

**The adaptation of Bring Your Own Device as a Green Information Technology Practice
at the North-West University**

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Master of Commerce in Computer Science and Information Systems at the Mafikeng
Campus of the North-West University**

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DECLARATION

I, TOCHUKWU NELSON AGU, declare that this study, The Adaptation of Bring Your Own Device as a Green Information Technology Practice at the North-West University is my own work. This dissertation has not been submitted for an examination or degree at this, or any other educational institution for the award of a degree. All sources in this study have been indicated and duly acknowledged by means of references.

Signed

Date

DEDICATION

I dedicate this work and all my success to my beloved mother

Stella N. Agu

and

to the loving memory of my father

Nelson A. Agu.

You taught me the value of hard work and you have successfully made me the man I am today.

I will never forget you.

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ABSTRACT

BYOD and Green IT have become the recent trends in organizations including higher education institutions. BYOD helps organizations increase their productivity and the satisfaction of employees since it allows them to make use of their mobile devices for both work and personal purposes at the work place. There are benefits of BYOD with regards energy conservation and Green IT.

Putting effort into illuminating the effect of a particular technology and envisaging the positive outcome of implementation is paramount to its adoption, therefore this study investigated the perception of employees regarding the adaptation of BYOD as a Green IT practice. The study centres on energy conservation through adaptation of BYOD as a Green IT practice in higher education. In an effort to explain the factors to be considered before adoption and to depict the relationship between BYOD, Green IT, and energy conservation, the technology acceptance model (TAM) was presented and a conceptual framework based on TAM was developed.

This study followed the positivist paradigm and the quantitative approach and data was collected using questionnaire from employees of the North-West University (NWU), South Africa.

The study found that the employees of this institution are willing to adopt BYOD in line with energy saving aspect of Green IT practice. The study also found that the institution supports BYOD to an extent and the employees perceive the existing BYOD practices in the institution to be of value to them and easy to use.

Keywords: BYOD, Green IT, Mobile devices, Energy conservation, Energy Consumption, Higher education institution.

LIST OF ABBREVIATIONS

GREEN IT	– Green Information Technology
BYOD	– Bring Your Own Device
HEI	– Higher Education Institution
ICT	– Information and Communication Technology
NWU	– North-West University

CHAPTER 1

OVERVIEW OF THE STUDY

1.1 INTRODUCTION

The two recent trends in the business technology industry are organizations embracing green practices and implementing BYOD solution for the office (Correia, 2013). The BYOD and Green IT concepts are very complex; the combination of the two trends which is the shift towards Greening IT through BYOD adoption, does not make it any simpler to discuss. Hence, this study sought to address the energy conservation aspect of BYOD and Green IT.

The explosive growth and popularity of BYOD is evident in Higher Education Institutions (HEIs) as expressed by Mark Askren in Dahlstrom and Difilipo (2013) that

What began in the last decade as a faculty or staff member connecting a personal laptop to the campus network has exploded into an ever-growing ecosystem of personally owned smartphones, tablets, cloud storage, processing, and other individually owned technologies that are everywhere we are.

Erasmus (2015) elaborated that this may also extend to presentation devices, recording devices, electronic readers and other related devices used particularly in higher education settings where academic employees have been making use of their own devices for a long time. An instance of this connection and integration is the pointing devices that are compatible with presentation application programmes, external devices for storage and personal connections.

Building a greener environment requires change and often a total abandonment of some deep-rooted habits regarding the usual ways things get done (Murugesan, 2008). Green IT encompasses practices for organizations such as HEIs taking bold steps towards environmental sustainability (Lamb, 2011). BYOD makes employees and their organizations more flexible as they can get their jobs done from any location, allowing them to make use of mobile or cloud applications for sharing required resources (Blizzard, 2015). BYOD, which in some cases is not implemented specifically for environmentally sustainable purposes, reduces or completely eliminates the use of a second device in the business and the personal aspects prove that it is greening the way IT related activities are done (O'Donnell, 2014).

In 2009, a report by Gartner Group acknowledged Green IT as one of the top ten technologies for 2010 as it encompasses how an organization can utilize traditional IT to curb their energy consumption (Denis-Rémis, Codou & Lebraty, 2011). Realistically, the two trends complement

each other since they increase efficiency of daily business activities globally through the use of technology. Integrating BYOD into organizational culture yields benefits such as efficiency employees, reduction in expenditure regarding energy use and technology acquisition for use within the organisation (Correia, 2013).

With the increased use of information and communication technology (ICT) and increased concerns with regards its impact on energy consumption, it is expected that employees adhere to certain Green IT practices (Du Buisson & Naidoo, 2014). In the 1980s when Bill Gates and Steve Jobs embarked on ensuring that every table has a PC on it, no one envisioned the huge number of businesses, consumers, and individuals that would eventually rely on these computers for their daily activities and business operations (CGI GROUP, 2010). Consequently, as mobile devices emerged and people acquired different mobile devices, organizations have started considering measures to harness mobile devices for work purposes, unlike when the computer used by employees was only in the work place (Blizzard, 2015).

1.2 BACKGROUND OF THE STUDY

A research conducted by Cisco (2014) shows that an average of 52 percent employees in South Africa come to the work place with at least one of their personally-owned IT devices. The research further reveals that 63 percent of employees in South Africa are given the liberty to access the network at their work place. Noik (2014) also shows that the most recent varieties of technology come the cutting-edge solutions. It is in the light of this link that the emergence of BYOD has enticed employees to make use of these new solutions at the work place. This development is evident in the workers who have invested in taking care of the cost of purchase themselves (Correia, 2013a). Even as BYOD is growing popular, it is also evolving to consist of not only devices but networks and cloud services (Kelly, 2015).

The North-West University (NWU) is one HEI that has not been left out in this BYOD trend as the institution has launched a WiFi service (Wireless Network for Mobile Computing). This service gives employees, students, and guests mobile access to the network of the institution (NWU, n.d.). A few years ago, NWU through technology partner OpenCollab successfully rolled out their NWU Mobile App, giving employees and students on the three campuses of the NWU an exceptional set of mobile tools that are useful for administration, academic, research and information purposes (Opencollab, 2013). Among universities in South Africa, this innovation is the first of its kind whose application and features stands to amaze the employees and students (NWU, 2014).

BYOD is a project that aims to interface main business and technology into a platform that enhances the organization and employee to function as one (Logicalis, 2012). In HEIs, the BYOD movement has witnessed a growing population of students and employees who own mobile devices, with prospects that this practice enhances functionality (Higher Education Academy, n.d.). A study by Educause in 2014 suggests that an estimated sixty percent of college employees make use of their personally-owned devices at the work place. In order to keep pace with the increasing use of mobile devices, forty percent of HEIs implemented BYOD strategy in 2014 (Negrea, 2015). Similarly, this increasing dependency on and use of different mobile devices is also visible at the NWU and it has led the institution into initiating a project which gives wireless access to educational resources throughout its three campuses, that is Potchefstroom, Mafikeng and Vaal (Khipu Networks, 2013).

The use of enhanced technology has a marked influence on almost every area in HEIs (Ahmad, Nordin, & Bello, 2013), hence organizations have to tackle the environmental impact of IT (Murugesan, 2010). The environmental impact of computer use has yet to be established as users increase. According to Climate Group (2008), energy efficiency has become a major objective in a world where natural resources are rapidly consumed and getting depleted. ICT plays a key role in energy efficiency while at the same time the same ICT contributes to power consumption.

Several HEIs have adopted approaches steeped in promoting energy conservation schemes among employees (Cabrera & Zareipour, 2011), but the aspect of going green with BYOD has not yet been exhaustively explored (Ferris, 2012). Duplication of devices could be hugely reduced by BYOD, and this means that users would have to make use of their personal devices or technology for both work and personal purposes. Thus, users are likely to have in their possession just one personal laptop, tablet, or some other mobile device (Ferris, 2012).

Huge savings could be made by implementing BYOD policies and lessening energy consumption. Due to the various available options for mobile computing and learning, ranging from laptops to tablets and smart phones, users would not have to use desktop computers for work purposes. The development and use of apps such as word processing, file management, and many more, contribute to reduced use of desktop computers (O'Donnell, 2014).

BYOD also plays a key role in education, hence it has become an integral component of the educational system in the world today (Hamza & Noordin, 2013). The implementation of

BYOD policies in various HEIs is anticipated to yield increased financial savings while at the same time realising the merits of an improved and efficient workforce (Gartner Inc, 2013).

1.3 PROBLEM STATEMENT

Computers are among the devices that contribute hugely to the rapid increase of energy consumption in the educational sector. Huge number of computers are purchased for use yearly, but it is not only the number of computers that is increasing energy consumption. The manner at which the computers are used contributes to the rising energy problem (Agarwal, Vimal, Ghosh & Nath, 2012). The rising number of computers being utilized and their replacements which happens from time to time make the adverse impact of IT on the environment an issue that cannot be ignored (Murugesan, 2010).

The issue of sustainability has become compelling and has emerged as an organisational priority (Claudy, 2011). Energy distribution is increasingly becoming costly hence it has become important to find ways to decrease energy consumption and consequently consume efficiently (United Nations Population Fund (UNFPA) (2013). The increasing energy shortages are becoming one of the biggest drawbacks in South Africa as continuous load shedding cripples different aspects of the country's economy (Reuters, 2015). This makes the reduction in the energy consumption of computers and other related information systems an issue that should be tackled in order to preserve the environment (Murugesan, 2010).

Currently, there is a shift by individuals and organizations towards the use of mobile technologies like tablets, laptops and mobile phones. This has caused duplication and multiplication of devices, hence raising the need to integrate various essential functions into one device (Revenaugh & Schweigert, 2013). According to United States Green Building Council (USGBC) (2010), green educational institutions are characterised by energy efficiency, assisting in reduction of utility costs (Ferris, 2012) and from this perspective, BYOD contributes to conservation of resources and sustenance of the environment, thus privileging the argument that Green IT could be further promoted through BYOD adoption (Baroudi, 2011).

However, in the rapidly evolving business environment, various aspects of Green IT practices and their constantly growing important role are not well explicated (Nazari & Karim, 2012) and there is limited research that has been done to understand the BYOD phenomenon with regards energy saving aspect of Green IT. Ferris (2012) explains that there is need to understand the BYOD phenomenon from the Green IT perspective, since according to Liu (2013), the

increase of environmental issues, alongside the soaring energy demands, require organizations to earnestly consider integrating Green IT practices into their various decisions. This study therefore is an attempt to fill this gap in literature, and also to investigate the perception of employees regarding the adaptation of BYOD as a Green IT practice.

1.4 RESEARCH QUESTIONS

1.4.1 Main research question

- a) Can BYOD be placed as an artifact and practice that provides solutions to energy saving aspects of Green IT in Higher Education?

1.4.2 Minor research questions

- a) What is the NWU employees' level of knowledge regarding of BYOD in relation to Green IT?
- b) What is the NWU employees' usage level of mobile devices?
- c) What is the current state of BYOD adoption and implementation in the NWU institution?
- d) What is the employees' level of interest regarding the adaptation of BYOD as a Green IT practice at the NWU?

1.5 RESEARCH AIM AND OBJECTIVES

1.5.1 Aim

The aim of this study is to investigate the NWU employees' perceptions regarding the adaptation of BYOD as a Green IT practice in Higher Education.

15.2 Objectives

In order to achieve the aim of this study, the following objectives drive the research:

1. To evaluate NWU employees' level of knowledge regarding BYOD in relation to Green IT.
2. To evaluate the NWU employees' usage level of mobile devices.
3. To investigate the current state of BYOD adoption and implementation at the NWU.
4. To determine NWU employees' level of interest regarding the adaptation of BYOD as a Green IT practice.

