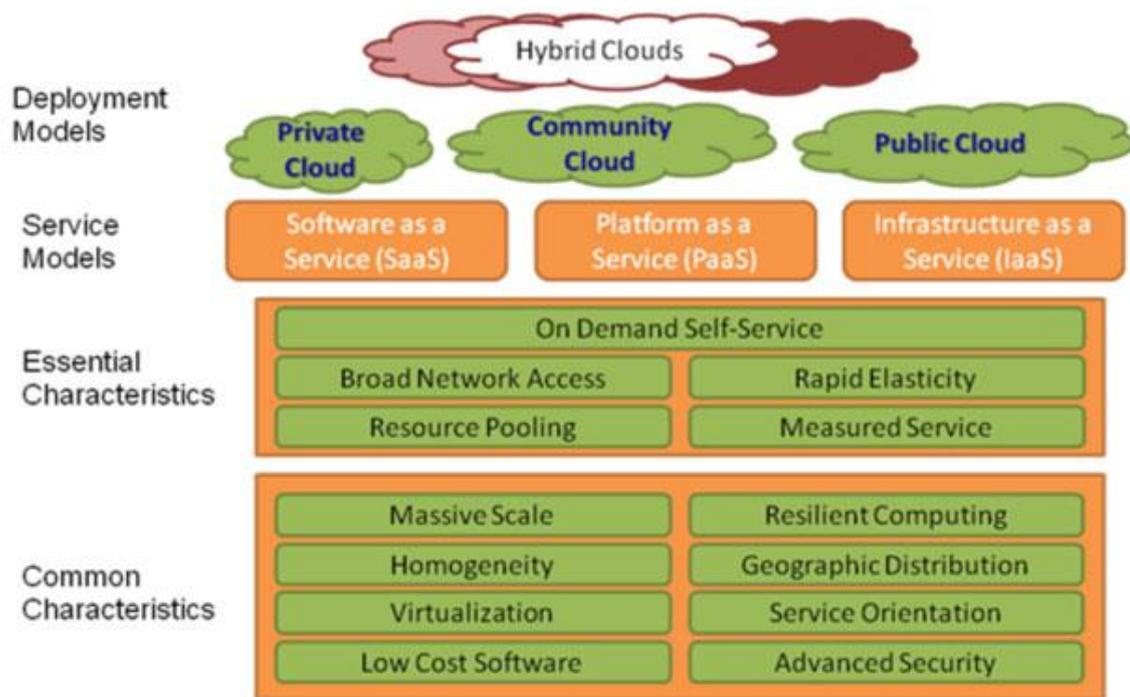


Figure 2.1: Cloud computing model, services and main characteristics (NIST, 2010)

2.3 Cloud computing services

In a cloud computing environment, software does not run on desktops, but instead on web servers' bases with shared virtual resources. It offers three main services (Mell & Grance, 2011:3):

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

Infrastructure as a Service

IaaS provides, on demand, infrastructure resources the majority of which are located remotely in data centres. IaaS, for Infrastructure as a Service, indicates that processing, storage and networking are delivered by the cloud computing provider over the internet. Workstations, printers and servers can be charged according to their use. Customers rent, for example, a central processing unit, memory or data storage and the cost is directly related to occupancy (Tata Communication Paper, 2011). The users own the operating system, application and information available on the platform. The client pays on a pay-as-you-go basis (Tata Communication Paper, 2011). The main providers of IaaS are Amazon Web Services (EC2/S3) and IBM (Blue House).

Platform as a Service

PaaS, provides techniques and environments for developing applications, working remotely and including personalisation and integration tools with existing or other programs hosted (Alam, 2013). The provider handles the material and proposed middleware services, while the responsibility of the editor is situated on the software side that he will install on the PaaS. The main worldwide providers of PaaS are SalesForce.com (Force.com), Google (Google AppEngine), Microsoft (Windows Azure), and Facebook (Facebook Platform). The platform is designed for the supply of material. PaaS offers flexibility, allowing in particular rapidly testing a prototype or ensuring a computer service in a short period of time. It also stimulates user flexibility as access to data and applications is possible from every connected device.

Software as a Service

Finally, SaaS is the most accomplished version of cloud computing. The company using the service is completely removed from the material and middleware problems. SaaS provides software packages in service mode without any operations for the company which uses them. The SaaS proposes applications put at the disposal of the end-users. Customers do not pay for holding the software itself but associated use via the available interface or via API provided often achieved through web services or REST (Representational State Transfer) (Bowers, 2011:46). Salesforce.com (CRM software) and Google (Gmail, Google Apps) are the main providers in this domain. Through the expansion of broadband, SaaS become an attractive solution for SMEs and home offices, and becomes attractive to big corporations.



Figure 2.2: Cloud computing services and main services providers

2.4 Main characteristics of cloud computing

The US National Institute of Standards and Technology (NIST) proposed five main characteristics of cloud computing as following:

- **On demand self-service:**

The customer may modify and define independently computing resources and options he needs, such as server-time response, the speed of data access and data processing, as well as the amount of data stored without service provider intervention.

- **Broad network access:**

Customers can access the service through the internet network from any terminal or device.

- **Resources pooling:**

A cloud provider can pool computing resources to satisfy several customers with different physical and virtual resources based on customer demands. The customer has control over parameters, such as the volume of data and the speed at which it is to be processed while the provider controls resource allocation.

- **Rapid elasticity**

Services can be provided on a large scale at any time without additional costs additional costs to the client.

- **Measured service**

The computing resources used are automatically controlled and measured by the supplier (e.g. amount of data stored, the bandwidth, the number of transactions and users). In this manner, pay-as-you-go is possible.

2.5 Cloud computing deployment models

Cloud computing services are offered in four models: the public cloud, private cloud, community cloud and hybrid cloud.

The public cloud is accessible from the internet cloud and managed by an external provider to the business. Google, Microsoft Azure, Amazon Elastic Cloud (CO2) and Vodacom hosted exchange are some public clouds.

The private cloud is managed internally by the company. The private cloud integrates and applies methods of the public cloud at organization scale. Vodacom dedicated hosting is one example of private cloud.

The community cloud is used by different organizations with common interests. NIST provides this definition

"The cloud infrastructure is shared by several organisms and supports a specific community that has shared concerns (e.g. assignment, security requirements, policy, and compliance considerations)".

It is similar to the public cloud but reserves organizations which share their interests or are possibly linked by their geographical positions.

The hybrid cloud is the adoption of two or more models of cloud computing infrastructures, private, public or community. The company may adopt the private cloud for critical or very specific applications, public cloud for applications with fewer risks, such as email or calendar.

2.6 Cloud computing benefits

The "pay-as-you-go" service offered by cloud computing allows organizations to avoid upfront costs for hardware and software, so that they can invest in their core business. In the SaaS model, the enterprise pays a fixed package according to its desires, giving the right to

usage the solution (Han, 2011). There is no requisite to plan server's licences, customer's licences, third licences, and no additional costs for the upgrades. The costs accompanying the operation and administration becomes the provider's responsibility. Yadin (2013) affirms that the services offered by cloud computing can be accessible anywhere and in any way. In addition, the flexibility of cloud computing enables users to adapt according to their hardware and software performances, as well as to their environment. Global Access Partner, (2011) summarises the benefits of cloud computing as follows:

- **Lower Upfront Cost:** The introduction of a new application in a system requires a cost in hardware and in software licence; but cloud service allows the client to pay the cloud provider only for the service, thus avoiding upfront cost payment.
- **Reduced financial risk:** The service offered by cloud computing can be interrupted without financial risk to the customer if he is not satisfied with the offer. The financial costs attached to technological problems of cloud computing are thus avoided by the customer.
- **Faster time to market (agility):** The successful implementation of a traditional application in a system takes several months while cloud computing allows deploying applications more quickly.
- **No capital expense:** The customer pays for ICT services on a per-use basis, thus transforming the capital expense into an operation cost.
- **Clear ICT value for businesses:** Demonstrable ICT value to the business is obvious with cloud computing as it provides a clear link between ICT expenses and business value.
- **Access to expanded expertise:** The cloud provider can offer services to professionals specialised in IT, such as the IT security and development of software - an optimisation of performances and the continuity of the business as opposed to a local IT department of a company.
- **Continuous enhancement:** The cloud may provide incremental enhancements and developments on a non-stop basis as an alternative to having irregular, troublesome and costly ICT upgrades.

Furthermore, with the financial crisis and the need for large organizations to reduce costs, the Total Cost of Ownership (TCO) offered by public cloud solutions decreases considerably. TCO is define as the total cost of all IT assets in its life cycle: acquisition, operation,

maintenance, monitoring, backup, security and training (Mtebe & Raisamo, 2014). According to Tata Communication. (2011), moving to IaaS cloud type solutions influences TCO costs. In the SaaS model, the enterprise only pays a package according to their needs, giving it the right to use the solution.

Virtualisation technologies provided by cloud computing promote green computing, reducing gas emissions and thus helping to fight energy consumption (Tiwari & Road, 2015). According to a recent study carried out by Mc Kinsey (2011), it is possible, with ICT, to reduce carbon emissions by 7 gigatonnes per year by 2020, a quantity higher than currently rejects all the sources of gas emissions in the United States. The increasing volume of data and information processes on the internet has a significant influence on the environment regarding energy consumption. Cloud computing is a technology solution suited to lowering energy consumption.

2.7 Cloud computing challenges and concerns

Despite all the benefits provided by cloud computing and discussed above, literature also raises some challenges and concerns that hold back organisations from using cloud computing (Hussein & Khalid, 2016).

- **Legal and privacy issues from a cross-jurisdictional perspective**

The legal issues became complex to understand in cloud computing. In addition, in the public cloud, contractual aspects should be very precise in with regard to pledges and likely services. Legal aspects must also be addressed, especially if the provider is based outside the company's country (Ali et al., 2015). Transferred data located in the cloud are not automatically present in the country. Indeed, they may be in another European or African country. Consequently, except otherwise specified by the service provider, it is not clear where the data are deposited. In addition, there is no physical access to these data.

- **The internet connection**

As the cloud consumes intensive data transfer, users need a high-performance connection. In certain situations, the cloud will be unsuitable for some businesses, such as companies in remote locations. If the connection does not have a guaranteed bandwidth, a shutdown might happen therefore restricting the company from all access to the cloud, its applications and data.

- **Changing skills requirements**

A company's employees should know cloud services and technologies. Even if the company saves costs on storage and processing of information, and employees spend more time to their duties attending to their tasks and responsibilities, cloud technologies may still cause the company to lose rather than gain. New skills are required for employees to perform their work in an effective manner.

- **Business continuity**

It is essential to ask whether the cloud provider will last over time. This is imperative to consider because a change of host can take time and may require recoding applications.

- **Hacking**

Hacking a company account could have adverse consequences for the company's reputation, while the imprudent use of applications by an employee could offer criminals the opportunity to enter the network and extract customer data.

- **Data security**

Data integrity during transfer or storage must be ensured in cloud computing. This requires that data operations are controlled so that only the operations that are allowed are performed. There is currently no common standard among cloud providers (Vaezi, 2012). Furthermore, data can be transferred between several geographically distant data centres; thus the individual or company does not know the position of data among the various data centres (Vaezi, 2012). The data owner must know what information is kept and, in some cases, must be able to request their removal.

Furthermore, there are other challenges and risks related to the use of a public cloud. The following graph shows risks and concerns related to the use of public cloud computing worldwide.

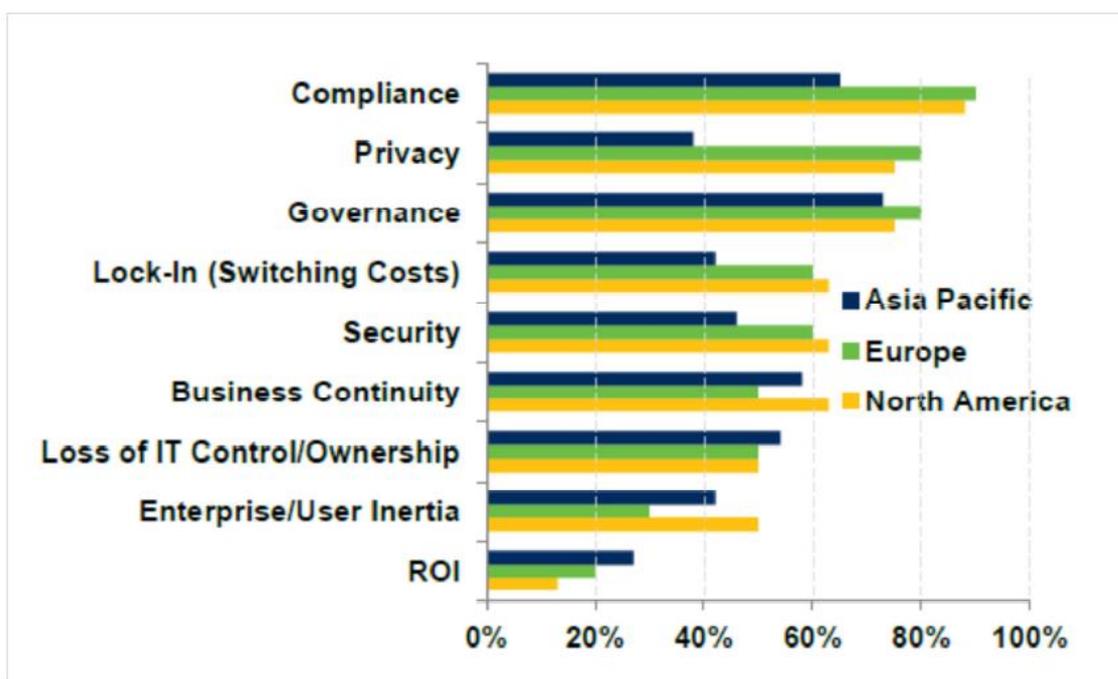


Figure 2.3: Public cloud concerns in the public sector (Source – World Economic Forum 2009 cloud computing Survey)

Besides the general benefits and challenges attached to cloud computing, Vriwzduh et al. (2013) describe some benefits and challenges of cloud computing in connection with higher education institutions. The following table illustrates these benefits and limitations.