1.6 BRIEF LITERATURE REVIEW

1.6.1 Introduction

Green IT is not just a new buzz word; it is rapidly evolving into a compulsory practice as an increasing number of organizations put into effect various forms of sustainable solutions (Bachour & Chasteen 2010, Cited in Nazari & Karim, 2012). In 2009, BYOD trend was recognized by Intel Corporation even as some organizations initially tried to reject the BYOD trend. Unlike these organizations, Intel Corporation were quick to follow the trend since it was seen as a way of reducing costs and enhancing productivity (Harkins, 2013). Similarly, other big organizations quickly joined the trend and expressed the various gains in performance enhancement, enhanced productivity and the organizational culture improvement (Higher Education Academy, n.d.). Encouragingly, a current survey conducted by Cisco suggests that South African firms are indeed not lagging behind in catching up with the BYOD trend. South Africa is following other developed countries and is getting ready for what is termed by Cisco as the factor that would propel the future of the IT sector (Noik, 2014).

The concept of using mobile devices started decades ago, but it also took decades to attain buy-in and acceptability (Tom, 2007) and currently the use of mobile devices in organizations in South Africa is significantly high (Noik, 2014). At present, employees can be found with their mobile devices and using the same technology at home as they do at their workplace (Blizzard, 2015).

Globally, the sale of mobile devices was estimated to amount to 821 million units in 2012 and 1.2 billion in 2013 (Gartner, 2012). By the year 2018, it is estimated that there would be increased millions of mobile-connected devices in South Africa. It is assumed that South Africa is getting to a time when almost different kinds of network activities are done through mobile technologies (Techcentral, 2014).

The total figure of personally-owned devices in the work place in South Africa has increased since 2010 (Harkins, 2013). Employees bring their own devices to the workplace in order to maintain communication with family and relations (Gaff, 2015). In such situations, employees utilize their devices solely for personal purposes (Gaff, 2015). However, Intel CISO Malcolm Harkins projects that 70 percent of Intel's 80,000 employees mostly utilize their personally-owned devices for at least part of their job by 2014 (Harkins, 2013). One of the main trends leading to this mobile explosion is the rapid growth of BYOD (Anderson, 2012).

As IT consumerization continues to transform, organizations are responding promptly to create strategies that pave way for BYOD (Citrix, 2012). BYOD as an aspect of consumerization which entails the use of technologies in a work environment, distinguishes itself more by concentrating on the technologies or gadgets originally procured by employees for personal use (Jones, 2012). When employees are given the freedom to make use of devices of their choice to get their work done, they tend to increase their level of productivity and mobility. An increased fulfilling work experience contributes to the organization's ability to hire and retain the best employees. The cross-over in device ownership to the users simplifies the challenge of IT for endpoint procurement and management (Citrix, 2012).

1.6.2 Definition of BYOD

BYOD refers to the use of personally-owned devices for both work and personal purposes in an organization (Gaff, 2015). According to Pogarcic, Markovic and Davidovic (2013), BYOD entails the freedom of employees to bring their personally-owned devices to the work place. BYOD can also be defined as a trend that allows employees to bring their own personally-owned devices such as laptop, tablet and smartphone to work and giving them the freedom to connect to the network of the organization (Yin, Liu & Liu, 2014) in order for them to access business and collaborative applications (Capgemini Consulting, 2013).

1.6.3 Importance of BYOD

According to Palmer Research (2013), BYOD helps HEIs reduce their printing needs since files and other resources can be accessed from any location within the institution, hence the monetary savings could be used to enhance their wireless platforms which support the use of mobile devices within the institution.

The constant advancement in energy saving features in mobile devices contributes greatly to energy savings (Global e-Sustainability Initiative, 2012) and BYOD further contributes to energy saving since it eliminates duplication of these mobile devices (Capgemini Consulting, 2013). Hence, there would be no additional need of having different devices for work and personal purposes (Eschelbeck, 2013).

According to Global e-Sustainability Initiative (GeSI) (2012), since most mobile devices consume less energy than desktops, this also contributes to lessening the general PC energy consumption. This also means that there would be no need to charge more than one device every day. Clearly, this could impact on the environment when translated to the whole workforce world-wide (Oaks, 2013). If the personally-owned devices of the employees are

charged at home, the devices can be used for almost the entire day depending on the durability of the battery, hence saving energy.

1.6.4 Energy consumption

Given that an average desktop computer and monitor uses between 60 and 300 watts of electricity, it has made energy consumption and cost reduction strategies become a key aspect of focus and prospect within Green IT (CGI GROUP, 2010). Hence, organizations can no longer concentrate on economic and social responsibility aspects without putting the earth into consideration.

BYOD solution provides organizations with monetary profits through improved energy efficiency of IT activities. Furthermore, a Green IT solution assists organizations in decreasing the environmental impact of the organization's IT operations. According to Correia (2013b), organizations can take advantage of this opportunity to assist in lowering the use of technology in quite a few ways as follows:

- Allowing employees to bring their personally-owned devices to the work place, which lowers the amount of technology that is used on day-to-day basis. This means that employees have no need for a work computer and a personal computer.
- Since mobile devices simply need electricity to recharge their batteries, this means that BYOD significantly lowers energy consumption.

For institutions that are dedicated to improving energy efficiency, there is huge unexploited potential for significant savings in merely considering the power management aspect of mobile devices. The savings could be used to invest in other aspects that would help lower energy consumption (Department of Environment, Heritage, Water and the Arts, Canberra, 2009).

1.6.5 Promoting energy conservation

HEIs should continue to determine and examine factors hindering the adoption of eco-friendly practices (Davis, O'Callaghan, & Knox, 2009). Campaigns aimed at promoting green IT initiatives positively influence energy conservation behaviours within organizations (Dixon, Deline, McComas, Chambliss, & Hoffmann, 2015) and so this presents an opportunity for organizations to take advantage of Green IT initiatives to reduce their negative impacts on the environment (Asadi, Hussin, Dahlan & Yadegaridehkordi, 2015). Information is vital in promoting BYOD and energy conservation behaviours in the use of BYOD devices. According to Abrahamse, Steg, Vlek, and Rothengatter (2005), this may involve providing general

information concerning energy related issues, or information regarding initiatives aimed at tackling energy related issues.

It is known that governments use policies as a means of enforcing and promoting different eco-friendly developments. It is acknowledged that efficient public policies assist in getting past the hindrances to sustainable development (Shi, Lai, Xie & Zuo, 2014).

1.7 RESEARCH METHODOLOGY AND DESIGN

This study sits well with the objective ontological perspective, which aligns with the epistemological view of the researcher that an objective process is the appropriate way of obtaining knowledge with regards the aim of this study. This perspective informed the choice of a paradigm for the study which is positivism, resulting in the use of quantitative approach and techniques employed for data collection and analysis of this study.

1.7.1 Quantitative approach

The quantitative approach was considered the best fit for this study. Quantitative approaches usually start with a sequence of pre-set categories, normally contained in standardized quantitative measures, and utilizes this data to establish comparisons that are wide and could also be generalized (Blanche, Durrheim & Painter, 2006). The data analysed for this study involved collection and coding into numerical form for analysis.

1.7.2 Survey method

The survey method gives description of trends, attitudes, or views of an entire population by selecting and studying only a sample of that population. According to Gray (2009), generalisations are made to the population from the survey sample outcomes. Additionally, survey method involves obtaining data from individuals and organisations with the help of questionnaires (Remler & Van Ryzin, 2011) which is the data collection technique preferred for this study.

1.7.3 Data collection techniques

The data for this study was obtained from both primary and secondary sources. Survey data can be collected through several methods, but the structured questionnaire tends to be the most widely used method of collecting survey data (Greenfield, 2002). Hence, the source of primary data was from a close-ended questionnaire, while secondary data was obtained from published and unpublished sources, journals, books, and various internet publications relevant to the study.

Secondary data is the gathered by a different person to achieve a general aim, official purpose, or for a particular research project (Blaikie, 2003). The information obtained from secondary data served as the foundation to develop the topic of the study and also determine the gathering of the primary data for this research study. This is justified by Blaikie (2010) which points out that literature review is a basic element of any study which serves the primary objective of providing background and perspective for the study and to create links between the study and the present state of knowledge on the topic under investigation.

1.7.4 Population and sampling

The overall number of possible elements or units that are included in a study is known as the population (Gray, 2009). The target population of this study are the academic and non-academic employees of the North-West University, South Africa.

Sample selection is typically based on a representative sample of the entire population, which is similar or the same with the main characteristics of the target population (Gray, 2009). Random sampling is best suitable for this study, since Remler and Van Ryzin (2011) suggest that random sampling helps to choose participants from a population in a manner that each person has the same probability of being selected. Hence, the employees of the chosen Higher Education Institution, namely the NWU employees, were randomly selected for the survey.

1.7.5 Data analysis

The analysis of data that obtained for this study was achieved through simple descriptive statistical techniques and inferential statistics. Data gathered was analyzed using quantitative analysis techniques. Microsoft Excel program and Statistical Package for the Social Sciences (SPSS 23) was used to save, organize data in categories, retrieve and compare required data gathered. This study employed frequency counts and tables, percentages, and correlation analysis. The outcomes were presented in tables and was further supported with explanation and discussions.

1.8 ETHICAL CONSIDERATIONS

Ethics in research address problems that come up in the conduct of research (Penslar, 1995). In simple terms, ethics can be defined as guidelines that govern the conduct and behaviour within a specific line of work (O'Leary, 2010). Research ethics create practical moral rules and principles for the conduct of research (Penslar, 1995).

Research ethics differ across various lines of work or institutions but there are commonly acceptable guiding principles. For this study, the researcher gained permission from the ethics committee of the NWU to conduct research and collect data from the respondents needed for this study.

The researcher ensured that the involvement of respondents was voluntary by ensuring that none of them was pressured or deceived into participating. He also made it known to the respondents that they have the right to withdraw at any stage or time they wish. Gray (2009) stated that anonymity and confidentiality of participants and data collected must be ensured. Hence for this study, the researcher also made sure that the information obtained remains confidential and used for the right purpose. The researcher made sure that the identities of the respondents remain anonymous.

1.9 PRELIMINARY CHAPTER DIVISION

Chapter 1: The overall introduction of this study is discussed in this chapter. It contains the background of the study, problem statement, research aim and objectives, research questions, brief literature review, and the research methodology and design of the study.

Chapter 2: This chapter focuses on the past literature reviews that are related and relevant to the topic of the study which has been discussed by different researchers.

Chapter 3: This chapter outlines the selected research methodology and design that was employed in this study for the purpose of getting answers to the research questions. The research method and data collection method are discussed in this section. Furthermore, the sampling design and data analysis method are also discussed in detail in this chapter.

Chapter 4: This chapter presents the data collected and data analysis using SPSS 23. This chapter also contains presentation, interpretation, and discussion of the research findings. In addition to that, the demographic profile of the respondents is outlined in this chapter.

Chapter 5: This chapter presents the conclusions of the study outcomes. From the outcomes of the analysis, conclusions of the study are made based on the conceptual framework and the research objectives of this study. This chapter also presents the recommendations for this study, and lastly a conclusion brings the entire research to a close.

1.10 CHAPTER SUMMARY

The pervasiveness of BYOD is driven by preferences of the end users. Allowing end users to combine their work and personal lives on one personally-owned device of their choice has an impact on the productivity and business cost of an organization, while at the same time supporting the aims of green IT (Baroudi, 2011). The old technologies are becoming out-dated and are being replaced in this fast evolving digital world by the new technologies which are quickly and broadly accepted, and workers are taking advantage to make adequate use of these technology in virtually all the areas of their lives (Ghani, Aryati, David & Julian, 2015).