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

Table 2.1: Limitations and benefits of cloud computing in higher education

2.8 Traditional role of IT service departments in HEIs

Located within higher education institutions (HEI) , the service IT department's responsibility is to manage and provide support in networking, telecommunications, administrative systems, support services, and learning management systems (Pitt, 2014).

Further, Vriwzduh et al. (2013) maintain that the IT department's role is to manage, control, and maintain IT infrastructure and to provide hardware (servers, network, desktops and laptops) and software (operating systems, emails, malware support). Moreover, the main function of the IT department at a university is systems development, IT services, application management network and infrastructure (Alias et al., 2016). In order to fulfil these functions on a daily basis, the IT service department recruits IT professionals, such as systems administrators, developers, and IT support technicians. The IT department is housed on the premises; thus the day-to-day software and hardware support is assured by its technicians.

The main users of the services provided by the IT department are students, developers, researchers, staff and lecturers (Sultan, 2010:110), and in some case, university campuses are located in different areas. However, Alias et al. (2016) insist that IT departments should rely on their IT staff to support and solve problems and maintain IT services daily across all campuses of universities. In contrast, Arutynov (2012) argues that in public cloud, users rely only on the cloud provider rather than the local IT department. Thus there would be no need for administration, management and upgrades from the IT department; everything is offered by the remote cloud provider.

According to Kats (2012), an IT business authority represents the responsibility, the power to define and implement norms, priorities and policies that protect the interests of the company and thus the interests of users. An HEI IT department plays a liaising role between the other departments, staff, administration and academics within the institution. Firstly, the IT department understands user and student needs, determines priorities, and allocates IT resources and budgets to the various departments. Secondly, developers of IT service departments design and implement institution applications according to the requirements of other departments, therefore, strengthening the power of central IT and department dependencies (Vriwzduh et al., 2013). Finally, it has the technical skills of all software and hardware support necessary for the proper running of all the institution's activities.

Further, the IT service department in a HEI aims to create a digital campus on which the students and staff can be most creative and effective, undertake their research and are assure of the smooth running of the institution. According to Monroy et al. (2012), several

services provided by the IT service department are typical of other corporations and organizations and create the same problems and challenges. Those services include:

- Maintaining computers and laptops
- Managing the storage space, servers and databases
- Maintaining emails and printers, administrating the contents of web pages, data, networks, multimedia design and production, and, finally, enterprise resource planning (ERP) management applications, such as finance, human resources payroll and marketing. Implementing a disaster recovery plan is also an IT department function in the institution. Some services are specific to the institution and sometimes bring particular challenges to the role of the IT staff.

Teaching

The IT service department provides virtual environments and powerful software, and specialises in teaching. The students are familiar with new technologies and, therefore, expect to be connected with their various mobile devices.

Research

Researchers produce large amounts of data and need tools to manage and generate information. Several researchers may collaborate with others across the world and other organizations and disciplines (Dumas, 2016). Researchers and students require innovation services and technology to be competitive, and the IT department should answer to such requirements.

Furthermore, the IT department implements and coordinates IT governance. The purpose of IT governance is to ensure that the work of the IT organization aligns with the mission of the institution and its strategic plans (Pitt, 2014). Effective IT governance articulates the criteria for the performance of the IT organization, measures its performance, and assigns resources to support the mission and the objectives of the institution's IT. In addition, it identifies and handles the risks related to the investments in IT (Pitt, 2014).

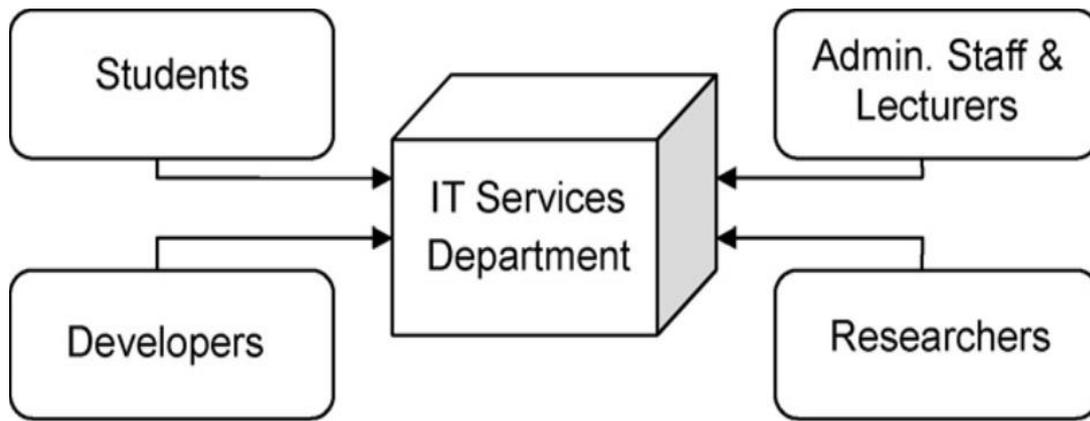


Figure 2.4: The main users of IT services in a typical university (Sultan, 2010)

2.9 Cloud computing utilisation in higher education

According to Alam (2013), cloud computing has become widely used in higher education worldwide, as well as in other sectors and industries. Several cloud services are already adopted by several universities and other educational institutions worldwide (Munjal, 2015). Figure 3 below shows the percentage of cloud computing usage in different industries in the world.

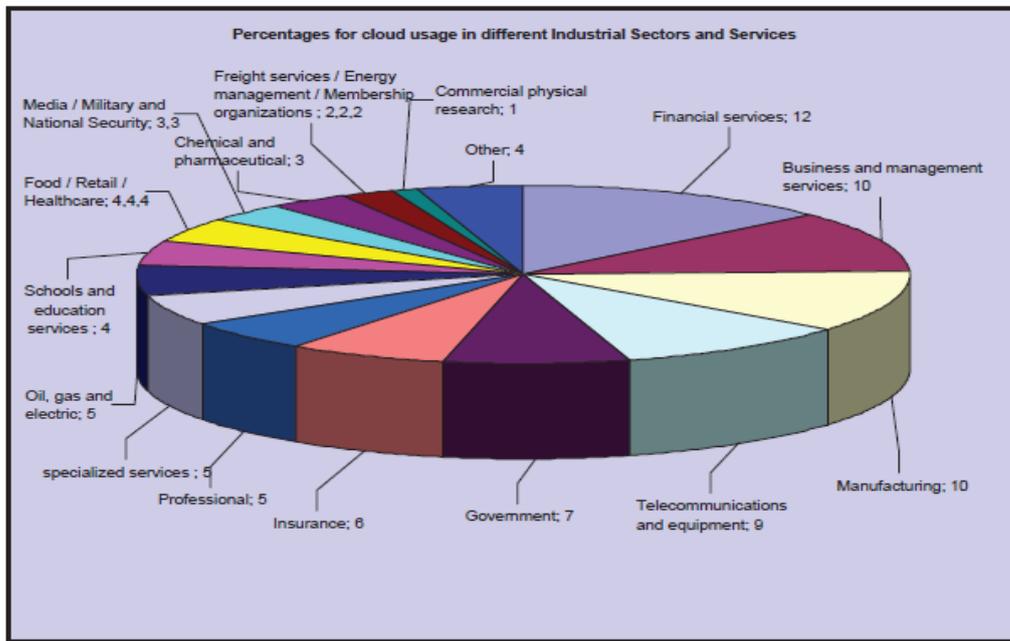


Figure 2.5: Cloud computing usage in different sectors and industries (Ercan, 2010)

Amongst these cloud services used by universities, there are email applications such as Microsoft 365 of Microsoft and Gmail for Google, Amazon Web Services (AWS) and ERP application such as Workday (Introduction, 2015). Some of these services receive particular attention from educational institutions due to their free offer (Educause, 2012). Thus the

University of Westminster made savings of about 1 million dollars after moving its service email Outlook to Gmail (Sultan, 2010:113). These were savings made partially from the installations, the licences and servers maintenance. On the other hand, the University of California implemented the Amazon Web Service for one of its courses, which allowed the use of an important storage space on Amazon servers by a large number of students in a few minutes across the city (Sultan, 2010:113).

Nowadays many technologies that erstwhile were expensive and inaccessible are now free and available so that students can now access and use them via many mobile devices. According to Munjal (2015), universities should take the opportunity provided by cloud computing and new technology by choosing the appropriate solutions and adapt them to their existing models in order to facilitate the work of staff and students, which then reduces IT costs. Cloud computing provides a virtual learning environment, a learning management system and e-learning, therefore, offering lower cost and an environment of collaboration amongst researchers and students (Dumas, 2016).

Ercan (2010) proposed (Figure 5 below) an infrastructure model for using cloud computing in HEI in which computing resources (such as processors, memories, storage space, and bandwidth) will be offered and controlled by the cloud provider on a pay-per-used basis instead of traditional IT department.

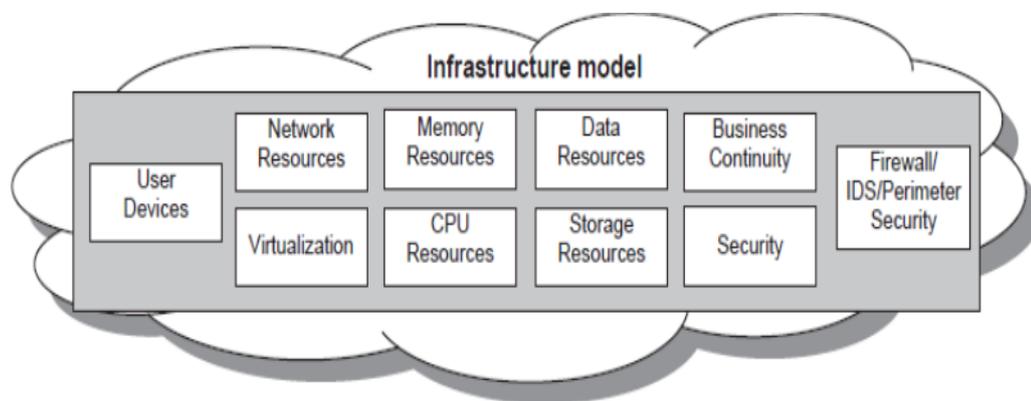


Figure 2.6: IT infrastructure application in Cloud Computing in a HEI (Ercan, 2010)

Rilwan and Mamman (2015), propose another architecture of using cloud computing in eLearning within HEIs. Traditionally, an eLearning system is hosted by the IT service department of the university. In this proposed model, the eLearning system is managed and maintained by the cloud provider. Faculty members, administration staff and students access the system via any devices through the cloud computing services as SaaS, PaaS and IaaS.

Both proposed models developed previously show that some of the key functions of the IT department in HEIs can be shifted to the cloud provider and, therefore, create an uncertainty about the role of the IT department in this particular context.

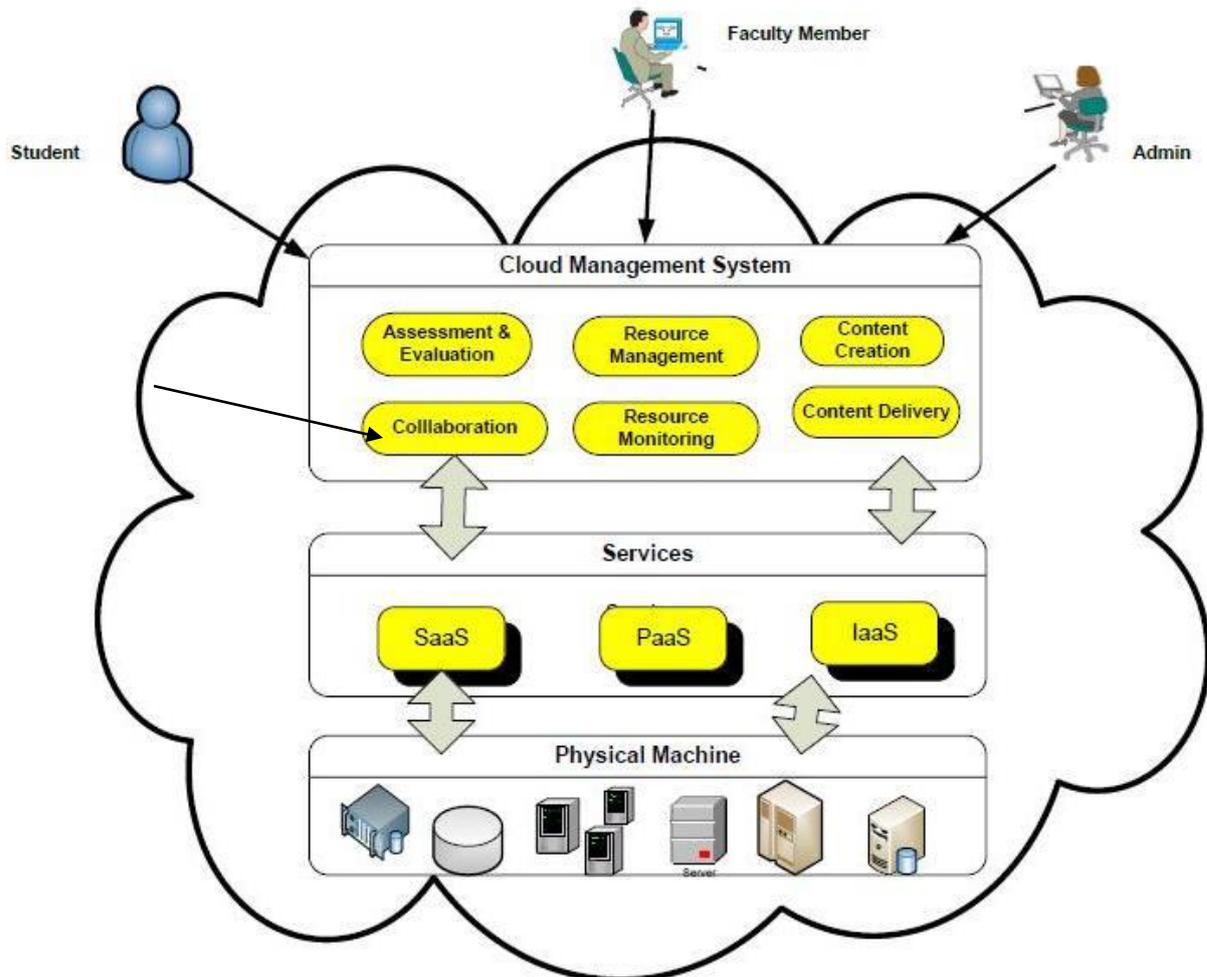


Figure 2.7: Cloud-based eLearning architecture at a university (Rilwan & Mamman, 2015)

2.10 Users perception of cloud computing

According to Alias et al. (2016), the sharing of knowledge among employees in the IT department of HEIs plays an important role in IT staff development. Also, through the methods such as social media, training, trouble-shooting and problem solving, IT staff can improve their skills and their careers. The culture developed in the central IT department of HEIs promotes knowledge sharing and employees' personal development in HEIs (Alias et al., 2016).

Cloud computing resulted from the outcomes of several existing technologies. The decision to migrate to cloud computing is not always welcome among the employees of the IT department. Indeed, IT staff worry about the change introduced by cloud computing (Cloud

Executive Perspective, 2014). Certain IT professionals consider the cloud a threat to their career in IT, while others see in it an opportunity for their future (Raza et al., 2015).

Cloud computing will change the culture and norms of an organization (Carraway, 2015). Further, cloud computing changes the way employees in the department interact with each other, thus increasing their fear of losing their posts and making them reluctant to engage with cloud computing (Carraway, 2015). The adaptation will depend on the way in which each IT employee can cope with these changes.

According to Arpaci (2016), students and researchers consider cloud computing to be a good opportunity for them as it supplies access to unlimited storage spaces and to personal data wherever they are. Further, the cloud helps improve their academic performances, their productivity and, finally, facilitates them in their daily tasks.

2.11 The impact of cloud computing on IT departments of organizations

According to Brooks (2015), cloud computing services profoundly changed the role of the IT service department and IT staff. Further Easton (2012) state that a part of the IT department staff needs to migrate to the cloud provider and the role of the remaining staff is reduced to one of support, management and consulting. Organizations need to redefine the IT department's role and staff, down-sizing the department and changing their business processes (Dutta et al., 2016). Bergsmark et al. (2014) indicate that cloud computing is going to reduce considerably a number of roles in the IT department and increase the need for staff qualified in cloud technology, such as cloud engineers. IT management and employees have to adapt to and prepare themselves for this change (Easton.2012).

Lou (2011:4) argues that cloud computing reduces the need for an internal IT department, dependent entirely on the cloud services adopted by the organizations. Each organization decides which services to migrate into the cloud and which to keep internally. By adopting only the SaaS, a large organization can still obtain the other services from the in-house traditional IT department. This view is supported by Al-lawati and Al-badi (2016) who affirm that the impact of cloud computing on IT departments in the banking sector depends on the services adopted and differs from bank to bank. They add that some services remain the responsibility of the IT department as not all are moved to the cloud for Service Level Agreement and security reasons.

Another view is that, with the shift of some IT services into the cloud, IT departments may take on a strategic management role rather than that of a 'cost center'. Cloud computing

suggests that IT services departments need to develop new skills for their staff to fulfil their new roles and functions within the organization (Ross et al., 2013; Gantz & Minton, 2015).

Choudhary et al. (2016) argue that the role of an IT department should be to focus on the value added by cloud services within the organization. Further, the role of IT departments is to ensure that IT staff participate in the improvement of cloud based services to answer an organization's needs (Choudhary et al., 2016) (Easton,2012) rather than dealing with tasks on the premises. As Al-lawati and Al-Badi (2016) state that, cloud computing impacts IT departments by transferring the traditional roles and responsibilities of IT employees to the cloud service provider and allowing them to focus on the tactical aspects rather than on the technical aspects of the department. In this way they can be more effective and more efficient in their work. Some positions, such as administrator and support and maintenance of IT infrastructure staff, decreased or even disappeared, following the adoption of cloud based services (Choudhary et al., 2016).

Cloud computing enables IT departments to be more flexible by using computing resources several times simultaneously for several objectives (Cloud Executive Perspective, 2015). Cloud computing reduces the dependence on systems such as ERP, the database management systems over the central IT department thus facilitating access to software and material unavailable within organizations (Monroy et al., 2013).

According to Choudhary et al. (2016), factors, such as cloud vendor pricing models, quality of service offer and competitive environment, also play a significant role in the impact of cloud computing on the organizational structure of the IT department. These factors determine whether or not the IT department should be a cost center or a profit center for an organization, depending on whether it opts for cloud computing or not.

2.12 Cloud computing impact on HEI

The majority of HEIs have more and more embraced the services offered by the cloud with the aim of taking advantage of the opportunities it offers (Brooks, 2015). According to Carraway (2015), cloud computing becomes a viable way of providing IT services in HEIs. However, the adoption of cloud computing in HEIs does not bring benefits only; it also entails some challenges. Thus cloud computing adoption varies from one institution to another, depending on the type of cloud services needed. Computing cloud entailed a radical change in the way colleges and universities can use IT services and oblige the computing organizations to rethink the way their computing units are staffed (Carraway, 2015).

The University of California (Berkeley, United States) implemented a cloud computing service to manage its IT infrastructure, and after four years of the cloud computing adoption and resulting changes in the IT department, only two IT professionals had lost their posts. Instead, skills and additional posts were needed in the department (Deloitte.2013). Another scenario developed at the University of North Carolina where the IT service department staff was reduced from 15 to 3 people after the introduction of cloud services, but the remaining staff working a full-time schedule supporting cloud services infrastructures. (Mircea et al., 2011).

However, according to a study into the HEI sector engaged in by (Brooks, 2015), the positions and the roles of the IT department employees remained almost unchanged with the adoption of the cloud computing. Only two roles had decreased in IT departments: systems administrators and developers. The following picture represents the changing roles of IT staff in connection with the adoption of cloud computing. According to Carraway (2015) new roles such as business analyst, It liaison, project manager, integration specialist and application administrators have evolved after the introduction of cloud computing in It department.

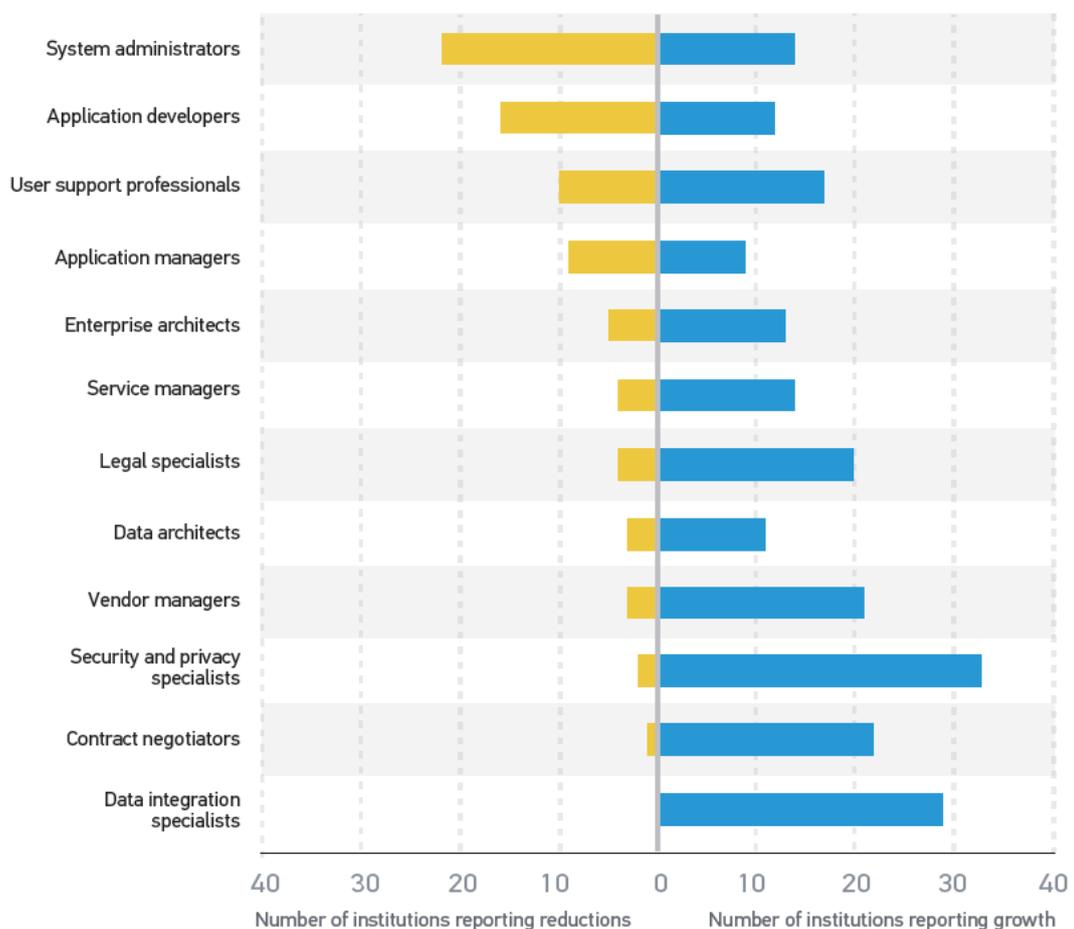


Figure 2.8: Changes in roles / positions resulting from moving services to cloud in HEIs
(Brooks, 2015)

Another view is that an increase in IT staff and their roles may be observed in the HEI context. These roles would include data specialists, security and privacy specialists, legal specialists and contract negotiators (Brooks, 2015) . These two points of view confirm Al-Lawati and Al Badi's (2016) assertion that the impact of the cloud depends on the service model adopted by the various institutions or organizations. The impact of cloud computing on IT departments differs from one organisation to another.