This chapter focused primarily on introduction, background of the study, problem statement, objectives of the study, research questions, brief literature review, the research methodology and design. The next chapter concentrates on the literature review of this study.

CHAPTER 2

GREEN IT, BYOD AND ENERGY CONSERVATION

Chapter one of this study focused on the background, problem statement, research aim and objectives, research questions, research methodology and design and ethical considerations of this study.

This chapter reviews literature linked to the study. The relevant materials for this chapter were sourced with the following keywords: BYOD, mobile devices, Green IT, energy efficiency, energy conservation, energy behavior, technology adoption and technology acceptance model. This chapter focuses on the different literature linking Green IT, BYOD, and energy conservation. Energy consumption and importance of BYOD were stated. The aim was to gain insight regarding the BYOD and Green IT concepts and the prospects of adopting BYOD as a Green IT practice. Additionally, effort was made to develop a conceptual framework to show the relationship between BYOD and Green IT and factors to establish BYOD as a Green IT practice based on the technology acceptance model.

2.1 INTRODUCTION

The modern IT systems depend on a complex mix of people, networks and hardware; hence, a green computing practice must be systemic in nature, taking into cognisance the growing complex problems (Bhadraa, Kundub & Guha, 2014). Green IT solution in this study refers to the Green IT practices that aim to guard and improve the environment by saving energy and resources as well as reducing unnecessary duplication of resources.

Asadi *et al.*, (2015) identifies Green IT as one of the most preferred strategies for organizations to curb the growing environmental problems, stating also that Green IT has gained status as research niche in the IS discipline. The phenomenon “Green IT” and its substitute term “Green Computing” have become generally regarded as greatly important. The concept “Green IT” was conceived nearly two decades ago. Energy-efficient lighting was supported by the Environmental Protection Agency (EPA) in 1991 through the introduction of Green Lights programme and followed by the 1992 Energy Star program which established energy efficiency specifications for computers and monitors (Fanara, 2007).

Internationally, Energy star is also recognised as a standard for energy efficient products. In 1992, Energy Star commenced the production of products which switch to sleep mode when

not in use, therefore using less energy when they are in standby mode (Rao, Rani, Swetha & Satyam, 2015).

2.2 BYOD, GREEN IT AND ENERGY CONSERVATION

Success in the improvement of energy efficiency of schools and other sectors contributes towards tackling problems of high energy cost and global climate change. In the United States, energy consumption in homes, businesses, schools, governments and industries is e about seventy percent of the natural gas and electricity combined. Achieving this efficiency would contribute to meeting future energy demands, which would bring about huge savings in energy bills, reduction in air contaminants and greenhouse gas emission (National Action Plan for Energy Efficiency, 2008). It is the responsibility of everyone to ensure that technologies do not cause irreversible changes that create negative impact on the health of the human society (Garg & Buyya, 2012).

Individuals make use of different mobile devices including laptops for their daily personal work and office work. Organizations have begun moving towards the use of mobile devices such as laptops instead of desktops for their employees. Desktop computers consume almost six times more energy than laptops hence making the shift to laptop use in organizations an important solution. Every drop counts even though it may not seem to be enormous savings (Vivekananda & Subhash 2014, cited in Shah & Soomro, 2015) as there also exist studies that ascertain the fact that organizations which put effort into greening their IT successfully have led to an economic boost (Murugesan, 2010) and according to CGI GROUP (2010) there is increasing number of evidence of the potential return on investment got from adopting Green IT approaches. Top organizations are implementing innovative solutions that lessen their utility bills and they are also embracing green procurement.

Because Green IT initiatives are proving to be economically as well as environmentally viable, it is logical why several organizations are taking advantage of green IT options with such extreme interest (Aggarwal, Garg & Kumar, 2012). A strategy that is deemed sustainable should be complementary to both business and the environment. Owing to the immediate impact of green IT on business value, it is expected that green IT will for some time continue concentrating on reducing costs and at the same improving the performance of energy consuming resources (Harmon & Auseklis, 2009). BYOD allows work resources to be accessed within and outside the work place (Beckett, 2014) rather than being bound to a desktop in an office space (Jones, 2012) and clearly this phenomenon is growing more popular (Beckett, 2014).

As mobile devices become an important part of daily personal lives, it is not a surprise that employees in several organizations increasingly desire the freedom to use their own mobile devices for both personal and work-related commitments. It is most times not convenient for employees to have two different mobile devices on them; having one for personal use and the other for work-related purposes (Pinchot & Poullet, 2015). In some instances, employees outside the workplace are not allowed access to IT resources and that has increased the desire to be self-reliant (Jones, 2012). Hence, lots of employees are beckoning on the IT departments of their organizations to support the use of personal devices and this phenomenon is what is known as “bring your own device” (Pinchot & Poullet, 2015).

Organizations worldwide are faced with the challenge of how to effectively manage their technology and energy consumption (Whitley, 2013), thus green IT is now the focus of not only of environmental organizations, but also different businesses from other industries (Shinde, Nalawade & Nalawade, 2013). Green IT can be defined as eco-friendly responsible use of computers and its resources. Power management and energy efficiency are the primary goals of Green IT (Mittal & Kaur, 2013). On the other hand, the main idea behind BYOD is that it allows organizations to decrease their technology and energy consumption. This is because giving employees the freedom to bring their personally-owned devices significantly decreases the number of technology tools at the work place (Whitley, 2013).

There are different policies regarding BYOD that are available for organizations and institutions of education. A lot of educational institutions have embraced BYOD on their campuses, especially through network access control. Even though this may have its disadvantages, it can be managed through adhering to a detailed BYOD policy document (Afreen, 2014).

One of the best Green IT practices involves reduction of energy usage (Nandakumar & Dhenakaran, 2013). According to Albino, Azzurra and Dangelico (2009), since the end of the 20th century, matters regarding going “Green” have been proposed academically, and according to (Baumol & Oates, 1988), appropriate strategies and activities are needed to tackle it more effectively and efficiently.

Energy efficiency and power consumption programmes emphasize the minimization of energy use to decrease energy consumption, electric utility costs and efficient approaches to conservation of power (CGI GROUP, 2010). The use of mobile devices for computing needs at whatever time and anywhere possible helps save power and contributes to efforts aimed at preserving the planet (Aggarwal *et al.*, 2012). Global energy supply is declining or flat as

energy demands continuously rise. Various organizations are generating more of their own electricity, which is the more reason why these organizations are putting more efforts into finding ways to reduce energy usage (Kochhar & Garg, 2011).

“Green IT” practices are attracting increased interest among organizations of different types including manufacturers and service providers. Due to the rapid rise of energy costs and an increased awareness of the effects of global climate change, various organizations are looking for strategies to balance increasing costs and utilizing technology in a manner that would have no negative environmental impact (CGI GROUP, 2010).

There are gains for businesses: reducing their costs, and concurrent investment in energy efficiency. Apart from energy savings realized through energy efficiency investment, organizations stand to gain from decreased maintenance expenses and improved working conditions. As higher productivity benefits these organizations, it also contributes positively to the growth of the economy (Energy Department of Energy and Climate Change, 2013).

Regulations and policies, as well as increased awareness and environmental responsibility on the part of the organization, can encourage Green IT initiatives (Wati & Koo, 2010). The significance of ethical and eco-sustainability concerns involved in the decision-making process of Green IT adoption sets it apart from other IT adoption practices (Molla, 2009). Green IT adoption can also vary from adoption of other green initiatives because of Green IT practice’s potential role in helping businesses realise their green objectives (Molla, 2009).

2.2.2 Green IT

Green IT is the practice of environmentally sustainable computing. It is concerned with the usage of IT resources in a way that is energy-efficient and cost-effective (Bose & Luo, 2011), while BYOD is another trend assisting organisations in decreasing energy consumption (The chief technology forum, 2012). BYOD is also known as an organizational trend that supports the use of employees' personally-owned mobile devices for daily business tasks in the work place (Whitley, 2013).

Green IT particularly encompasses a wide area dealing with the study and practice of efficient use of computing, the consideration of the total cost of disposal and recycling of obsolete hardware, and eco-friendly treatment of e-waste resulting from computing resources (Scheid, 2011). According to CGI GROUP (2010), “Green IT is the study and practice of using computing resources in ways that help reduce energy and operating costs, enable sustainable

business practices and reduce the environmental impact of IT practices in the larger community.”

Green IT is also known as Green computing (Greenpeace International, 2010) and is defined by Yadav *et al.*, (2012) as “the positive (or least negative) relationship between the physical computer and its impact to the environments in which it moves from cradle to grave.” Soomro and Sarwar (2012) define green IT as the study and practices that encompass the computing lifecycle from cradle to grave. Therefore, according to Bose and Luo (2012), Green IT incorporates strategies, practices, hardware assets, software assets, tools that support the improvement and realisation of environmental sustainability (Soomro, 2012).

It also involves the study of effective ways of designing, manufacturing, utilizing, and discarding of computers and its related subsystems with little or no effect on the environment (Long & Long, 2004). Green IT aims to realize economic viability and advance the usage pattern of computing devices (Carina, 2014). The promotion of technology and usage patterns that are energy efficient and eco-friendly constitutes one of the main objectives of Green IT (Bello, Ahmad, & Nordin, 2013). Greenpeace International (2010) also states that Green IT strives to overcome economic issues and improve the way computing devices are used. Dhanam, Sivaraj, and Vanathi (2014) also made it known that Green IT aims to realise economic viability and enhanced system effectiveness and usage at the same time adhering to social and ethical responsibilities.

Green IT practices involve the reduction of the energy consumed when using computers and its related devices. Green IT is a way of achieving economic viability and improving system performance and usage against the backdrop of societal norms and ethical responsibilities with regards the environment (Scheid, 2011). It is required that the society we dwell in be environmentally conscious by lessening their energy consumption which results from the huge dependency on computers and other related devices. Green IT is an interesting domain that contributes towards the improvement of energy efficiency throughout the life cycle of computing devices (Bello *et al.*, 2013). Thus, Green IT is environmentally suitable computing or IT (Dhanam, Sivaraj & Vanathi 2014).

Due to technology information adaptation in organizations, BYOD is one of the technological trends that brings rapid transformation to organizations (Davies, 2011). Its adoption is usually driven by the potential economic gains. On the other hand, green IT practices could be driven by concern for the earth even if monetary gains might not be much within a short time (Molla,

2009). Whether it is implemented for a selfless purpose or monetary gain, it is important for organisations to direct effort towards becoming more energy-efficient (Davies, 2011).

There have been emerging technologies and concepts over the years and organizations have been incorporating these into their strategies to the common benefit of their business operations (Njiva, 2015). A lot of recent IT systems are beginning to depend on hardware and people to facilitate the move of their computing systems toward a greener computing system (CGI GROUP, 2010) and due to the rapid growth of the use of mobile devices, the importance of BYOD is increasing (Njiva, 2015). This tends to be a difficult balance to achieve since it requires the satisfaction of both users and the management (CGI GROUP, 2010).

Environmental problems such as energy and shortage of resources pose a big challenge to the world and there is need for urgent solutions. IT is considered an important tool in realising increased efficiency. This practice is referred to as Green IT which encompasses energy conservation by IT and energy conservation of IT (Widjaja, Mariani & Imam, 2011) and this is the basic tenet of this study which centres on energy conservation through the adaptation of BYOD as a Green IT practice.

BYOD is a phenomenon, which is made of up elements of a Green IT solution. Yadav, Kumar, and Kumar (2012) explains that a typical Green IT solution consists of elements such as user satisfaction, policy compliance, the reform of management, thin client solutions, telecommuting, virtualization, and lessened energy consumption. Green IT solutions seek to sustain computing performance while lowering energy consumption (Wang, 2008). BYOD policy entails letting employees use the network of their organizations through their personal device or technology (Afreen, 2014). BYOD helps simplify work for employees, increasing employee satisfaction, productivity, and workforce mobility in the process (Capgemini Consulting, 2013).