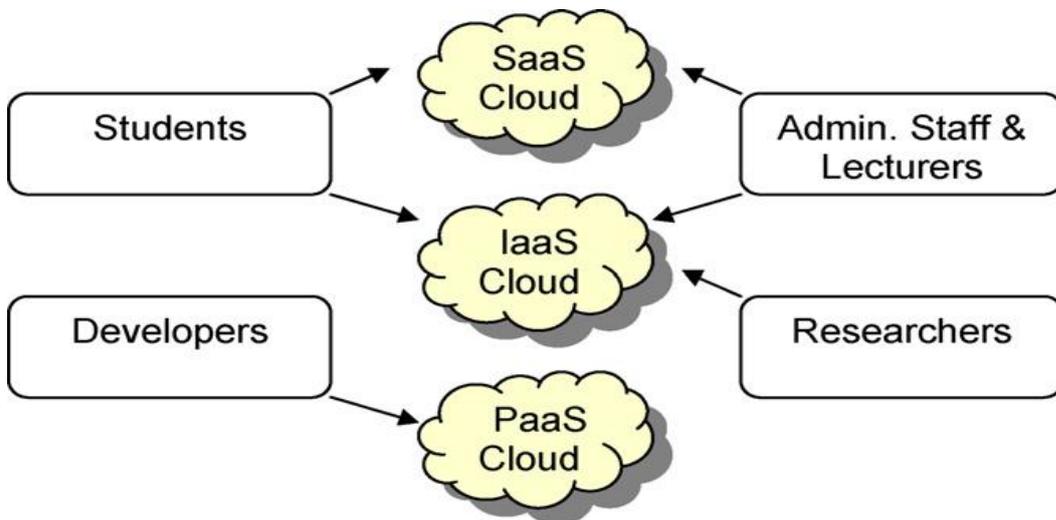


Figure 2.9: The main users of IT services at a typical university using clouds computing services (Sultan, 2010)

According to a study conducted by Cisco and World Wide Word (2013), 50% of large and small South African enterprises use cloud computing services for their activities, against 48 % in Kenya and 36 % in Nigeria. The report adds that 16 % of South African companies consider adopting cloud computing for their businesses in a few years' time. Muhammed et al. (2016) predict that, with the higher rate of people using mobiles devices and the promise of a fast and reliable internet connection, developing economies in Africa, such as South Africa and Nigeria, will derive more benefits from adopting cloud computing.

Koch et al. (2012:15) assert that, in South African higher education, IT staff is internal to the IT department of universities, i.e. there is no outsourcing of IT staff members. On the other hand, 53.3 % of universities use consultants for certain services. However, the core of the activities is still managed by the IT department. Although some authors (e.g. Sultan, 2010),

propose a particular model for the use of cloud computing at a traditional university, so far no studies have pointed out the resultant changes in management required by the introduction of cloud computing in the SA university context. Hence, this present study aims to explore an effective introduction of cloud computing in SA universities, time to provide a better understanding of the role of IT department in this context.

Several HEIs are developing cloud strategies to assist different campuses with the adoption of cloud computing and the transfer to the cloud (Brooks, 2015). The benefits and opportunities of cloud for HEIs are well established, such as flexibility and agility that enable HEIs to be more efficient and make cost savings (Bimol et al., 2014). However, cloud computing changes the role of the central IT department of a HEI which manages the provision and supervision of IT across all campuses. Several factors listed in the following table influence the role of IT in the HEI and play a significant role in the success of cloud computing in the HEI.

Table 2.2: Factors influencing the IT department role in a HEI

Factors	Reference
New roles and skills required, such as cloud engineers, contract negotiators, and security specialists.	(List, 2015; Gantz & Minton, 2015)
New expertise required in cloud computing technology	(Brooks, 2015)
Staff reduction (traditional IT staff, such as system administrators and developers)	(Bergsmark et al. 2014; Choudhary et al. 2016)
Staff increase (specialised cloud computing professionals)	(Bergsmark et al., 2014)
Business value added	(Al-lawati & Al-badi, 2016; Choudhary et al., 2016)
New training and certification required in cloud computing	(Raza et al., 2015)
Users' perception and attitude (student, researcher and staff)	(Arpaci, 2016)

2.13 Optimal ways of managing the cloud computing impact on tertiary institution IT departments

Using cloud computing is an opportunity for universities and not an option (Monroy et al., 2012). However, cloud computing will have a direct impact on the IT service departments

and on the IT staff of institutions (Berman, 2015). 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). A proper training should be provided to IT staff and users on how to use, maintain and configure the application proposed by cloud computing (Dutta et al., 2016).

IT departments will have to develop new expertise such strategic service brokers to meet the needs of the cloud users (Cloud Executive Perspective, 2015). Further, some services will be removed from the IT service department of the university to the cloud provider, and others will remain the department's role and responsibility (Katz et al., 2011). According to (Raza et al., 2015) training and certification in cloud computing are required for IT staff to facilitate their adaptation to cloud services. HEIs must develop a change management program to help IT staff to understand the impact of cloud computing within their environment and to cope with this change (Grajek, 2014).

2.14 Chapter Summary

This chapter has provided an overview of cloud computing, the main concepts, features and different types of cloud computing. It has explored benefits and challenges related to cloud computing. In addition, it has given an overview of the traditional role of the IT department of HEIs and the factors that influence the role of such departments. Finally, the use of cloud computing in HEIs and its impact on IT departments has also been discussed.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter describes the research and design methodology applied to this study. The research question relates to exploring the impact of cloud computing on the role of the IT department of a higher education institution in the Western Cape. The chapter begins with an overview of research assumptions, then the research paradigms in Sections 3.2 and 3.3. It continues with discussions of philosophy to substantiate and provide the rationale of the applied paradigm that is appropriate for this study. Section 3.4 clarifies the research design process embraced for this study. In Section 3.5, certain research methodologies are presented and discussed. Section 3.6 discusses the research case that was selected for this study. This is followed by a discussion of the specific samplings in Section 3.7. Finally, a discussion is presented in Sections 3.8, 3.9, 3.10 and 3.11 on data collection and analytical methods, the validity and reliability of the data, as well as the ethical considerations of the study.

3.2 Research assumptions

Finding the research paradigm associated with a research design that answers the research questions and achieves the research objectives is very delicate. A paradigm is the set of beliefs and agreements shared by scientists or philosophers and which guides research, identifies problems and indicates what is acceptable as a method and result (Glesne, 2011).

Three research philosophies are relevant to this research, namely, ontology, epistemology and methodology. The ontology refers to a philosophical domain that focuses on the study of being. In other words, it looks at the real nature of what surrounds us and the meaning of life (Glesne, 2011). The ontological analysis constitutes the knowledge base for a particular field of enquiry and it conceptualises the underlying knowledge. In turn, a researcher could perceive and analyse the world in order to establish certain propositions in this domain (Chandrasekaran et al., 1999).

On the other hand, Crotty (1998:8) states that "*Epistemology is a way of understanding and explaining how we know and what we know*". Maynard (1994:10) says that "*Epistemology is concerned with providing a philosophical grounding for deciding what kinds of knowledge are possible and how we can make sure that they are both adequate and legitimate*". Epistemology serves the purpose of answering two different questions:

- How do we know the world?

- What is the relationship between the investigator and the known? (Denzin & Lincoln, 1998).

A methodology can thus develop from these two elements of research, ontology and epistemology - either from the reality of research, that is, from laws and nature, or from the subjective perception of knowledge. Methodology is another discipline that is related to epistemology. Methodology focuses on researching strategies for deploying knowledge. It can be said that the method is the process to achieve the objectives and that the methodology is the study of research (Bryman, 2008).

In this particular study, ontological questions refer to the level of impact which the introduction of cloud computing will have on the role of the IT department in a university institution, more precisely one in the Western Cape (South Africa). The case study was chosen as a method according to the nature of the research questions and the assumptions made to acquire the knowledge of the subject of study. What made it possible to answer epistemological questions, such as what factors influence the role of the IT department in a higher education institution and how these factors influence the role of the IT department in the context of a university institution in the Western Cape?

3.2 Research paradigms

Choosing a suitable research methodology to conduct the research process is not an easy task. Given the wide variety of methods and the increasing complexity of the research subjects, the choice of an appropriate method requires a reflection on a gait of choosing the method. Therefore, in order to select the appropriate methodology, it is necessary to understand the different research paradigms. The three known paradigms of research are: Positivism, Interpretivism and Critical Research.

3.3.1 Positivism

Positivism postulates that the knowledge progressively acquired by science has the following characteristics: (i) It is the knowledge of reality, (ii) a reality in itself, (iii) it is objective, and (iv) independent on the observer who describe it (Glesne, 2011). The role of the observer or researcher would then be to account for reality, adopting an attitude of objectivity and neutrality with regard to the research object and using methods supposed to enable it him or her to discover it and to describe it as it exists. Quantitative research methods are more often used in positivist studies, such as surveys and experimental studies (Leedy & Ormrod,

2013). These methods include rigorous instrumentation of the observation context of the object with experimental devices, such as hypothesis testing, laboratory and variable control.

However, this research does not seek to manipulate quantitative data, as it does not try to test any variable; therefore, this study did not use the positivist paradigm.

3.3.2 Interpretivism

Contrary to the positivist approach, the interpretive approach allows researchers to apply their personal values and allocate their own meaning to the knowledge of reality, hence developing concepts in a particular context (Glesne, 2011). An interpretivist understands the meaning of the social situation from the point of view of those living it (Smith, 1989). Smith (1989:85) believes that “*Social reality is based on a constant process of interpretation and re-interpretation of the intentional, meaningful behaviour of people including the researcher*”. Therefore, the description and interpretation of social enquiry is deemed as a constructive process consequently, the researcher cannot be isolated from the investigative phenomenon (Smith, 1989). The reality is based on beliefs and values that are exclusive to every person and is defined by the use of language, literature and other diverse tools.

In interpretative research, the emphasis is on apprehending the complex social and personal variables within which the social phenomenon studied is located. Because these variables are tough to measure, the researcher engages in an intense process of investigation, understanding and analysis. Results obtained from the investigation and data collection processes must be interpreted by the researcher. Therefore, it is inevitable that the researcher’s individual values, his beliefs and knowledge might influence the final understanding of the participants (Yin, 1994).

3.3.3 Interpretive paradigm application to this study

One or more paradigms can be used in a research study because each research study adopts its own research philosophy. The interpretative paradigm in particular corresponds to the philosophical assumptions related to this research. Thus, the study of the impact of cloud computing on the role of the IT department in a university context is an analysis of different staff members’ perceptions of the impact of cloud computing on their functions in the department. Hence, the interpretative paradigm is chosen as the best adapted to facilitate a thoroughly qualitative sense of the study.

3.4 The research design

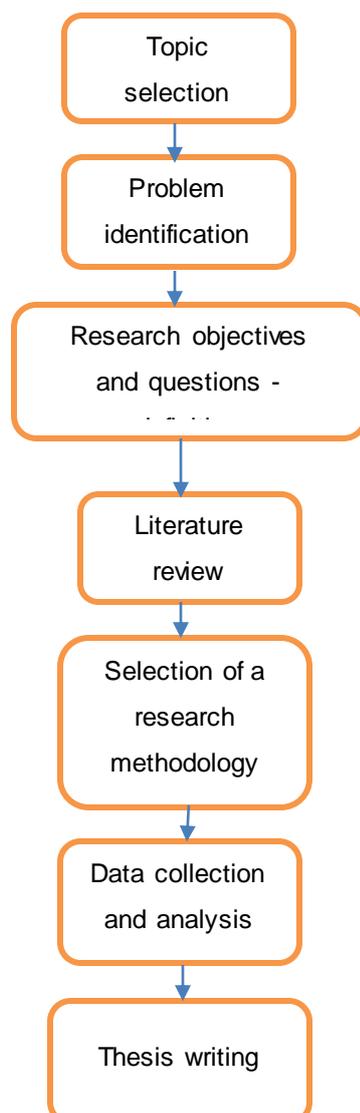
This part of the study deals with the process that leads to the development of the research problem and the assumptions and / or research questions associated with it. It is during this preparatory phase that the researcher endeavours to clarify the objectives he pursues, to gather and to deal with the scientific literature in relation to his research topic and, through a

critical analysis of the literature, to define the problematic in which the hypotheses and the questions, which will enable him to pilot his research, will be included (Mouton & Marais, 1996).

This design phase, even if it keeps the researcher away from the field from which he will collect the data necessary for his investigative work, is, nevertheless, important because it determines the quality and relevance of the operations that will be carried out thereafter.

The objective of this study is to explore the impact of cloud computing on the role of the IT department of a university in the Western Cape. A relevant review of the literature on the subject was conducted, followed by a selection of the research methodology adopted and, finally, the method of data collection.

Figures 3.1: Research methodology process



3.5 Research methodology

Research methodology is “*the strategy, plan of action, process or design lying behind the choice and use of particular methods and linking the choice and the use of methods to the desired outcomes*” (Crotty, 1998:3). The methodology refers to theories on which researchers build their work. Methods are the techniques and tools that researchers borrow when they need to explain a phenomenon. This has repercussions on the research process, with a focus on data and information, in terms of data type, data source and means of analysis. There are two basic research methodologies: quantitative and qualitative methods (Fuchs & Hanning, 2001).

3.5.1 Quantitative methodology

Quantitative research takes a deductive approach in order to test hypotheses and to build a knowledge base in the field of interests. Quantitative methods, on the other hand, can be seen as a process of observation with a collection of data related to a laboratory controlled process. Furthermore, the validity of a quantitative research approach also be deemed to be achieved through the logic of a common structured approach (Popper, 1959). Concepts are reviewed and tested by the enunciation of variables that are observable, tangible and clearly defined. The test of causality between the variables is carried out through control indicators which allow the procedures. Therefore, the results are evaluated in relation to the validity of the research process.

3.5.2 Qualitative methodology

Qualitative research is related to a natural model of science (Bryman, 1988). The qualitative approach is concerned, in the extreme, with constructivism, interpretation and perception, and less with the identification of a rationale or objective; it is an insistence on the social construction of the nature of reality. The word ‘qualitative’ implies that research in this field focuses on a mixture of different people’s perceptions.

In contrast to quantitative research, a qualitative approach often refers to a non-deduction. Case-study approach, ethnography, grounded theory, action research and life history (Glense, 2008; Leedy & Ormrod, 2013) are among qualitative methodologies. Questionnaires, interviews, observation and documents are examples of the data-collection methods in qualitative methodology (Bryman, 2008; Myers, 1997).

The difference between quantitative and qualitative methods primarily lies in the influence of interpretation and subjective perception, which is reflected in the research methods used in this study.

3.6 Case study: Research strategy

Robson (2002:178) defines a case study as: “*A strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence.*” A case study provides an understanding of the uniqueness of the in-depth study. As Yin (2003) explains, this approach has an advantage over other research strategies when the questions "how" or "why" are asked to discover a current phenomenon, and where the researcher has almost none, or no control at all, over the events.

The selection of a case study as a research strategy can be based on several reasons. Many authors believe that a case study is the most common qualitative approach used in information systems (Orlikowski & Baroudi, 1991; Alayi & Carlson, 1992). With regard to this present study, the main focus and interest of the research is information systems in a selected organisation. Furthermore, a case study allows researchers to use multiple data sources and a variety of research methods to explore research questions which, in turn, strengthens the validity and reliability of the data by means of the seven principles of Meyers and Klein (Meyer & Klein, 1999) in interpretive research. This has also influenced the choice of the case study as a research methodology for the current study. However, the case study as a research strategy, according to some critics, is not considered a reliable, objective and legitimate method because of the difficulty of generalising the results to a wider population (Yin, 1994).

3.7 The sampling design

Sampling procedures are classified into two main categories: probability sampling and non-probability sampling. For a mini-thesis, such as this one, the choice of sampling must be clear to avoid tampering the samples' results.

In the case of probability sampling, each unit of population has a chance of being selected. For this type of sampling, randomisation is seen as a characteristic of the selection process, rather than a hypothesis formulated about the structure of the population.

In non-probability sampling, it is assumed that the distribution of characteristics within the population is equal. This is why the researcher believes that any sample would be representative and the results, therefore, would be accurate.

For this study, the non-probability / purposive sampling approach implies that the chances for each person to be chosen in the sampling are not known, but the characteristics of the population are used as the main measure of selection. In addition, the purposive approach is

indicated for small-scale in-depth studies (Richie et al., 2003). Using this selection method, the researcher selects the prospective respondents according to the following criteria: (i) working in the IT department, (ii) having an IT function in the IT department, (iii) having more than one year of experience within the IT department.

3.8 The data collection

For a case study, the traditional data sources of a historical research strategy can be exploited, such as primary and secondary documents, as well as cultural or physical artifacts. To these historical data, the case study adds other sources of data collection, which include direct observation of the events studied, interviews with the actors involved, and questionnaires (Yin, 2003:7-8). Single case studies typically concern extended periods of time and involve an in-depth analysis of a large number of data from the subject being investigated.

This research used two methods of data collection. The analysis of the literature has provided a theoretical basis for the research in order to explore and clarify various necessary concepts for the research. The information was collected by identifying significant articles on the topic of cloud computing. A variety of sources was selected, namely articles, newspapers, books and reports, as well as documents published on the internet.

The empirical method used in this study is a single-case study conducted with open-ended interviews as a source of data collection in order to understand the context and help answer the research questions. A copy of the interview questions has been attached as Appendix 2. The interviews were recorded on audio tape and then transcribed on paper for data analysis purposes.

3.9 The data analysis

The best known analysis of qualitative data, and the most widely used method for studying interviews or qualitative observations, is content analysis (Krippendorff, 2004). It consists of transcribing qualitative data, analysing the information collected and then processing it. The analysis describes the investigation material and investigates its meaning. A content analysis technique was used as a data analysis method for this study. It involves identifying specific categories and criteria for selection before starting the analytical (?) process. Content analysis is the most usual method for studying qualitative interviews or observations. It encompasses transcribing qualitative data for constructing an analytical framework, to encrypt the information collected and to process it (Hsieh et al., 2005).

The aim of a content analysis technique is to “*provide knowledge and understanding of the phenomenon under study*” (Downe-Wambolt, 1992:314). A conventional content analysis technique has served as a method of data analysis in the present study (?). This content analysis is the method that tries to perceive what has been said by the study participants in the most objective and most reliable way possible (Hsieh et al., 2005).

The first step in this qualitative analysis was to organise and prepare the data, that is, the transcription of the interviews done by the researcher. Then, on the basis of the organised material, the researcher went through all his data to develop an overall idea. This allowed the researcher to make sense of the data and also to prepare the next step for systematically organising data according to a finite number of categories.

The second step concerned the data coding process in which the researcher organised the material into coding units before giving meaning to these units by linking them to a particular category of the coding system. This process, often referred to as "content analysis", consists of classifying the elements of the material analysed in a way that allows the researcher to better understand its characteristics and significance. This is done in two stages: the segmentation to clear the units of meaning, and then the classification according to categories.

The selection of the coding units is a significant step in the processing of qualitative data in that it determines the granularity of the analysis and guides the interpretation of the content elements that were analysed. Two approaches can be envisaged at this level: either to refer to criteria of form (e.g. word, sentence, paragraph, message and the like) or to create coding units by giving them specific meanings that have transpired from the elements of the material, such as the ideas expressed by the participants, as well as perhaps their way of speaking. The first approach allows a reliable segmentation of the document to be analysed, while the second approach offers more flexibility and prepares the coding according to the semantic categories. Rourke (2001) proposes to combine the two approaches by taking advantage of the rigour of formal segmentation and the richness of semantic segmentation. Therefore, the two approaches were used in this study.

3.10 Trustworthiness, validity and reliability

The value of scientific research is largely dependent on the researcher's ability to demonstrate the credibility of his discoveries (Drapeau, 2004). Validity, according to Babbie & Mouton (2001:122), refers to the extent to which an empirical measure adequately reflects

the real meaning of the concept under construction. “*Reliability is the degree to which the measure of a construct is consistent or dependable*” (Bhattacharjee, 2012:56).

The internal validity is assured by checking whether the data collected represent the reality. One way to achieve this is to use Meyers and Klein’s (2011) seven principles of interpretive research. This method has been used to validate this study the seven principles are:

- The fundamental principle of the hermeneutics circle
This principle proposes that all human understanding is achieved by iteratively considering the interdependent meaning of the parts and the whole they form. The principle of human understanding is fundamental to all other principles. As part of a research, the parts are the preliminary interpretations of the researcher and of the participants, while the whole is the emergence of a shared knowledge following the interactions between the researcher and the participants. In this study, this principle was achieved by constantly checking the researcher’s understanding of the respondents’ interpretation and then deducing knowledge of the subject.
- The principle of contextualisation
This principle states that organisations are not static and that the relationships between organisations, individuals staff members and technologies are constantly evolving. Therefore, it is necessary to clearly describe the historical context and to position people as actors and not as results of history. This was achieved by the investigation and understanding of the historical context of the researched organisation.
- The principle of interaction between the researcher and the subjects
This principle demands critical reflection on how research data have been socially constructed through interaction between the researcher and the participants. In the course of a research, the perception of the participants is modified by their appropriation of the concepts used by researcher interacting with them, implying that they become analysts of their own actions. Similarly to the application of the first principle, the researcher’s understanding of the respondents’ constructed interpretations was continuously checked and re-checked.
- The principle of abstraction and generalisation
There are four types of generalisations in interpretivism: the development of concepts, the creation of theories, the identification of specific implications and the contribution to new ideas. This principle was applied by developing concepts out of the analysed responses.

- The principle of dialogical reasoning

The researcher must not only be sensitive to his prejudices, but must also become conscious of its own history. To acquire the awareness of his prejudices, he will question them cyclically so that the perception acquired of his initial (?) prejudices become the prejudices of the next cycle. This principle was applied through constantly examining the researcher's possible prejudices while collecting and analysing empirical data.

- The principle of multiple interpretations

It is a question of studying the influence of the social context on the actions studied. The researcher must, therefore, study the problem from different points of view and document them. Unlike the dialogical reasoning, it is not only a matter of concentrating on the prejudices of the researcher, but also on the various interpretations of the participants. This principle was achieved by questioning participants regarding their various viewpoints with respect to the influence which the adoption of cloud computing was having on the IT department (e.g. organisational, technological, individual).

- The principle of suspicion

This requires sensitivity to possible "divergences" and "distortions" in the narratives of the participants. This principle was achieved by the researcher's comparison of verbatim responses of the participants in this research with the analysis-based interpretation of the researcher.

External validity entails generalising the observations collected with regard to other objects or contexts. To do this, the sample used must be targeted at and representative of the problem. Its most accurate and precise description is desirable when qualitative work is published or presented at a conference.

In qualitative research, reliability is estimated, on the one hand, by comparing the results of the various investigators, when there are several (which is not the case in this study), and, on the other hand, from the work encoding of the 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).

3.11 Ethical considerations

In any research endeavour, the researcher must take into account that the research process must be supported by ethical principles. Because this study focuses on people and their

behaviours, ethical factors needed to be considered. Thus, according to the Business Faculty of CPUT, the researcher requested permission to commence with the research, and the Ethics Committee approved the research by delivering an ethics clearance (Appendix 3) so that interviews could be conducted.

The researcher informed the participants by giving them the details of the research and submitting a letter of consent (Appendix 2) which they were asked to read and sign. Participants responded via emails. They were informed that the research was strictly confidential and anonymous. No personal information would be disclosed. Participants were free to withdraw at any time from the research without any penalties against them, and were assured that their refusal or withdrawal would not result in any adverse consequences for them.

3.12 Chapter Summary

This chapter has described the method of research used in this study, as well as the ethical considerations applied. First, after having clarified the epistemological position and the choice of the case study as the research methodology, the interpretative paradigm was adopted in this third chapter according to the research questions and the research paradigm. The qualitative method was selected as a research method according to the research questions and the type of data collected. The following chapter describes the findings and discusses the data collected during the research.

CHAPTER 4: FINDINGS AND DISCUSSION

4.1 Introduction

The following paragraphs describe the findings according to the research questions and the discussion associated with these questions. The tables below describe the answers derived from the interviews and the literature review. The interviews were conducted with IT professionals in the department of the institution according to their area of professional activity in the department. The IT department of the HEI is divided into sections such as networking, end-user support, back-end support and development.

4.2 Empirical setting

Cloud computing is used by individuals, organisations, government agencies and academic institutions. But the use of the cloud may be different in different contexts in a chosen organisation. This study investigated the impact of cloud computing on the role of the IT department in an academic institution in the Western Cape. This department's primary function is to provide computer services to users, students and researchers throughout all departments. It was the IT department that was chosen to conduct interviews.

4.3 Description of participants

For this study, 10 individuals were interviewed all of whom worked or had worked in the IT department last year. The positions held by the participants varied from supervisors to technicians and managers who have been assigned codes for the purpose of confidentiality.

CODE	POSITION
P1	Network technician
P2	Integrated system and facilities
P3	IT technician
P4	End-User computing
P5	IT supervisor
P6	IT manager
P7	LMS manager
P8	Network supervisor
P9	System administrator
P10	System administrator

4.4 IT department role in the HEI before introducing cloud computing

This section provides answers to the first research sub-question, i.e. describes the role of the researched IT department in general and before introducing cloud computing.

The data collected 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 (Pitt, 2014). One of the respondents (Interviewee P9) confirmed the literature review findings:

“The role of IT before cloud computing was to supply services to staff and students”.

The services included learning management system (LMS) administration and maintenance, hardware and technical support, network connectivity and internet (Pitt, 2014). Interviewee P7 stated:

“The cloud computing I am talking about is the LMS (Learning management system) which has moved to the cloud. Previously the services were hosted by the IT department. The IT department was responsible for the maintenance of operating systems and application and the update of our LMS. Our role was administration and user interface support”.

Furthermore, an IT department also manages servers and databases, application development and email system support (Monroy et al., 2012; Kats, 2012). An IT department also provides a virtual environment specialised in teaching and research (Dumas, 2016).

One of the respondents (Interviewee P2) indicated:

“The service that my section..... Which is an enabler service. We look the data center as a service, we hosting virtual and physical infrastructures; we are not the network team. We are also back-end to some of other services such as emails.”

His role was very much hidden from the user, providing back-end services to other IT services such as emails and hosting virtual and physical infrastructure.