ICT is increasingly playing vital role in the advancement and creation of economic opportunities while its negative impact, including global warming and climate change alongside the scarcity and increasing cost of energy, are becoming severe barriers for the sustainability of the digital economy worldwide (Molla *et al.*, 2009). Nonetheless, a lot of organizations are discovering suitable ways to be greener in their computing and also aid their business as the same time (CGI GROUP, 2010). The economy and business is greatly influenced by climate change and Green IT. Increasing numbers of organizations are putting green policy and the problems associated with climate change into part of their business policy

and strategy (Sheikhalishahi, & Grandinetti, 2012). Hence, various organizations are gaining more knowledge on suitable ways to become greener in the aspect computing and at the same time improve their business (Aggarwal *et al.*, 2012) because organizations with long-term climate change risks and opportunities included in the policy of their business will realize more tactical benefits over their rivals (Sheikhalishahi & Grandinetti, 2012). It is vital to focus on the BYOD acceptance as it is expected that the effective acceptance and adoption of BYOD will consequently help advance the economy of South Africa (Njiva, 2015).

Green IT can also aid the development of solutions that provide gains by setting up all IT processes and practices in alignment with the basic principles of sustainability, and finding out improved ways of using IT in business processes to achieve sustainability gains throughout and beyond the organization (Mishra, Jain, & Kurmi, 2015).

The media and management attention are being drawn towards Green IT practices in the world today, partly because of the increased concern and emphasis on programmes relating corporate social responsibility (CSR). CSR efforts aim at initiatives that helps to establish a brand image that is eco-friendly because of the increasing awareness of the general public regarding environmental problems (Aggarwal *et al.*, 2012). Comfort, and the need to save the environment are all motivators of positive attitude towards Green IT practices (McComas, Dixon, & Deline, 2012) and BYOD employees are comfortable with the use of their own devices.

Green IT initiatives reduce the energy consumption of organizations which means reducing the energy bill (Kiruthiga, & Vinoth, 2014). Therefore, the general energy consumption resulting from computation, communications and storage could be reduced by going green (Mishra, Jain, & Kurmi, 2015).

2.2.2.1 The necessity of green IT in Higher Education Institutions

There is disparity in the extent at which green IT is perceived by different individuals and organizations. A lot of individuals and organizations are not aware of how or where to start or are not eager to implement green IT. Despite the attention of the corporate world being drawn to green initiatives, some IT experts, decision makers, and IT departments still perceive the green movement to be a burden (Murugesan & Laplante, 2011). Even a lot of institutions of learning have accepted the fact that green movement or practices aimed at saving the environment are appropriate, nonetheless they still have the notion that effort towards greening their practices are costly to put in place, hence hindering implementation (Luna & Koman,

2002). Regardless of these common misconceptions, the adoption of Green IT is irrefutably advantageous for organizations as they carry on their operation in a world where increased attention is on environmental responsibility (Liu, 2013), and upon a closer examination, they will discover that green initiatives are appropriate and effective strategies (Murugesan & Laplante, 2011). Tomlinson (2010) identified that various environmental issues and other related climate problems however are critical factors in the course of advancing Green IT, hence it is important for institutions to consider initiatives that could be costly in the short term but more profitable overtime or in the long term. Liu (2013) asserted that from a cost benefit angle, green IT can be taken advantage of to increase or complement the worth of an organization.

Since conserving energy resources is the duty of every individual in the world, now all business organizations in different ways are considering or has commenced the adoption of green IT. The adoption of green IT could be for reasons such as setting a positive example for employees that will facilitate morale increase and company loyalty; achieving competitive edge by distinguishing the business from its rivals; enhancing efficiency and reducing costs of operation; and creating a more clean and healthier work environment (Bose & Luo, 2012). Businesses and social practices that are based on ICT have changed several businesses into e-businesses (Molla et al., 2009), and institutions of learning into e-learning based on the advancement of ICT. Murugesan (2008) explicated that existing studies on green IT practices have proved the importance of the involvement of organizations in management of assets, energy efficiency, and the facilitation of green practices using IT.

Organizations today are becoming part of the movement to go green notwithstanding the current global economic situation. As every organization rely on IT for efficient operation, the motivation to make their IT operations more efficient offers a way to also decrease energy use. Organizations get to understand that creating a strategy for Green IT adoption is the appropriate way to get started with energy efficiency (Greengard, 2008; Overby, 2008, cited in Bose & Luo, 2012).

Tom Murphy of Bradford Networks made it known that Education Institutions have been among the top adopters of the BYOD trend for years and in doing this they have paved way for easy adoption of BYOD for enterprise organizations that are just beginning to consider and allow their employees use any device they are comfortable with (Infosecurity magazine, 2013).

HEIs are accountable for significant environmental impacts, which includes the huge amount of activities they carry out daily, and for their similarity to "small cities" (Mosly, 2015). Various organizations have realized that going green is in their best interest especially in the aspect of public relations and cost reduction (Pundkar & Bamnote, 2014).

It is important for HEIs to develop a plan to decrease energy use across campus and ascertain standard practices for executing an energy reduction plan (Yadav *et al.*, 2012). It is important to ensure the involvement of the IT department in an energy reduction plan with campus environmental policies and campus awareness programs (Yadav *et al.*, 2012). Based on this perspective, HEIs have the need to search for better ways to green their operations and one of the strategies for HEIs to succeed is the adoption of Green IT (Mosly, 2015).

It is known that most of the computer energy is mostly carelessly used. One of the reasons being that most computers are not powered off when they are not in use (Suman, Soniya & Mehak. 2012). In order to assist HEIs in realising their vision, concentration should be on policies that will enable economic, social and environmental sustainability within the institution. A short survey of the present activities of some HEIs across 12 OECD member countries by Johnston (2007), revealed that universities are making significant progress in the aspect of sustainable development, especially environmental aspects, despite the absence of a national legislative framework.

A survey for educational institutes in US and UK revealed that students and employees are allowed access to the network by 85 percent of the institutes surveyed. The survey also revealed that personal devices are utilized for educational and personal purposes almost at the same rate (Afreen, 2014).

On a global scale, the introduction and maintenance of sustainability on campus and in the general community still pose a primary challenge. The protection and preservation of the scarce natural resources, the sustenance of a booming economy and cultivation of a high quality of life, raises the need for HEIs to respond quickly and to also put in more effort into the movement (Johnston, 2007). The students and lecturers in HEIs make up a large part of population on campus, and are mainly the large users of computing resources and energy. The adverse effects of computing activities is not expected to cease except if the individuals directly involved in the activities improves their usage patterns by becoming more responsible and conscious consumers of energy. The fact that ICT, its related infrastructures, and

computing power will keep increasing in capacity and reach, requires that the users of these resources must be adequately educated and very much informed (Bello *et al.*, 2013).

The adoption of Green IT practices will assist in positive contribution of business executives towards environmental stewardship and environmental sustenance and at the same time lessening energy costs. The benefits that comes with green initiatives and strategies are for everyone and not just for the environment, government, or organizations. The decrease or complete elimination of practices that are wasteful will not only help realize more monetary savings but contribute in making the world a better place (Agarwal & Nath, 2011).

HEIs can realise all this and add to the advancement of the green movement in different ways, starting from; 1. Their role as a consumer of resources, 2. Their role as an educator; which involves providing skills required to grow green economies, 3. To their role as a hub for research and innovation; contributing positively to knowledge creation and supporting business research and development to build the required green technologies and services for a green economy (Johnston, 2007).

2.2.2.2 Environmental Concern

Environmental concern specifies the extent at which individuals are conversant with environmental issues and the efforts they put in towards the solution to help tackle them as well as their readiness to personally contribute to the advancement of their solution (Dunlap & Jones, 2002). “Environmental concern can be taken as an attitude towards facts, one’s own behaviour or other’s behaviour with consequences for environment” (Weigel, 1983, cited in Pradeep, 2012).

Globally, there is a common objective which is the rise of pro-environmental behaviour and the reduction of negative impacts of our activities on the environment. The rise in environmental concern serve as a tool for realising the objective, and will be more valuable with behavioural changes (Takács-Sánta, 2007). This suggests that environmental concern denotes a particular attitude that has a direct influence on intentions or may be pointing towards a common attitude or value orientation on a larger scale (Fransson & Gorling, 1999, cited in Pradeep, 2012).

The findings of Molla, Cooper, Deng, and Lukaitis (2009) point out that climate change is an issue of great concern to most IT professionals and vast majority are of the belief that IT plays the role of bringing about environmental problems and at the same time plays the role of solving environmental problems. Pradeep (2012) made it clear that despite the policies and solutions

put in place to solve environmental problems, the most significant role in this pro-environmental behaviour lies on the individuals.

Suryawanshi and Narkhede (2015) elucidated that greening ICT will assist in sustaining the future of ICT and at the same time is very useful to the preservation of the environment. A study by Junior, da Silva, Gabriel, and de Oliveira Braga (2015) deduced that environmental concern has a significant relationship with people's intention to purchase green product. Another study by Dagher, Itani, and Kassar (2015) established that if the level of environmental concern and attitude is increased among all genders, green marketers would gain more profits.

2.2.3 BYOD

This study adopts the definition of BYOD by Brodin, Rose and Åhlfeldt (2015) which describes BYOD as the use of computing devices which are mobile, that can be utilised in the workplace, beyond the workplace, as well as the home of the employees, and the use of these mobile computing devices for both work and personal purposes, whether it is organization-issued devices or employee-owned devices.

BYOD is not restricted to only smart devices. Laptops, netbooks, e-readers, smartphones, tab devices and more are also regarded as BYOD devices (Thomson, 2012). BYOD signifies a significant change from earlier IT models, in which organizations normally allowed employees to only make use of organization-owned devices for all work-related purposes, including keeping up to date with organization email or making use of organization data and applications (Pinchot & Paullet, 2015).

A debate in favor of BYOD effectively makes use of available resources, especially because computers are not put into use after office hours (Afreen, 2014). When energy consumption is decreased, the expected energy savings objectives will be achieved, and also energy efficiency will help to eliminate investing in new infrastructure which would instead be useful in meeting greater demand. There would be huge environmental, economic, and social potential of energy equity if these considerations are understood properly (Natural Resources Defence Council March, 2014).

IT experts, Chief information officers and IT support personnel are expected to create environmentally sustainable IT solutions (Murugesan & Laplante, 2011). Globally, energy sustainability is faced with similar energy saving issues. One of the urgent and effective solutions to improving energy sustainability is to lessen the rise in energy demand. This can be achieved through adhering to energy conservation activities (Alias *et al.*, 2010). Little effort and less complex steps by an individual organization can make very enormous impact when

transferred to a large number of individuals and organizations globally (Murugesan & Laplante, 2011).

2.2.3.1 The explosive growth of BYOD

Rapid advancement is being experienced in the mobile world (Lewis, 2011) and “the BYOD movement is acquiring considerable momentum” (Merga, 2015). Fortunately, organizations have started to acknowledge the potential benefits and losses of mobile usage, allowing them to plan properly. The computing paradigm is being compelled towards a significant advancement because of the emergence of blackberry phones, tablet computers, iPhones, and other similar mobile devices (Lewis, 2011). So organizations need to ensure that the policies they create will take care of various devices that employees tend to use including phones, laptops, tablets, desktops and more (Tudor, 2014).

Efforts to prevent employees from coming into the workplace with devices of their choice will not be easy and will not be less difficult especially with the advancement of technology (Garba, Armarego & Murray, 2015), hence as technology keeps advancing, so will the capabilities related to BYOD (French, Guo & Shim, 2014). Even in the workplaces where the IT department still dictates the type of technologies to be used, tenacious employees still find ways around those requirements to accomplish their tasks (Jones, 2012).