Kats (2012) affirms that an IT department also determines priorities, allocating IT resources and budgets across the institution. One of the responses gathered from Interviewee P2 confirms the literature review finding: *“our other role also is to estimate the budget we get and how to allocate it in an efficient manner”.*

Network and internet connectivity is also supported by the IT department. For the effective functioning of an institution all campuses are connected via the internet (Monroy et al., 2012). One of the respondents (Interviewee P8) remarked: *“as network manager my section provides connectivity between service, the internet and the remote site to the main office”.*

Another important service provided and supported by the IT department is emails and printers. HEIs make use of printers every day for exams and assignments, thus being

dependent on reliable and efficient printer services. Email services are one of the main services offered and supported by the IT department as well (Kats, 2012).

Previously these services were hosted internally but due to a lack of space and maintenance, emails have been moved to the cloud as indicated by one of the respondents (Interviewee P6):

“For example, our email system moved to cloud office 365. Now we don’t have to worry about mailbox size or email services”.

The increasing demand for space and recovery of emails has forced the IT department management to migrate the emails to the cloud which offers more flexibility, space and security. Now staff and students can access their emails off campus via any devices.

The table below summarises the literature review regarding the other roles of IT departments in HEIs and the empirical responses gathered from the interviews.

Table 4.1: The IT department’s role in the HEI before the introduction of cloud computing

Literature Review	Reference	Empirical Study	Case
<ul style="list-style-type: none"> IT departments provide LMS support Services support 	(Pitt, 2014)	<ul style="list-style-type: none"> Provides end-to-end services to users, such as LMS, blackboard, and email Provides hardware and technical support Provides backup services Maintains and updates the LMS 	✓
<ul style="list-style-type: none"> Maintaining IT infrastructures User support 	(Sultan, 2010)	<ul style="list-style-type: none"> Maintains hardware computer infrastructure Provides user support 	✓
<ul style="list-style-type: none"> Manage network and internet connectivity. System development 	(Monroy et al., 2012)	<ul style="list-style-type: none"> Provides networking and connectivity support between services and between remote sites and the main campus 	✓
<ul style="list-style-type: none"> Administration of web pages Servers and database management Managing ERP system 	(Monroy et al., 2012)	<ul style="list-style-type: none"> Data integration Database administration 	✓

<ul style="list-style-type: none"> Implement and coordinate IT governance 	(Pitt, 2014)	<ul style="list-style-type: none"> Estimates IT Budget Allocates IT budget in an efficient manner Implements mitigation plan and risk 	✓
<ul style="list-style-type: none"> Provide virtual environment specialised in teaching and research 	(Dumas, 2016)	<ul style="list-style-type: none"> Hosts virtual and physical infrastructures 	✓
<ul style="list-style-type: none"> Determine priorities Allocate IT resources and budgets across the institution 	(Kats, 2012)	<ul style="list-style-type: none"> Estimates IT budget Allocates IT budget in an efficient manner 	✓
<ul style="list-style-type: none"> Design and implement institution applications according to the requirements of other departments 	(Kats, 2012) (Alias, 2016)	<ul style="list-style-type: none"> System and application development 	✓
<ul style="list-style-type: none"> Manage emails and printer system 	(Kats, 2012)	<ul style="list-style-type: none"> Maintain hardware and software Support printers and emails services 	✓
N/A	N/A	<ul style="list-style-type: none"> Enabler service, such as back-end service for emails Data centre as a service Service hidden from user 	

4.5 Cloud computing influence on the IT department of the HEI

This section provides answers to the second interview question: What is the influence of cloud computing on the IT department? Data collected from the interviews reveal that cloud computing influences the IT department in the HEI in different ways. Cloud computing reduces IT expenditure as most of the service is moved to the cloud and the customer pays the provider only for the service (Munjal, 2015). Therefore, the customer is less concerned about upfront payments for IT infrastructure and also less concerned about maintenance. The provider is responsible for maintenance and updates. One of the respondents (Interviewee P2) mentioned:

“Cloud computing has a shift in the type of cost that is required; it’s like moving from one level of technology to the next. Cloud computing reduces the cost of the traditional IT infrastructure as everything is virtual.”

This confirms the findings in the literature review.

Literature argues that cloud computing affects IT positions in such a way that some IT positions decrease and others increase in the departments (Dutta et al., 2016; Bergsmark et al., 2014). Some IT positions will become obsolete, and new qualified IT cloud-based technicians will be required.

For example, positions such as data integration specialists, security and privacy specialists, legal specialists and user-support personnel have seen a growth, whereas the positions of system administrators, application developers have seen a reduction in some cases (Brooks, 2015).

The participants agreed that cloud computing influences the position of IT staff, as explained by Interviewee P10 whose comments support the literature findings:

“The cloud computing influences the HEI IT department as the IT department no longer uses hardware, blackboard support. Migration services has moved the physical on the premises to the cloud, like extraction, loading, transfers at once off. After the IT department provided connectivity support, data integration and access to the cloud by users”.

However, in this particular department the views differed regarding fewer or more staff needed in the department. Interviewee P10 elaborated:

“Cloud computing doesn't necessarily mean more or less people are required unless you set it up in a particular manner that needs some sort of reconfiguration, depending on the type of service you use and configuration. Just people in a different area”.

Therefore, as a result of the type of cloud computing services adopted at the moment, the focus at this point is on re-skilling IT staff rather than reducing or increasing staff. The IT department of the institution uses a different approach, and managers promote staff development and learning.

Yet some staff members may feel redundant and express low morale as described by Interviewee P2:

“On the negative side, staff may feel obsolete and they are being made redundant causing a ‘low-morale’ situation to resentment.”

This then affects the culture of the department and confirms findings in the literature.

Cloud computing influences the IT department as some key functions which were traditionally maintained by the IT department may now be move to the cloud (List, 2015; Gantz & Minton, 2015). The LMS, for instance, which was maintained by the IT department, is entirely moved to the cloud; only authentication remains in the department. One of the respondents (Interviewee P7) explained:

“Previously the services were hosted by the IT department. The IT department was responsible for the maintenance of operating system and application and the update of our LMS. Our role was administration, user interface support. We also did a little data integration where we extracted the data from ITS (Information Technology System) into blackboard, now everything is on the cloud”.

The table below describes the literature review regarding the influence of cloud computing in the IT department and the empirical responses gathered from the interviewees.

Table 4.2: Cloud computing influence on an IT department of a HEI

Literature Review	Reference	Empirical study	Case
<ul style="list-style-type: none"> • Cost reduction 	(Munjal, 2015)	<ul style="list-style-type: none"> • Shift of the type of IT cost which is required. 	✓
<ul style="list-style-type: none"> • Reduce of positions 	(Dutta et al., 2016; Brooks, 2015)		N/A
<ul style="list-style-type: none"> • Increase in positions 	(Bergsmark et al., 2014; Brooks, 2015)		N/A
<ul style="list-style-type: none"> • New IT skills needed 	(Ross et al., 2013 ; Gantz & Minton, 2015)	<ul style="list-style-type: none"> • Less hardware and system support, more connectivity support, data integration and user access 	✓
<ul style="list-style-type: none"> • 		<ul style="list-style-type: none"> • 	✓
<ul style="list-style-type: none"> • Key IT functions that were traditionally maintained internally have 	Al-Badi (2016)	<ul style="list-style-type: none"> • More redundancy plans in place in the cloud. Back-up plan • No need to update or upgrade the 	✓

shifted to the cloud		LMS. • No blackboard support	
• Change in IT department culture	(List, 2015; Gantz & Minton, 2015)	• New mind-set must be adopted • Staff feeling redundant and have a low morale	✓
• Change in IT job focus	Al-Badi (2016)	• Connectivity support, data integration and access to the cloud by users. • increase of bandwidth consumption	✓

4.6 Cloud computing impact on IT department staff skills

The introduction of cloud computing into a business profoundly affects the IT skills and jobs within the organisation (Brooks, 2015). According to List (2015) and Gantz and Minton (2015), some new IT skills emerged after the introduction of cloud computing.

The data obtained from the respondents show that new skills are required, as the literature argues, as cloud computing is a new technology. One of the respondents (Interviewee P9) commented:

“Cloud computing requires the skilling of IT staff as new technology it brings new challenges and opportunities”.

However, cloud computing changes the focus of skills and skills are sinking. As cloud computing requires a high internet bandwidth, some additional skills are required, such as network security, firewall and policy-based networking. The same staff perform the same tasks but in different areas after having been re-skilled. As an IT leader, Interviewee P5 made the following observation:

“The only skill affected now is hardware support as we move to the cloud. Staff need to learn more skills as prioritisation of traffic because of bandwidth concerns. How to prioritise the bandwidth utilisation it calls policy base networking. Otherwise cloud doesn’t reduce the skills or the need of other skills. Cloud doesn’t really reduce the skills of IT staff within the department, the skills are sinking”.

Bergsmark et al. (2014) argue that the introduction of cloud computing decreased the need for some IT positions while the demand for other IT positions increased. However, the participants indicated that the introduction of cloud computing did not increase or decrease positions in the IT department, as the HEI promotes staff development. The IT supervisor (Interviewee P5) indicated:

“There is no need for new positions but a re-skilling of current IT staff as mentioned earlier. I have to ensure that employees don’t lose their jobs by re-skilling them.”

On the other hand, the focus of some IT positions has changed with the introduction of cloud computing (Al-Badi, 2016). The information gathered from the interviews shows that skills did not necessarily decrease or increase in the IT department. Skills were sinking so the focus is to re-skill people in the department. The expectations are more focused on administration services than technical support.

One of the respondents, an IT team leader (Interviewee P4) explained:

“The skills set is moving in the direction of the cloud computing; it changes the focus of skills. The expectation is administering the services rather than looking after the hardware itself. The type of skills required is more complex from an HR perspective. The same people doing different types of jobs such as re-skilling the same people”.

That supports what the literature indicated about changing the focus of the work.

The LMS manager, Interviewee P7, said there was no comment regarding this question.

The table below shows the literature review concerning the impact of cloud computing on IT staff skills in the IT department of a HEI and the empirical responses gathered from the interviews.

Table 4.3: Impact of cloud computing on IT staff skills in the IT department

Literature review	Reference	Empirical study	Case
<ul style="list-style-type: none"> The introduction of cloud computing thoroughly transformed IT skills. 	Brooks, 2015	<ul style="list-style-type: none"> Cloud computing changed the focus of skills 	✓
<ul style="list-style-type: none"> Some additional IT skills have emerged after the introduction of CC 	(List, 2015; Gantz & Minton, 2015)	<ul style="list-style-type: none"> Skills are sinking Prioritisation of traffic Policy-based networking Security and firewall 	✓
<ul style="list-style-type: none"> Some IT skills have decreased after the introduction of CC. 	Bergsmark et al., 2014	<ul style="list-style-type: none"> A greater demand for administration of services. 	N/A

<ul style="list-style-type: none"> The focus of some IT skills has changed after the introduction of CC. 	Al-Badi (2016)	<ul style="list-style-type: none"> Cloud computing changed the focus of skills. The expectation is of more administration of services Re-skilling of staff 	✓
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4.7 Managerial and technical skills and new expertise resulting from the introduction of cloud computing

This section provides answers to the question: What managerial, technical skills and new expertise following the introduction of cloud computing in the IT department?

IT staff, such as system administrators and managers, can adapt to become service brokers by providing advice regarding models and policies to organisation so that the latter can take full advantage of the cloud service (Ash, 2012).

Firstly, the staff in the networking section said that only technical skills on network security were needed in the department – no managerial and new expertise. The networking section was less affected by the introduction of cloud computing as indicated by the network team leader (Interviewee P8). He commented:

‘There is not a really an impact on the IT network staff, only security skills which will be required in the future’.

A similar observation was made by the LMS manager. He indicated that no technical and managerial skills and expertise were required from staff in his section. The cloud provider took charge of everything; only network connectivity was required of his section.

“Fairly little on my side. They don’t need any additional skills for the blackboard, the provider offers all services, and all we need is just to log a call. There are no new technical skills required for the blackboard. The maintenance of the system is provided by the cloud provider 24/7 by 365”.

“For the blackboard side no new managerial skills are required with cloud computing”.

Secondly, other information with regard to the three questions and collected from other sections of the IT department show that some technical and managerial skills were needed. However, some skills are synchronising and sinking. New technical skills on Microsoft 365, mime cast as the emails moved to the cloud as the literature describes.

Technicians need to understand and support users with email-related issues in the cloud. Some findings reveal that data extraction and network and policy prioritisation were also

required as internet traffic increased with cloud computing. Yet, other findings show that no technical and managerial skills were required. One team leader (Interviewee P4) indicated:

“The bigger shift is how you manage your infrastructures, how you manage your physical infrastructure to the cloud and virtualisation. I don’t think there are new skills; I think it is a learning curve that has to do with product knowledge”.

“In my team there wouldn’t be new expertise because the staff are already used to virtualisation technology, have idea of cloud computing”.

Furthermore, project management skills were required as managerial skills were needed in the department. The IT leader must understand the impact of cloud computing and evaluate the business value generated by the cloud computing in the department, as well as resource allocation. One IT leader (Interviewee P6) commented:

“The managerial skills are project management skills because managing resources is different in the cloud. For example, our email system moved to cloud office 365. Now we don’t have to worry about mailbox size or email services; now we need to manage the added value we can get from the cloud services”.

Again, this confirms the literature review findings. A similar observation was made by one of the respondents (Interviewee P3) who stated:

“Managerial skills in project planning, time management will be required within the department”.

The adoption of cloud computing services is an endeavour which unfolds over a long period of time and requires processes, time and resources. Thus, for a successful implementation, an IT manager needs project management skills. Furthermore, cloud computing offers new skills, new opportunities and challenges. Management needs skills to manage these issues, know where to allocate staff and which training is required.

The table below describes the literature review with regard to the managerial and technical skills and new expertise resulting from the introduction of cloud computing.

Table 4.4: Managerial, technical and new expertise resulting from the introduction of cloud computing within the IT department

Literature review	Reference	Empirical study	Case
<ul style="list-style-type: none"> New technical skills arise with the introduction of cloud computing. 	(List, 2015; Gantz & Minton, 2015)	<ul style="list-style-type: none"> Synchronisation skills Policy networking Data integration Office 365 , mime cast 	✓
<ul style="list-style-type: none"> New managerial skills arise with the introduction of cloud computing. 	(Ash, 2012)	<ul style="list-style-type: none"> Project management skills Team development 	✓
<ul style="list-style-type: none"> New expertise arising with the introduction of cloud computing 	(Brooks, 2015)		N/A

4.8 IT department staff members affected by the introduction of cloud computing

This section answers the questions regarding which staff members of the IT department are affected by the introduction of cloud computing. According to Brooks (2015), most IT staff have been affected by the introduction of cloud computing. New positions are created after the introduction of cloud computing within an organisation (Deloitte, 2013). However, some IT positions also decreased after the introduction of cloud computing, such as IT desktop support, developers and system administrators (Brooks, 2015).

Firstly, data collected show that some IT staff were affected as the department moved to the cloud. System administrators and desktop support were affected because less support is needed for actual machines. The focus turned to service delivery and away from physical support. One supervisor (Interviewee P5) of a section made the following remarks, thus confirming the literature findings:

“Various people were involved as we moved to the cloud at the different level will be affected like now system administrator and desktop support are affected. Depending on what services will be focusing on. Emails support when it becomes to emails and so on.”

The back-end section was also less affected as they already had some virtual experience and involvement and had been less engaged with physical support. The IT team leader (Interviewee P4) explained:

“All staff will be affected in the future, but staff members directly affected is the one using physical hardware who moved directly to virtualisation. IT staff who do student support, share

drive support and emails as well. From 16 machines running in traditional environments they can easily run more than 80 virtual machines. Their focus now is the service they can deliver, less worries about the physical machines. However, my team is not directly affected. Business Administration team that runs ERP is also affected'.

Another finding from the interviews was that, despite the fact that all IT staff are affected, job losses did not occur in the department but, as mentioned before, re-skilling of IT staff was the priority of managers and IT supervisors. One of the respondents, an IT supervisor (Interviewee P5) indicated:

"There is no need for new positions but a re-skilling of current IT staff, as mentioned earlier. I have to ensure that employees don't lose their jobs by reskilling them".

However, a shift of focus in some IT positions was observed and a decrease in some traditional IT functions, such as system administrator and desktop support (Choudhary et al., 2016).

On the other hand, only IT staff who did not want to be re-skilled would lose their jobs, as one of the IT managers (Interviewee P4) explained:

'Yeah, the staff are affected. The problems with the IT department was that there was no 24/7 support for the blackboard. When the services die on a Friday afternoon, we only have support the Monday at 9:00 am. I think IT department staff will have less to do regarding blackboard. Few IT staff will be affected because all IT staff will be re-skilled for the cloud, not losing their job. The only people losing the job will be those who don't need to re-skill".

Further data collected from one participant show that network staff were not affected, as the cloud services adopted by the department did not affect the network team. Consequently, there was no decrease or increase of staff.

The network supervisor (Interviewee P8) indicated:

"Network staff are not affected by the cloud, more the infrastructure department that are currently hosting the services offered by the cloud."

The table below summarises the literature review regarding IT staff affected by the introduction of cloud computing and the empirical responses collected from the interviews.

Table 4.5: IT staff affected by the introduction of cloud computing within the IT department

Literature review	Reference	Empirical study	Case
<ul style="list-style-type: none"> Most staff are effected. 	Brooks, 2015	<ul style="list-style-type: none"> IT staff affected Only network staff not affected at the moment 	✓
<ul style="list-style-type: none"> New job positions required 	(Deloitte, 2013)		N/A
<ul style="list-style-type: none"> IT staff, such as system administrators, desktop support and developers are affected. 	Brooks, 2015	<ul style="list-style-type: none"> System administrators Desktop Support 	✓
<ul style="list-style-type: none"> Decrease of job positions 	Brooks, 2015		N/A

4.9 Training and new certifications needed in the IT department after the introduction of cloud computing

This section describes the literature review pertaining to the training and new certifications needed after the introduction of cloud computing in the IT department.

As with any other technology before, cloud computing requires training and certification which IT staff and organisations should do in order to be able to use it (Raza et al., 2015). The training and certification vary according to the type of service and the provider, ranging from Microsoft AZURE cloud, Office 365, Cisco cloud to Oracle cloud.

The data from the interviews show that there was a need for training and certification; though not for the network sections at that point in time as the cloud technology used did not yet affect their section. However, their function will be affected in the future.

Training required for the remaining section was Microsoft AZURE cloud training and Office 365 training as the email services had migrated to the cloud. The LMS needed some training in data integration and SLA as, according to the section manager (Interviewee P7), the provider was taking charge of almost everything:

“Very little training. The training that I see for blackboard side is the authentication system which is still done locally. Other training will be how to interact with the cloud provider for support and also look at the service legal agreement”.

“Fairly little certification for blackboard support, the provider offers all services and support.”

Furthermore, certification in Microsoft cloud services, Oracle cloud and Cisco cloud would be future requirements in the department as mentioned by one of the respondents (Interviewee P9). The reason for this was that the department was in the process of completing cloud adoption:

“Certification in technology, such as MCSE cloud services (AZURE), Oracle cloud, and Cisco cloud are required”.

The table below describes the literature review concerning training and new certifications required in the IT department after the introduction of cloud computing, as well as empirical responses gathered from the interviews.

Table 4.6: Training and certifications resulting from the introduction of cloud computing within the IT department

Literature review	Reference	Empirical study	Case
<ul style="list-style-type: none"> Impact depends on the type of cloud service adopted by the institution 	Al Badi (2016)	<ul style="list-style-type: none"> No training is needed for network staff 	✓
<ul style="list-style-type: none"> New training is required in the cloud computing environment 	(Raza et al., 2015)	<ul style="list-style-type: none"> Microsoft AZURE training Training on SLA and authentication for LMS Office 365 training 	✓
<ul style="list-style-type: none"> New certification is required in cloud computing. 	(Raza et al., 2015)	<ul style="list-style-type: none"> MSCE AZURE cloud certification Oracle cloud Data centre certification 	✓

4.10 Business value added by the IT department after the cloud computing adoption

This section answers the question regarding the business value added by the IT department after cloud computing adoption. Literature points out that there are several benefits associated with the cloud computing. According to Yadin (2013), cloud computing allows HEIs to increase their efficiency and agility, and stimulates their sense of innovation while reducing their IT budget. One of the respondents, the LMS supervisor (Interviewee P7), stated that *“for me, outsourcing is cheaper than hosting on premises”*.

HEIs will derive more benefits from moving to the cloud. Yet IT management should choose the appropriate cloud computing services to adapt to their needs so that they can record an added business value (Yadin, 2013). Furthermore, cloud computing provides an institution with an effective way of teaching (Oberer & Erkollar, 2012).

Cloud eLearning enables users, students, staff and researchers to access the LMS from any devices, such as computers, tablets and cell phones at any time and from anywhere without interruption (Oberer & Erkollar, 2012). As described by one of the respondents, the LMS supervisor (Interviewee P7):

“I never have had 24/7 support before; I now have 24/7 support from the cloud provider. In cloud computing, the maintenance of the system is provided by the cloud provider at 24/7 by 365.”

The data collected reveal that cloud computing allows a 24/7 service for LMS and black board, services that the IT department could not provide before. This 24/7 service increases productivity and speed. Less support from the IT department also means reducing costs, and staff can now focus on other tasks. The LMS manager (Interviewee P7) explained:

“Imagine having a 24/7 by 365 support from the IT department. Can you imagine one IT technician earns more than R150000 a year; times 3 for 3 technicians. It’s almost R700000. Knowing that the IT department doesn’t offer a 24/7 support you can get an approximated value that we gain by using cloud computing. And if you had other costs like office you are close to 1 million rand a year. And the hosting is far less than that.”

Cloud computing enables IT technicians to focus on another aspect of their work to make sure that value is added. In this regard, one IT supervisor (Interviewee P6) confirmed the literature findings:

“24/7 availability because it was difficult to provide services after work hours. With cloud now we get support 24/7 by paying the services. Less training in smaller teams, no need to buy hardware. Our focus will be making sure everyone is connected at all the times.”

Nevertheless, the supervisor of the enabling section argued that the business value could not be estimated as they had not decided on the business value. He (Interviewee P4) pointed out:

“The business value is very difficult as we don’t decide the business value. The more invisible you become, the more successful you will be. The focus won’t be on what kind of technology you are going to use, but the focus is what the end results are intended to be, that will give the IT department certain choices and enable that project as they can.”

Furthermore, according to him, the technology that the department adopts should be one that best answers to the needs of the IT department. It should not simply be a new technology with has drawn attention from the community.

The table below describes the literature review with regard to the value added by the IT department after introducing cloud computing, as well as empirical responses gathered from the interviews.

Table 4.7: Business value added by the IT department after cloud computing introduction

Literature review	Reference	Empirical study	Case
<ul style="list-style-type: none"> • Cost reduction • Increased speed • Increased productivity • Improved strategy 	(Yadin, 2013)	<ul style="list-style-type: none"> • 24/7 service support • No need to buy hardware • Savings 	✓

4.11 Findings

Considering the analysis of the case study of the IT department in the HEI, it appears that, in some sectors, the role of the IT department has been impacted by the introduction of cloud computing. Some services, such as emails and LMS, have migrated to the cloud.

Firstly, the role of the IT department before cloud computing was to provide IT services to users, such as students, staff, researchers and other actors working with the HEI. Services varied from e-learning, technical support, hardware and software infrastructure maintenance to networking and connectivity for the various campuses and users. In addition, the IT department was in charge of estimating the IT budget, managing the databases and ERP system and dealt with risk management and data recovery.

Secondly the introduction of cloud computing shifted the type of IT costs within the department and also reshaped the type of work traditionally performed by IT staff: Less hardware and technical support and more connectivity and user access support.

Cloud computing brings with it a decrease in functions, such as system administrators, desktop support and developers within the IT department. However, no loss of jobs was observed; the focus was on re-skilling the current staff because the HEI encourages staff development and training as opposed to the corporate world.

Thirdly, when the demand for traditional roles, such as system administrators, desktop support and developers are decreasing, new positions appear that require new skills in cloud techniques, such as security, data integration in a virtual environment, SLA and authentication. Therefore, new certification and training are required for IT staff in the department. Furthermore, skills in policy networking, synchronisation and project management are required for IT staff and IT leaders. Office 365, Microsoft AZURE cloud and Cisco cloud are amongst the certifications needed.

Fourthly, despite the changes brought about by cloud computing, certain positions, such as network administrators, remain unchanged because they are not being impacted by the cloud.

Lastly, the culture of the IT department was also affected because some employees expressed low morale and fear due to the change of practices and skills brought about by the cloud, which make them more reluctant to adapt.

Cloud computing provides a 24/7 support and service to the IT department users. Therefore, some IT staff can focus more on other aspects of their work. Users can now access the LMS from any devices at any time which increases the efficiency of the institution.

4.12 Answer to the research questions

The study has examined how the role of the IT department was affected by the introduction of cloud computing in an HEI. The results are as follows:

The role of the IT department of the HEI before the introduction of cloud computing was to provide IT services to users who are students, researchers and staff. Services ranged from hardware and software support, to management and network connectivity.

Cloud computing impacted the role of the IT department of the HEI by changing the work focus of IT staff, without affecting positions in the department because its management encourages employee development. Some knowledge in administration, support and programming has become obsolete, new knowledge in virtual technology, data security and data integration.

The culture of the department had also been affected by the introduction of the cloud. Some staff expressed a sentiment of frustration and low morale caused by change and the new requirements of cloud computing which made them reluctant to learn new skills.

Training and certifications were required for the IT staff in the department depending on the type of cloud service adopted. Re-skilling included training in data security, data integration and virtual technology. Certification in Microsoft, Cisco and Oracle were also required.