The utilization of smart technology at the workplace has been in practice since the introduction of the blackberry phones and organizations sometimes made these devices available to their employees in order to increase their mobility and productivity (Mansfield-Devine, 2012). In the 1980s, organisations recognised the perfect employee as an employee who is innovative, resourceful, focused and with the ability to accomplish tasks successfully from any location. This can be regarded as one of the ideas leading to the move towards BYOD (Dawson, 2012) and technology advancement has also amplified the demand to integrate personal computing devices into the workplace (Lee, Crossler & Warkentin, 2013).

2.2.3.2 Awareness of BYOD with regards to green IT

Green IT will remain a productive field owing to the rapid growth and adoption of IT globally which would help explore prospects for environmental change, expansion on different transformative societal effects that are already in progress. Assisting individuals and institutions discover, understand, and become conscious of their activities is one of the main objectives of Green IT through facilitating the circulation of information regarding environmental issues, and helping people and organizations to share best practices for tackling

the issue. The objective of Green IT is to assist people make a difference, and transform the earth to be more in harmony with the proper way it is supposed to be (Tomlinson, 2010).

Despite the increasing knowledge in Green IT, so many people are still not acquainted with terms relating to Green IT, which the professionals and users in this area of study or domain are not exempted in this ignorance (Murugesan, 2010). Findings from a particular study suggests that from the perspectives of the academic employees, none had ever seen the acronym BYOD before (Ghani et al., 2015). This further implies that the adoption process requires knowledge as a key element (Rogers, 2003). In order to tackle this problem, institutions and individuals are taking steps to acquire knowledge and certifications regarding Green IT (Murugesan, 2010). Increased knowledge will contribute positively to the adoption process as individuals tend to key into the adoption process when they know more about the technology, concept, the practice or initiative to be adopted (Rogers, 2003).

The development and promotion of advanced green related technology or tools can be an important approach for organizations to have growth in productivity, enhance their corporate image and in the long run have an edge over their competitors (Claudy, 2011). Among the products resulting from technological inventions, the computer remains one of the most commonly utilized ever created. Considerable amounts of electricity is needed to power the system unit and monitor, print, or revive batteries (Vermatt & Shelly, 2011). In the world today, inadequate knowledge in the aspect of energy-efficient computing has at present caused huge waste of energy and money (Rogers, 2003). On daily basis, a computer uses between 95 and 650 watts of electricity based on the pattern of use (Vermatt & Shelly, 2011). Since there are adverse effects emanating from the careless use of technology, people or users should be knowledgeable with regards to energy consumption (Vermatt & Shelly, 2011) hence, the value of knowledge in accepting the green movement should not be overlooked (Rogers, 2003).

2.2.3.3 Advantages of integrating BYOD in a work environment

There are many advantages of integrating BYOD in a work environment which encompasses greater employee satisfaction and productivity, and reduction of the entire cost of technology (Whitley, 2013). BYOD solution provides organizations with monetary profits through improved energy efficiency of IT activities Correia (2013b). This cutting-edge solutions relieve organizations the stress of installing entirely fresh hardware across the organization (Jones, 2012). Furthermore, a Green IT solution can assist organizations in decreasing the environmental impact of the organization's IT operations. Organizations can take advantage of this opportunity to assist in lowering the use of technology in quite a few ways as follows:

- Allowing employees to bring their personally-owned devices to the work place, which will lower the amount of technology that is used on day-to-day basis. This means that employees will have no need for a different work computer and a different personal computer (Correia, 2013b).
- According to Whitley (2013), since mobile devices simply need electricity to recharge their batteries, this means that BYOD will significantly lower energy consumption.
- In a BYOD environment employees tend to rely less on desktop PCs to carry out their daily business tasks (Whitley, 2013).

Green IT solutions or practices provide monetary profits for organizations through improved energy efficiency of their IT operation. Improved energy efficiency will help organizations to lessen the environmental impact of their IT operations (Du Buisson & Naidoo, 2014). For institutions that are dedicated to improving energy efficiency, there is huge unexploited potential to obtain huge savings in merely looking into the power management aspect of mobile devices. The savings can be used to invest in other aspects that would help lower energy consumption (Department of Environment, Heritage, Water and the Arts, Canberra, 2009).

2.2.3.4 Organizational support

Organizational factors are frequently examined in studies relating environmental management and technical innovation (Lin & Ho, 2011). A BYOD survey by Loucks, Medcalf, Buckalew and Faria (2013) shows that users are ready to fund the devices and ideas they deem necessary to be effective for them at work. BYOD places organizations in an enviable spot because employees are ready to fund personal devices, which facilitates their work, increasing their productivity and innovativeness in their tasks at the workplace. Although some employees still prefer to make use organization-owned devices and on the other hand, the readiness of employees to fund their devices does not necessarily mean that organizations need to allow employees to bring their own mobile devices to work.

In some organizations where IT departments support and encourage employees to make use of devices they think is efficient for their jobs, organizations can achieve a substantial competitive edge (Loucks, Medcalf, Buckalew & Faria, 2013). A survey revealed that most of IT leaders indicated that their institutions have supportive environments for faculty and employees personally-owned technologies (Dahlstrom & Difilipo, 2013). IT leaders indicated that rising faculty and employee satisfaction and productivity as the two most driving factors for letting employees utilise their own technologies (Dahlstrom & Difilipo, 2013). Motivation through incentives for adopting innovation and making sure that funds and required technical resources

to drive the innovation will influence the adoption of technical innovation positively. The degree at which an organization encourages its employees to adopt a specific technology or system will also affect technical innovation. The degree at which employees believe that their organization assists them in aiding the use of a specific system is known organizational support (Jiang and Klein, 2000).

PCs consume up to forty to fifty percent of the entire electricity consumption relating to ICT in Higher Institutions. Even the manufacturing and discarding of these devices also has significant effects on energy and the environment. Thus, in sustainable ICT initiatives, they should be of high priority (Computing for sustainability, 2009). Organizational support is vital in encouraging employees to adopt a green solution. The needed resources for adopting any green solution will be readily available and will be a better motivation for employees to adhere to the expected green solution. Implementing a green solution has to be a team work between the different units of an organization. (Gonzalez-benito & Gonzalez-benito, 2006).

Globally, HEIs are beginning to focus more on green IT as an initiative for realizing a greener environment and cost savings (Agarwal et al., 2012). When energy-saving programs are integrated in their IT policy of HEIs, they would be able to save significant cost (Agarwal et al., 2012). Managerial interventions make available contextual grounds for increasing positive intention regarding use of technology (Lee, Lee & Kwon, 2005).

The outcome of a study by (Lee et al., 2005), showed that perceived usefulness and perceived ease of use are not the only factors that has major role in adoption. It further asserted that organizational support also have a vital role to play in adoption, and it is among the factors that strengthens the relationship between perceived usefulness, perceived ease of use and employees' intention to use technology.

An organization can also make sure that the employees have access to the needed assistance from IT department as regards their personally-owned devices. The access to necessary support by employees has the propensity of leading to positive behaviour towards the expected behaviour and further demonstrates formal attitude toward a specific behaviour (Compeau & Higgins Cited in Putri & Hovav 2014). Technology that is perceived as useful by employees tend to be used more especially if they perceive organizational support to be strong (Lee et al., 2005).

In any organization, the support of the top management is a very essential factor of adoption (Cooper & Zmud, 1990), and it can be taken as organizations' supportive attitude.

Organisations tend to adopt green IT practices when the strategies are approved by the top management and necessary resources are provided and guaranteed assurance with a strong motivation (Hemingway & MacLagan, 2004). In such a situation involving strong supportive attitude and believe, organizations grip strong backing and consequently increasing their green motivation (Chen & Chang, 2014).

2.2.4 Energy conservation

Huge amount of electricity is required to operate computers and other related devices (Kushwaha, & Singh, 2015). The operation of these computers highly depends on electricity, hence there is effort to make recent computers more efficient in order to save the energy and cost. Additionally, it is very important to manage computer resources efficiently as this will contribute positively towards energy saving (Suman, Soniya & Mehak, 2012).

For this study, energy conservation is defined as the avoidance of energy misuse beyond its purpose of use and the use of technological advancement for improving efficiency of energy consumption (Japan International Cooperation Agency (JICA), 2005). Furthermore, energy conservation according to JICA (2005) means enhancing “efficiency of energy consumption”. Disterer and Kleiner (2013) stated that the use of modern technological mobile devices provides lots of benefits which has made them a part of the daily and private life of individuals. The use of these mobile devices in the work place is also widespread and common. On the other hand, individuals tend to face the challenge of handling two devices; one for personal purposes, and the other for work activities.

As further confirmed by Mrkalj (2013), when an individual is in possession of an organization-owned computer, it is commonly not the only device he or she owns. Usually, employees make use of mobile devices such as laptops, tablets and smartphones outside the workplace. Getting rid of the organization owned computers and allowing the employees to make use of their personal devices saves energy. Hence, Disterer and Kleiner (2013) asserts that dual use which is the use of one device for personal and business applications, may become a suitable solution. Consequently, the outcome is BYOD, which defines the situation in which employees make their personally-owned devices available for organizational use.

According to the Natural Resource Defence Council (NRDC) (2011), a mobile device such as laptop consume roughly a quarter of the energy of a comparable desktop. Laptops consume a reduced quantity of material than comparable desktops, and hence their footprint is fairly lesser.

Desktop computers that are seven or more years old tend to consume over ten times more energy to operate compared to a modern Energy Star laptop.

The energy efficiency of computation has been increasing tremendously and constantly yearly for more than six decades (Koomey, Berard, Sanchez, & Wong, 2011). These recent advancements in technology is giving rise to mobile devices that competes with and may completely exceed the potential efficiency of the average workplace computer. Being that more options are created and procured for personal use by employees, organizations should consider taking advantage of this trend to decrease its technology use in several ways (Whitley, 2013).

Koomey, Berard, Sanchez, and Wong (2011) further stated that the advancements in energy efficiency facilitated the invention of laptops, smart phones, and several other mobile devices. According to NRDC (2011), new desktop computers also consume more energy than mobile devices. Whitley (2013) affirmed that mobile devices do not require a lot of energy to function compared to the average PC, and have the capability of charging faster for all day use without being plugged to electrical sockets for power.

In event of a power outage, the savings actually begin to mount up as the laptop or notebook user can ideally make use of his or her device due to the battery, while backup power supply is needed to sustain desktops. These backup power supply are designed to assist organizations evade data loss in event of a power outage, but then a substantial amount of energy is required to run the backup power supply (NRDC, 2011). According to Kaur (2013), laptops consume 15 to 60 watts while desktops consume 250W. Desktops PCs consumes more energy than datacentres. In addition, the quantity of power consumed by desktops PCs and their global environmental impacts are huge and should not be ignored. This makes the use of mobile devices more important (Mohammed, Muhammed, & Abdullahi, 2015).

Energy conservation tries to reduce electricity consumption by reducing the over-all number of appliances, facilities and services in use that have need of electricity to operate (Croucher, 2011). Since BYOD helps eliminate duplication of devices (Whitley, 2013), “*inevitable*” could be the best suitable word for BYOD (Var, 2013). BYOD environments have the tendency of providing offices devoid of workstations. Although the traditional desktop computers still remain the practical computing options in most workplaces, but there is undoubtedly reason to consider that the traditional desktop computers would lose that position to mobile devices (Whitley, 2013). Employees are starting to rely more on mobile devices, especially personally acquired devices, hence smartphone procurement is rapidly increasing yearly, tablets rise in

relevance, and traditional desktop computer lose position to laptops (Gens, Levitas & Segal, 2011). In economics, electricity is described as a derived demand. This implies that people, and organizations do not entirely demand electricity for its own sake rather they use electricity since the appliances, services and facilities that are needed generally demand electricity to function or operate (Croucher, 2011).

2.2.4.1 Promoting energy conservation

Energy crisis is a huge challenge daunting the world. Energy supply around the world has failed to meet up with the huge increase in the demand of energy which has led to the increased focus on conservation issues (Schultz, Khazian & Zaleski, 2008). The methods of business operation have changed because of the challenge of responding to the environmental issues. “Going Green” has become a major challenge, as substantial changes in mind-sets are required to harness the gains that accompanies “Going Green” (Wati & Koo, 2010).

For BYOD to thrive in the aspect of energy saving, it is important to increase awareness on BYOD as a way of supporting Green IT. It is important to implement change regarding the way energy is managed in an organization. This change can be achieved through effecting organization-wide energy conservation solutions. This is among the utmost fruitful and cost-effective methods that result in huge improvement of energy efficiency (Worrell & Galitsky, 2008). Survey results reveal that promotional and educational resources should be focused on raising the knowledge regarding sustainable practices (Davis *et al.*, 2009). Campaigns aimed at promoting green IT initiatives positively influence energy conservation behaviours within organizations (Dixon, Deline, McComas, Chambliss, & Hoffmann, 2015). Enlightenment on the benefits of BYOD with regards to Green IT is very necessary, as Abrahamse *et al.*, (2005) further asserted that providing information helps to raise awareness regarding energy issues and prospects of lowering its impacts.

Information is vital in promoting BYOD and energy conservation behaviours in the use of Byod devices. According to Abrahamse *et al.*, (2005), this may involve providing general information concerning energy related issues, or information regarding initiatives aimed at tackling energy related issues. Marans and Edelstein (2010) explained that people are most likely to adapt to changes when they understand and become aware of the benefits of adhering to any practice that lowers energy consumption.

The importance of education and training cannot be over emphasized when introducing or setting up a new technology or strategy. This is also needed in the aspect of any Green IT

solution which may be new to an organization, and sometimes not known by the individuals that are expected to adhere to the practice (Herrick & Ritschard, 2009). Comfort, and the need to save the environment are all motivators of positive attitude towards green IT practices (McComas, Dixon, & Deline, 2012) and BYOD employees are mostly comfortable with the use of their own devices.

It is known that governments use policies as a means of enforcing and promoting different eco-friendly developments. It is very much acknowledged that efficient public policies will assist in getting pass the hindrances to sustainable development (Shi *et al.*, 2014). Lack of information with regards to energy efficiency is a common debate frequently emphasized to explicate why individuals tend to lack interest in adhering to any energy efficiency option that may help save cost (Croucher, 2011). Some researchers argue that individuals with more environmental knowledge tend to be more eager to protect their environment (Pothitou, Varga, Kolios & Gu, 2015).

Increasing energy efficiency should be done from several aspects and a solid organization-wide energy management program is crucial even though technological enhancements in technological gadgets assist in energy conservation, it is also imperative to have a change in the behaviour and attitude of employees as it can also have a huge effect (Worrell & Galitsky, 2008). Energy training initiatives can assist employees adhere to energy efficiency practices in their daily work. Despite the position of employees in any organization, it is important for every employee to be aware and accustomed with energy consumption and organizational objectives for enhancing energy efficiency (Caffal Cited in Worrell & Galitsky 2008).

It is important to conduct energy awareness programs for employees. This can also include distribution of promotional materials to employees in order to endorse and encourage energy efficiency (Abrahamse *et al.*, 2005). Empowering individuals with Information is a frequently employed strategy to promote energy conservation behaviours. The strategy usually comprises of information regarding energy-related issues, or precise information concerning potential way of tackling the issue (Abrahamse *et al.*, 2005).

Making necessary information available helps to increase people's level of awareness regarding energy-related issues, and their knowledge regarding potential solutions. Vital information regarding energy conservation can be sent or made available to individuals through mass media campaigns, seminars, and personalized information (Abrahamse *et al.*, 2005). Similarly, Mills and Schleich (2012) asserted that information on energy usage, conservation

opportunities and the energy performance of technologies is anticipated to influence the acceptance of the use of energy-efficient technologies.

Energy knowledge can be described as the awareness, familiarization, or understanding of energy price, energy conservation behaviours, and the after-effects of energy conservation behaviours (Van Raaij & Verhallen, 1983). Negative energy conservation behaviour adds immensely to misuse of energy which give rise to low energy efficiency performance and high cost of energy. Therefore, it is important to put more emphasis on increasing the level of energy knowledge and energy conservation behaviour among individuals in order to promote the corporate image of any HEI and also to help build an energy sustainable future for generations yet to come (Ting et al., 2010).

2.2.4.2 Energy consumption and importance of BYOD

According to Palmer Research (2013), BYOD will help HEIs reduce their printing needs since files and other resources can be accessed from any location within the institution, hence the monetary savings could be used to enhance their wireless platforms which support the use of mobile devices within the institution. The constant advancement in energy saving features in mobile devices contributes greatly to energy savings (Global e-Sustainability Initiative, 2012) and BYOD will further contribute to energy saving since it eliminates duplication of computing devices (Capgemini Consulting, 2013). Hence, there would be no additional need of having different devices for work and personal purposes (Eschelbeck, 2013).

A computer or device that needs a reduced amount of power to function will not require huge cost to operate (Herrick & Ritschard, 2009). According to Global e-Sustainability Initiative (GeSI) (2012), since most mobile devices consume less energy than desktops, this will contribute to lessening the general PC energy consumption. This also means that there would be no need to charge more than one device every day. Clearly, this could impact on the environment when translated to the whole workforce world-wide (Oaks, 2013). If the personally-owned devices of the employees are charged at home, the devices can be used for almost the entire day depending on the durability of the battery, hence saving energy.

The need for computers cannot be over emphasized as they assist in completion of tasks in reduced time but we fail to analyze its impacts on the environment (Samiksha, Ravindra, Suryawanshi & Chavan, 2013). Given that an average desktop computer and monitor uses between 60 and 300 watts of electricity, it has made energy consumption and cost reduction strategies become a key aspect of focus and prospect within Green IT (CGI GROUP, 2010).

Hence, organizations can no longer concentrate on economic and social responsibility aspects without putting the earth into consideration (Du Buisson & Naidoo, 2014).

2.3 CONCEPTUAL FRAMEWORK OF THE STUDY

Adoption of Green IT solutions has been studied with several models by different researchers (Molla, 2008). The conceptual framework explored in this study was based on TAM. The constructs introduced in the conceptual framework were derived from the discussions in the previous sections of this study. The diagrammatic representation of the conceptual framework is in Figure 2.2.

It is essential to have technology perceived as useful and have perceived ease of use (Buser, 2012). In addition, organizations are supposed to reconsider how technology adoption works in the future (Loucks, Medcalf, Buckalew & Faria, 2013). This is because implementing BYOD rightly will not only lead to acceptance, it will yield more organizational support and keen validation, as well as employee satisfaction and empowerment (Buser, 2012).

TAM explains ICT usage behaviours, which includes what influences adopters to accept or reject the use of information technology (Davis, 1989). TAM contains four major constructs: Behavioural Intention, Attitude, Perceived Usefulness (PU) and Perceived Ease of Use as shown in Figure 2.1. According to Davis (1989), perceived usefulness and perceived ease of use are the two constructs which form the major factors leading to system use and these predict attitudes regarding the use of the system.

Numerous studies on IT acceptance have produced various competing models and every single model has its distinct determining factors of acceptance (Venkatesh, Morris, Davis, and Davis, 2003). TAM consists of perceived ease of use and perceived usefulness. Perceived usefulness refers to the extent at which an individual believes that making use of a specific system would improve their work productivity, and perceived ease of use refers to the extent at which a person believes that making use of a specific system would be devoid of challenges (Davis, 1989).

TAM has been evaluated in several empirical studies and reasonably proved to be versatile in quality, producing statistically reliable outcomes (Nyoro, Kamau, Wanyembi, Titus & Dinda, 2015). TAM is a model that focuses on the technological related factors regarding the adoption of technological innovations (Molla, 2008). TAM has demonstrated to be a helpful model in aiding understanding and description of use behaviour in implementation of information systems (Legris, Inghamb, & Colletettec, 2003).

Researchers have applied TAM broadly because of its simplicity and parsimonious nature. It is the most cited theory among ICT systems implementation and adoption (Korpelainen, 2011). Davis, Richard P. Bagozzi and Warshaw (1989) explain that the aim of TAM is to offer explanation of the determining factors of computer acceptance and providing clarification on user behaviour across a wide range of end-user computing technologies and user population, while at the same time being both parsimonious and theoretically justified.

TAM was originally proposed by Davis in 1986, and it has become one of the most popular models relating to technology acceptance and use (Legris et al., 2003). Realistically, one would prefer a model that aids prediction but also assists in explaining to researchers and practitioners why a particular system may be rejected and seek suitable counteractive measures (Davis et al., 1989).

Several studies in IS have investigated Green IT adoption based on the theories like the TAM (Dedrick, 2010). TAM gives the foundation upon which the external variables that affect belief attitude and intention to use can be determined (Park, 2009). The actual use of a technology system by an individual is determined by the individual's behavioural intentions, attitude, perceived usefulness of the system, and perceived ease of the system. TAM as well put forward that based on mediated effects on perceived usefulness and perceived ease of use, external factors can influence intention and actual use of the technology system (Park, 2009).

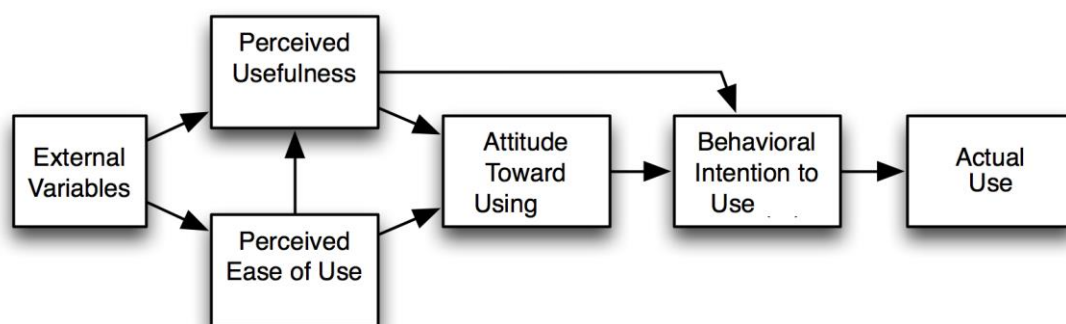


Figure 2.1: Technology acceptance model

Source: Davis et al., (1989)

2.3.1 Perceived ease of use and perceived usefulness

Technology is an active contributor towards the realization of green IT goals rather than a passive observer (Soomro & Sarwar, 2012). It has a very important part to play in every modern

work environment and brings about huge transformation to the business operation and how employees carry out their duties (Queensland Government, 2015).

To begin with, people are likely to accept technology depending on the degree they believe it will assist them in carrying out their work better. This is the perceived usefulness. In addition, despite potential users believing that a given technology is useful, there is the possibility that they perceive the technology difficult to use and that the performance gains of usage are dwarfed by the effort of using the technology. Hence, in addition to usefulness, perceived ease of use has an effect on usage (Davis, 1989). The time of IT departments instructing on the particular type of technologies to be used is fast fading (Jones, 2012) and competency tends to be greater because employees are used to their devices and are more efficient at problem solving. Workload is a drawback for employees, but due to the use of personal devices employees have the tendency to extend longer their working hours by working from home after work hours. Two benefits of BYOD include autonomy and competence, and BYOD is typically linked with increased freedom (Hensema, 2013).