4.13 Chapter Summary

This chapter has summarised the main findings of this research by answering the various research questions raised in Chapter 1. The next chapter gives the conclusion and recommendations for further study.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter concludes this study by revisiting the research objectives presented in Chapter 1. In addition, the chapter discusses some theoretical and practical contributions of this case study. Furthermore, it presents the limitations of this study and future research areas.

5.2 Revisited research objectives

The main objective of this study was to explore the impact of cloud computing on the role of the IT department of a HEI in the Western Cape. To achieve this main objective, four research objectives were formulated as follows:

- *To explore the traditional role of an IT department in the HEI:* This was achieved in two ways by reviewing the relevant literature on the topic and by conducting an empirical study within the IT department.
- *To investigate the impact of cloud computing on the IT department of the HEI:* This was achieved by reviewing the relevant literature and identifying factors that influence the role of an IT department in a HEI, and then comparing these factors with the empirical details of the study after cloud computing adoption.
- *To determine how the IT department reacts to the adoption of cloud computing:* This was achieved by reviewing the literature and by the empirical study.
- *To determine an optimal way of managing the cloud computing impact on IT departments in tertiary institutions:* After having achieved the above three research objectives and having looked at the literature, it was easy to determine the way the HEI in the case study did manage the impact of cloud computing.

5.3 Contributions of the study

5.3.1 Theoretical contribution

Currently, the sector of higher education in Africa, and more precisely in the Western Cape, is going through a financial crisis to which it must find solutions. This study contributes to the body of knowledge on IT and cloud computing as it analysed the impact of cloud computing on the role of an IT department in a higher education institution in the Western Cape. Most of

the previous studies conducted on the topic of cloud computing focused more on technical aspects and on the corporate context, and very little on the higher education sector of emerging countries. This study offers a better understanding of the impact of cloud computing on HEIs, specifically on their IT departments. Furthermore, the study has used a case study approach, and has penetrated the real world of HEIs and gives researchers a start to investigate IT departments after cloud computing adoption within the context of emerging countries. This is especially important as IT departments are the core IT service providers in some HEIs.

5.3.2 Practical contribution

Cloud computing, because of its services, seems to be beneficial; but it is necessary to consider all challenges and limitations before adopting it. This study focuses on a practical case and describes how the IT department was affected by the introduction of cloud computing.

This study provides a detailed understanding of the impact of cloud computing on the IT department in a HEI, and has documented the way in which the HEI management can counteract any disadvantages. The study also offers some suggestions on the subject. A successful implementation of cloud computing requires a good understanding of the technology and the impact of the cloud on the role of IT staff and their work. The cloud affects the service delivery provided by the IT department to users, and it is necessary to take into consideration any challenges which might hinder a successful implementation.

The adoption of cloud computing can bring challenges related to the skills of IT staff which could create a feeling of frustration and a fear of losing their posts or becoming obsolete. Thus the management of the HEI should take action by promoting staff development to preserve jobs and offer training and certifications to their IT staff. This should be discussed with the staff for their own interest and they should be assured that the culture of their department would not be affected adversely.

5.4 Limitation of the study and future research

5.4.1 Limitation of the study

Several limitations may be associated with this study. Firstly, 10 individuals, as a number of participants in the research and employed in the IT department, could be considered a small sampling. Secondly, only two services, emails and LMS had been migrated to the cloud by

the IT department, which limited the results of the study. Thirdly, the study method employed is a single case study which greatly limits the generalisation of the results and their implications.

5.4.2 Future research

After having analysed the findings of this study, the following recommendation can be made: Because the study has focused on only one case, two future studies are proposed following this study. One future study may include IT departments at other HEIs as a sample which would provide more data and facilitate generalisation. Another research could consider the different types of cloud services adopted by HEIs and conduct an assessment of the added business value of cloud computing at a HEI in an emerging country.

5.4.3 Chapter Summary

Cloud computing necessitated a revision of outsourcing practices associated with technologies and services that open up a much wider field of use. In a fast-paced world, everyone can access any type of standard or specific service from anywhere on the planet at any given time, on condition of being connected to an existing network. Cloud computing has introduced a revolution in the world of information technology and offers companies, specifically HEIs, excellent opportunities for IT expansion and stream-lining as well as cuts in expenditure.

The findings show that an IT department of a HEI provides many services to the institution. However, due to the lack of experience and budget constraints, some services can be more efficient, more secure and cheaper when migrated to a cloud computing provider. Yet, cloud computing affects the skills and posts of the IT staff in the IT department. Consequently, there is a need to re-skill and train IT staff to cope with the changes brought by cloud computing. On the whole, this study has produced enough evidence that higher education institutions can gain significant benefits from cloud computing. However, IT managers need to choose the right solutions so that they can secure an added business value.

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LIST OF FIGURES

Figure 2.1: Cloud computing model, services and main characteristics

Figure 2.2: Cloud computing services and main services providers

Figure 2.3: Public cloud concerns in the public sector

Figure 2.4: The main users of IT services in a typical university

Figure 2.5: Cloud computing usage in different sectors and industries

Figure 2.6: IT infrastructure application in cloud computing in a HEI

Figure 2.7: Cloud based eLearning architecture in HEI

Figure 2.8: Changes in roles / positions resulting from moving services to the cloud in HEI

Figure 2.9: The main users of IT services in a typical university using cloud computing services

Figure 3.1: Research methodology process

LIST OF TABLES

Table 2.1: Cloud computing benefits and limitations in higher education

Table 2.2: Factors influencing the IT department's role in HEI

Table 4.1: Role of the IT department in the HEI before introducing cloud computing

Table 4.2: The influence of the introduction of cloud computing on the institutional IT department

Table 4.3: The effect of the introduction of cloud computing on IT staff skills in the IT department

Table 4.4: New technical, managerial skills and new expertise required in the IT department following the cloud computing adoption by the institution

Table 4.5: IT department staff members affected by the cloud computing adoption in the institution

Table 4.6: Training and certification needed in the IT department of the institution after the cloud computing adoption

Table 4.7: Business value added by the IT department after the introduction of cloud computing

APPENDICES:

ABBREVIATIONS AND CLARIFICATION OF TERMS

List alphabetically and clarify / define the main words and concepts that were not explained in the text of the proposal. There should be no need to add further appendices to the research proposal. Important concepts can also be explained by means of selected footnotes.

- **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
- **IS** : Information System
- **ICT** : Information and Communications Technology
- **Responsibility** : a duty or task that a person is required or expected to do
- **Role** : The function assumed or partly played by a person or thing in a particular situation
- **ERP** : Enterprise Resource Planning
- **ITSM** : Information Technology System Management
- **UC** : University of California
- **HEI** : Higher Education Institution
- **TCO** : Total Cost Ownership
- **LMS** : Learning Management System
- **SLA** : Service Level Agreement
- **CRM** : Customer Relation Management

Appendix 1: Interview question



Interview questions for Mini Thesis for the fulfillment of

Master of Technology in Business Administration

Title: the impact of cloud computing on it department role: case study of a higher education institution in the Western Cape

Student Name: N'souh Yonkwa Toutcha

Student Number: 212009923

Supervisor: Dr Zoran Mitrovic

- What is the role of the IT department in the HEI before introducing the Cloud Computing?
- How the introduction of Cloud Computing does influence the institutional IT department?
- How does the introduction of Cloud Computing affect the skills of IT staff in the IT department?
- What new technical skills in the IT department are required following the Cloud Computing adoption by the institution?
- What managerial skills in the IT department are required following the cloud computing adoption by the institution?
- What new expertise in the IT department results from the adoption of cloud computing by a HEI?
- What IT department staff members are affected by the Cloud Computing adoption in the institution?
- What kind of training will be needed in the IT department of the HEI after the Cloud Computing adoption?
- What new certifications will be needed in the IT department after the adoption of the cloud computing by HEI?
- How does the IT department add business value to a HEI after the cloud computing adoption?

Appendix 2: Participants consent letter



CONSENT TO PARTICIPATE IN RESEARCH

Title: The impact of cloud computing on IT department role: A case study of a higher education institution in the Western Cape.

You are asked to participate in a research study conducted by Mr. N'souh Yonkwa Toutcha, MTech student in Business Administration from the Cape Peninsula University of Technology.

The study is conducted in a completion of the researcher's MTech thesis at Cape Peninsula University of Technology.

You were selected as a possible participant in this study because of your key position in the institution, your knowledge of its organization, and its processes in relation to Cloud Computing or Information Technology (IT) that can enlighten us in answering some of this research questions.

1. PURPOSE OF THE STUDY

This research purpose is to:

- Explore the impact of Cloud Computing on an IT department's role in a HE institution.

2. PROCEDURES

If you volunteer to participate in this study, we would ask you to do the following:

1. You will be supplied with the interview questions so that you can prepare for face-to-face interview.
2. The interviews will be open ended.
3. The interviews will be recorded using the tape recording device (cellular phone or voice recorder) with your permission.

The meetings will take place at the site of your choosing and a time suitable to you. With reference your workplace at your preferred time.

3. POTENTIAL RISKS AND DISCOMFORTS

No potential risks are envisaged at this stage. However, if something might come up, it will be dealt with in a sensible and sensitive manner.

4. POTENTIAL BENEFITS TO PARTICIPANTS AND/OR TO SOCIETY

It is envisaged that this research will add value to the theoretical body of knowledge in the field of Cloud Computing in tertiary institution in SA. This can help the Higher Education Institutions in understanding cloud computing, by users and IT professional.

5. PAYMENT FOR PARTICIPATION;

No payments to the participants will be made.

6. CONFIDENTIALITY

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission. Confidentiality will be maintained by means of referring to the interviewees as Interviewee IEXP1, IEXP2, IEXP3, etc, and by means of themes and categories that will be identified and used in the analysis and discussions of the findings and the outcomes, in the research report, the thesis, and in conference papers and articles that would be submitted for possible publication in academic journals.

The researcher further pledge that any information given by participants will be handled in the strictest confidence, and that the information participants give will not be used to reflect negatively on them or their institution in any way. The information will be stored in files that will be locked in the filing cabinet of the researcher, in his office or on well protected laptop and storage devices.

7. PARTICIPATION AND WITHDRAWAL

You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you don't want to answer and still remain in the study. The investigator may withdraw you from this research if circumstances arise.

8. IDENTIFICATION OF INVESTIGATORS

If you have any questions or concerns about the research, please feel free to contact me at; (cell) 0784155783; E-mail: regiroch1984@gmail.com OR yonkwat@cput.ac.za

9. RIGHTS OF RESEARCH PARTICIPANTS

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as research participants, please contact Dr. Zoran Mitrovic, CPUT Faculty of Business and Management Sciences via e-mail at mitrovicz@cput.ac.za.

SIGNATURE OF RESEARCH PARTICIPANT

The information above was described to *me, the participant* by Mr. N'souh Yonkwa Toutcha in *English* and *I am the participant* in command of this language. I was given the opportunity to ask questions and these questions were answered to *my* satisfaction.

I hereby consent voluntarily to participate in this study. I have been given a copy of this form.

Name of Participant

Signature of Participant

Date

SIGNATURE OF INVESTIGATOR

I declare that I explained the information given in this document to _____ [*name of the participant*]. *He/she* was encouraged and given ample time to ask me any questions. This conversation was conducted in *English* and *no translator was used*.

Signature of Investigator

Date

Appendix 3: Ethics clearance



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Symphony Road Bellville 7535

Office of the Chairperson Research Ethics Committee	Faculty: BUSINESS
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At a meeting of the Research Ethics Committee on 17 August 2016, Ethics Approval

was granted TOUTCHA N' SOUH YONKWA for research activities

Related to the MTech/DTech: MTech Business Administration at the Cape Peninsula University of
Technology

Title of dissertation/thesis:	THE IMPACT OF CLOUD COMPUTING ON INFORMATION TECHNOLOGY DEPARTMENT ROLE : A CASE STUDY OF A HIGHER EDUCATION INSTITUTION IN THE WESTERN CAPE Supervisor: Dr Z Mitrovic
-------------------------------	---

Comments:

Decision: **APPROVED**

	17 AUGUST 2016
Signed: Chairperson: Research Ethics Committee	Date

Clearance Certificate No | 2016FBREC386

Appendix 4: Editing certificate

DR GIFT MHETA
PhD Linguistics

5 Elm Gardens
17 Cromwell Road
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10 April 2017

EDITING CERTIFICATE

Re: N'souh Yonkwa Toutcha

I confirm that I have edited N'souh Yonkwa Toutcha's MTech dissertation titled, "The impact of cloud computing on IT Department role: A case study of a higher education institution in the Western Cape". I am a freelance editor specialising in proofreading and editing academic documents. My highest qualification is a PhD in Linguistics. Currently, I am the Writing Centre coordinator at Durban University of Technology.

Should you need anything clarified, please do not hesitate to contact me.

Yours sincerely,



Dr Gift Mheta