There have been numerous studies on technology acceptance based on the TRA, TPB, TAM, Unified Theory of Acceptance and Use of Technology, and many others in which intention to use and actual usage is presumed to be determined by Perceived Usefulness or Perceived Ease of Use (Buettner, 2015).

According to Bhattacharjee (2001), in order to determine an individual's intention to adopt a technology, perceived usefulness is one of the appropriate constructs. More so, Melville (2010) affirms that TAM posits that the adoption of IS and its usage is dependent on the perceived ease of use of the system and the perceived usefulness, especially in the aspect of increasing the productivity of the individual. IT has pervaded most business processes in different organizations, it makes available a way to also solve the problems arising from IT use. At the same time, IT managers are persistently under pressure to lessen the overall cost of IT operations and to run organizations with energy efficient IT (Molla, 2008).

As organizations are realising that it is important to embrace the trend of BYOD instead of turning a blind eye towards it (Maisto, 2012), and as the commitment to lessen the environmental impact and energy consumption of IT are becoming increasingly key objectives for organizations (Curtis, 2008), organizations are putting in huge amounts of time and money to develop new and effective means of conserving energy (Saha, 2014).

2.3.2 Perceived behavioural control

Perceived behavioral control explains an individual's perceptions of their ability to exhibit a specific behavior (Ajzen, 2002). Perceived behavioural control refers to an individual's beliefs regarding inputs or influence relating to the individual's decision to use (Taylor & Todd, 1995) and an individual's access to knowledge, guidance and devices. It is mainly focused on the control, by the individual, of the operation of the technology (Brier, 2004) that may bring about a positive or negative result (Taylor & Todd, 1995). A study by Ortbach et al. (2013) recognises the worries of the employees regarding required technical support for the setting up and usage and according to (Lamb, 2015) are "defined as a perceived behavioural control belief of IT Consumerization."

2.3.3 Attitude and behavioural intention

The researcher defines behavioural intention towards the adaptation of BYOD as a Green IT practice as a person's intent to carry out an actual usage behaviour aimed at energy saving (Koo, Chung, and Hee, 2013). The behavioural intention to adopt a particular technology has effects on the usage behaviour (Venkatesh et al., 2003) and the positive or negative emotions of a person with regards to carrying out that behaviour is reflected by attitude (Fishbein & Ajzen, 1975).

According to Ajzen and Fishbein (1980), attitude involves a person's perception regarding adhering to a certain behaviour, whether the behaviour would be favourable or not as well as the person's perception of the available motivation geared toward carrying out the behaviour. Attitude towards a particular behaviour is also considered a person's favourable or unfavourable assessment or view of carrying out that particular behaviour.

2.3.4 Application of TAM to the study

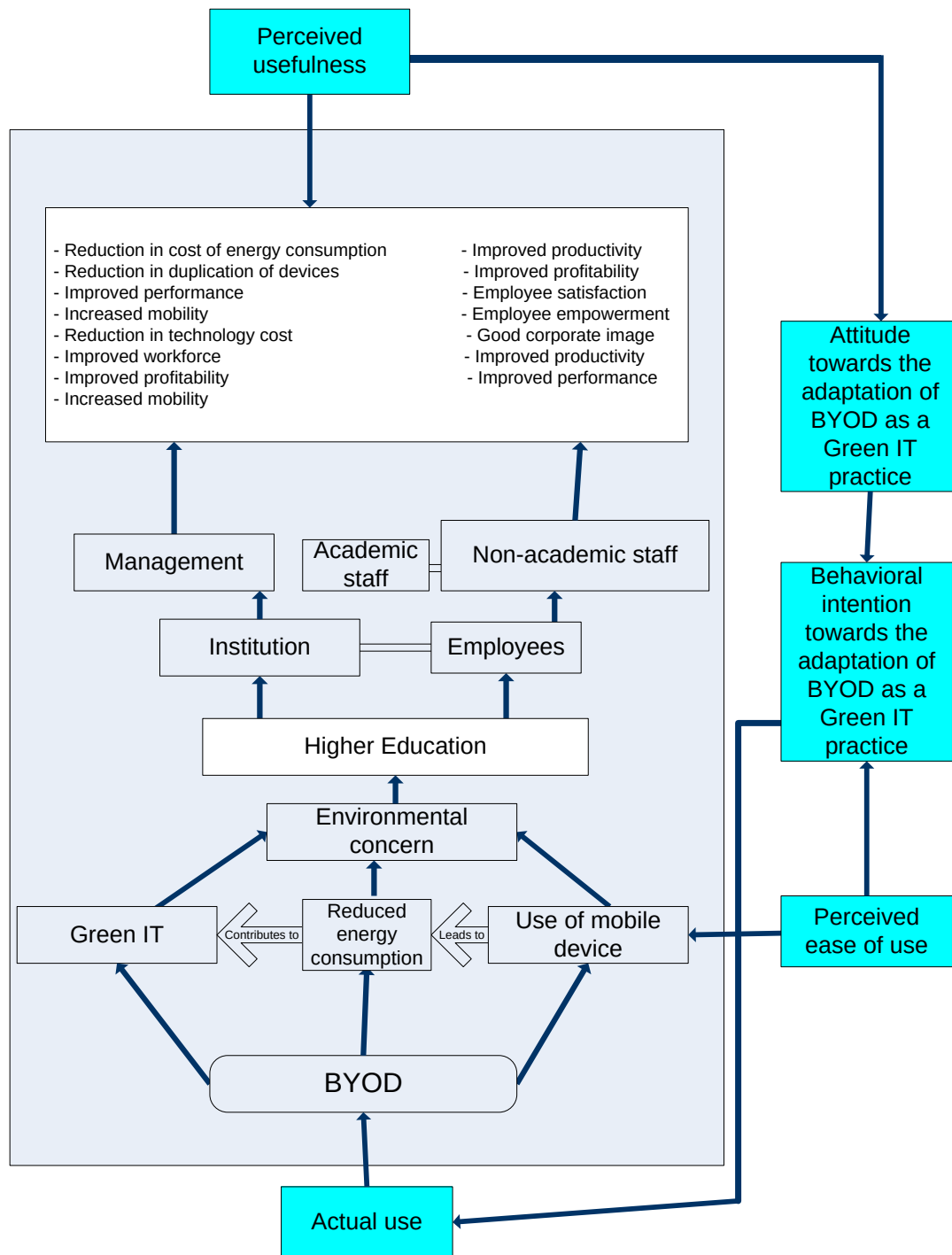


Figure 2.2: Conceptual framework of the study

Source: Adapted from Davis et al., (1989)

In the field of information systems, the adoption and usage of Information technology in the work environment remains a key focus (Sichel, 1997). The conceptual framework of this study in Figure 2.2 depicts the actual use of BYOD to include the use of mobile devices which in turn helps reduce energy consumption, therefore contributing towards greening of IT in a

higher education environment. The application of BYOD with Greening of IT in mind in HEI helps realize most of the sustainability goals of a green conscious institution and achieving a lot of other advantages. Different forms of BYOD exist but it takes a certain level of environmental concern for a HEI to consider the adaptation of BYOD for the purpose of contributing towards greening of their IT. Alharbi and Drew (2014) explain that defining the importance of a specific technology and envisaging the expected outcomes of putting it in place is crucial prior to its adoption. As depicted in Figure 2.2 in this study, the adaptation of BYOD with greening of IT in mind assists in realizing a lot of benefits which includes, reduction in cost of energy consumption, elimination of multiple or duplication of devices, reduction in cost of technology acquisition, good corporate image, improved work force, improved productivity and etcetera which are considered to be the perceived usefulness of BYOD.

There have been effective incorporation of technology and mobile devices in the daily activities of individuals (Cruz, Boughzala, & Assar, 2014) as having access to mobile devices enables individuals to handle different business and social responsibilities during the course of the day, almost in real time as issues are confronted, instead of heaping all the messages and responding to them at a later time when the person gets back to their workstation (Sarker & Wells, 2003). The value or usefulness of BYOD as perceived by the employees helps tune their attitude towards favoring the adaptation of BYOD for any broader purpose besides just having access to the institutional network. Bose and Luo (2012) state that through technological changes and behavioural changes, the impact of IT on the environment can be hugely decreased. Technological changes concentrate on enhancing IT and business infrastructure to make them eco-friendlier. By creating and putting into effect organizational policies in alignment with the Green IT strategy embarked on by an organization, behavioural changes can be achieved. In this study, the conceptual framework in Figure 2.2 above illustrates that when positive attitude towards the initiative is ensured, it is expected that the behavioural intention of employees towards the green initiative would also be more positive as the usefulness of BYOD is difficult to resist.

The users' tendency to accept a technology that is perceived to be easier to use is high (Davis, 1989), hence BYOD has emerged as an unstoppable force, with or without the approval of the organization (Var, 2013). In realizing sustainability goals with BYOD, it is important to ensure proper awareness or knowledge of the concept among the employees in the institution. Increased knowledge, together with organizational support, help ensure the ease of use of any form BYOD in HEI. The perceived ease of use of BYOD ensures that potential adopters of

BYOD are willing to partake in the greening of IT with BYOD. Var (2013) indicated that work devices are left in the dust as employees are continuously personalizing their home devices since BYOD allows employees to make their own decisions regarding the way they execute their jobs. Hence Tata (2014) pointed out that the acceptance of BYOD may not be a choice for every organization, but it is a trend that all organizations will need to put into consideration and according to Sarker and Wells (2003), the continuous and constant advancement of technology calls for the need to put in more effort towards understanding exactly how and why new technology is adopted or rejected by people (Sarker & Wells, 2003).

2.4 THE LITERATURE GAP AND REASON FOR ENGAGING IN THE STUDY

For this study, BYOD is explored as a Green IT practice. This study attempts to fill in the gap regarding the limited literature in integrating BYOD into green initiatives, as well as the relationships between Green IT, BYOD and energy conservation

In reference to the literature highlighted and discussed in this study, BYOD is a trend that should not be ignored as it can be adopted as a Green IT solution in organizations. This needs combined efforts of employees and the management of HEIs in taking advantage of this trend to save cost and the environment.

When a new technology is adopted, a number of challenges and opportunities are always faced, hence the engagement in this study. BYOD has come to stay and this makes it important that organisations tap into its benefits. Developing a sound BYOD policy would be the best way to implement BYOD in the work place and also contribute towards boosting the organization's green campaign. The main aim of BYOD in the work place is to ensure that employees come to the work place with their mobile devices, and utilize them as devices for boosting their daily productivity at work. Adhering to such practice boosts the Green campaigns of any organization being that BYOD helps reduce the number of technology used daily at the work place hence reducing energy consumption.

2.5 CHAPTER SUMMARY

This chapter focused on the key concepts of this study and their relationships. The general advantages of the key concepts and the conceptual framework of the study was developed and discussed in this chapter. This chapter is followed by Chapter three which concentrates on research methodology and design. The next chapter also explains the philosophical underpinnings of the study.

CHAPTER 3

RESEARCH METHODOLOGY AND DESIGN

3.1 INTRODUCTION

Chapter two presented the conceptual framework for the adaptation of Bring Your Own Device (BYOD) as a green information technology (Green IT) at the North-West University by reviewing literature, and other relevant topics relevant and related to the study. In this chapter, the researcher presents the research methodology and design, including the philosophical background, the research paradigm, research approach, data collection and analysis methods used in investigating the employees' perception regarding the adaptation of BYOD as a Green IT practice.

The main aim of most academic research is not just about proving things, but more about investigating questions, enquiring into phenomena and exploring subjects or problems. More so, selecting suitable research paradigm and approach for a particular study will be done based on the subject of the study and the circumstances (Clough & Nutbrown, 2012).

3.2 RESEARCH PROCESS

The basic process of research is based on interest and desire to seek knowledge (Wisker, 2001). Hence, Figure 3.1 is a diagrammatic representation of how the chapter was structured for seeking knowledge required for the topic of the study. It explains the choice and steps involved in the research methodology and design followed by the researcher. Myers (2009) endorsed that a well thought research process generally facilitate the creating of new knowledge. The created knowledge is termed “new” since the facts and making sense of the facts, or the theories employed to explicate the facts perhaps have not been previously employed in that exact way in that particular area of study.

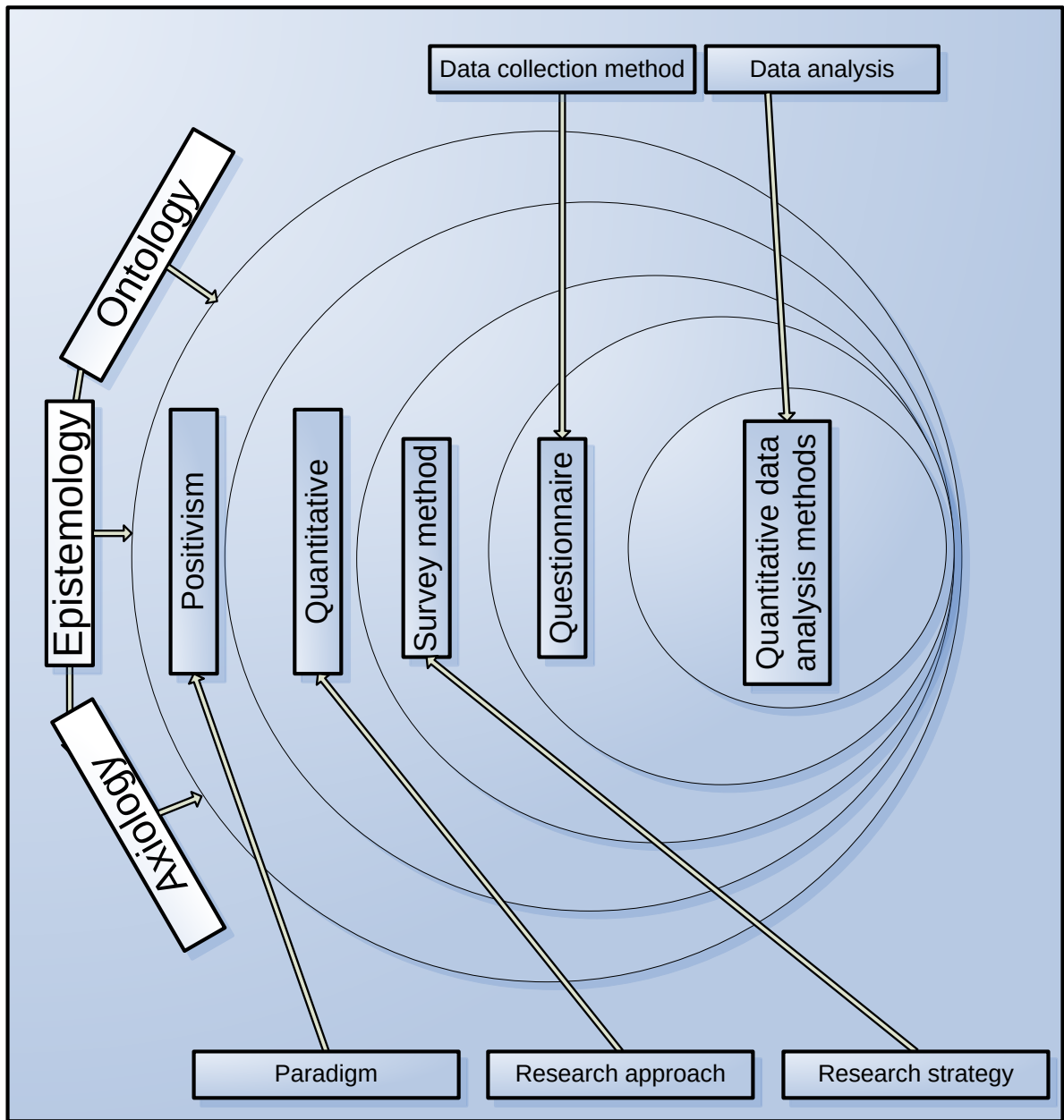


Figure 3.1: Diagrammatic representation of the research process

Source: Adapted from Saunders, Lewis and Thornhill (2009)

3.3 RESEARCH DEFINITION

Research differs in nature and each of them has a specific purpose and applicability. Research is embarked on for realizing different aims which differ based on the research type, starting from description to comprehending and the empowerment of individuals (Sarantakos, 2012). Wisker (2001) defined research as a process which involves inquiry and quest into providing answers to questions and looking for knowledge regarding the researcher's topic of interest and understanding of the world and its methods.

Based on the explanation of Myers (2009), the researcher defines research in a University environment, as an authentic or pioneering inquiry conducted for adding to knowledge and understanding in a specific area of study which could yield new knowledge.

3.4 RESEARCH METHODOLOGY

This section described the foundational choices of the researcher towards addressing the research problem. The following sections will explain more about the choices made.

3.4.1 The philosophical background

In one way or the other, social researchers typically follow the perspective of a specific set of theoretical or philosophical, ontological and epistemological assumptions (Blaikie, 2010). More so, to assist in the decision-making regarding methodology and to enhance the reliability of research, it is important that the researcher reflects and make clear his ontological stance and to make sure that the methodology is in line with the chosen ontological stance, giving a basis for the decisions taken that aims to validate the methodology and the preceding data collection methods and analysis (Jackson, 2013).

The assumptions on what manner the world is viewed and the best way to study it should be taken into consideration (Bhattacharjee, 2012). It is important not to ignore the philosophical assumptions and researcher's stance since it is fundamental to the methodological choices that would be made in the whole research process (Jackson, 2013). The philosophical assumptions are crucial to the concept of research design and covers the useful assumptions regarding how the social world is observed by a person. Additionally, it also includes considerations regarding epistemology and ontology which have significant differences that will influence the methods the researcher tends to follow (Easterby-Smith, Thorpe & Lowe, 2002).

3.4.1.1 Ontology

Prior to expounding the choice of ontology for this study, it is imperative to have ontology defined. According to Crotty (2003), ontology is defined as “the study of being” or the methodical study of existence (Uschold & Gruninger, 1996), and also according to Blaikie (2010) “ontological assumptions are concerned with the nature of social reality”. The opinion of a researcher regarding reality is the main foundation of every other assumptions, this means that the researcher's belief forms the centre of the researcher's different assumptions (Guba & Lincoln, 1994). These assumptions make clear the kinds of social phenomena that is existing or that can exist, including the circumstances surrounding their existence, and the associations between them (Blaikie, 2010).

According to Pring (2004), “One purpose of research is to explain what the case is or what has happened. A reason for seeking explanations might be to predict what will happen in the future or what would happen if there were to be certain interventions.” This view visibly reflects in the aim of this study which is targeted at investigating the employees’ perception regarding the adaptation of BYOD as a green IT practice.

Researchers in information systems and other related fields have studied technology adoption from different viewpoints. These researchers have formulated different models covering factors and phases to predict adoption that will eventually give rise to constant use (Renaud & Van Biljon, 2008). In similar effort, this study sought to explain the components of the proposed conceptual framework of this study which is an extended version of the technology acceptance model.

For this study, the researcher believes that the constructs have just one distinct reality which when observed will always be visible to any observer. Thus, this knowledge can be statistically generalized to a population by employing statistical analysis of observations regarding the reality that is not difficult to access (Bahari, 2012). Ontology is also how the reality within the study is viewed, which in its simplest form can either be objective or subjective. While the subjective form views reality as being comprised of the views and communications with living subjects (O’Gorman & Macintosh, 2015), the objective form of ontology portrays the position that social entities exist in reality external to social actors concerned with their existence (Saunders, Lewis & Thornhill, 2009).

This study aligns with the objective ontological perspective. A researcher holding the objective ontological perspective would view reality as being made up of objects that can be measured and tested as well as phenomena that remains in existence even when they are not being directly perceived or experienced (O’Gorman & Macintosh, 2015).

The stance decided upon will help align the study with the most appropriate approach (Jackson, 2013). Being clear on the ontological stance of the study by the researcher influenced the quality and features of the techniques, data, analysis, and findings generated. Usually the aim of positivists is to come up with laws, therefore providing a foundation for prediction and generalization as well as the use of deductive approach (Scotland, 2012).

The ontological stance of the researcher influences the methodological choice, which is based on how the researcher views reality; if the reality is an external, independent reality or an experienced, constructed reality centred on social or personal human conception (Jackson, 2013). The researcher in this study takes the objective stance and intends to generate findings

that would be independent of himself. The researcher believes that the aim of the study can be observed and measured.

3.4.1.2 Epistemology

Epistemology can be defined as “the study how we know things” (Bernard, 2000). Epistemological assumptions explain the kinds of knowledge that are obtainable, how they can be known, and the conditions or standards for justifying its legitimacy and adequacy (Blaikie, 2010).

Based on the ontology of the study, the epistemological assumption of the researcher is that obtaining knowledge regarding the aim of the study would be an objective process, and one that is measurable. Furthermore, the epistemological assumption by the researcher supports that a report which is measured and objective would be a more valuable and dependable knowledge. Based on the researcher’s assumption and in accordance with the view of O’Gorman and Macintosh (2015), it can be inferred that this study aligns best with the positivist epistemological perspective and this is the epistemological choice of the researcher in this study.

The positivist epistemological perspective of this study in summary assists in positing and clarifying beliefs (O’Gorman & Macintosh, 2015). To start with, there are two main differences to be established, which includes the likelihood to obtain knowledge regarding the world with no mediation and interferences. This implies that objectivity is obtainable, since different people observe things in similar way. A positivist epistemology supports that investigator is not attached to the object which is under investigation and can assume an objective position towards the investigation process (Mertens, 1998).

While ontological positions show the view of the researcher regarding the nature of social reality, the epistemological position reveals the researcher’s view of what can be known regarding the world and the way it can be studied. The primary focus of epistemology is to make clear social reality, to assume a particular stance, and to pinpoint ways of going about the investigation (Kura & Sulaiman, 2012).

3.4.1.3 Axiology

According to Saunders, Lewis and Thornhill (2009), “Axiology is a branch of philosophy that studies judgments about value”. Based on the ontology and epistemology of the study, this study was carried out in a value-free manner in investigating the employees’ perceptions of BYOD as a potential way of saving energy which will objectively apprise the conceptual framework of this study developed based on the technology acceptance model, which is an

important model to understand in this study. The researcher ensured that he remained independent of the data and upheld an objective position. This is line with the statement of Saunders, Lewis and Thornhill (2009) which explains that axiology of a positivist study is that research is done in a manner that is value-free, as asserted by O’Gorman and Macintosh (2015) that the outcomes of social research are value-free and according to Saunders et al., (2009), “the researcher is independent of the data and maintains an objective stance”.

3.4.2 Research Paradigms

The way a study is designed and carried out by a researcher is guided by the researcher’s mental model of references which guides his or her reasoning and observation (Bhattacharjee, 2012). Paradigm can be defined as the overall organizing framework for theory and research that consist of methods for finding answers, fundamental assumptions and problems, and models of quality research (Neuman, 2011). Wisker (2001) also stated that paradigm is the fundamental assumptions regarding how elements of the area under investigation match and how to carry out the investigation, and make sense of the findings. Creswell (2014) explained that the selection of research paradigms, design and approach are the three key components regarding the approach to conducting a research study.

While paradigms do not seem visible in studies sometimes (Creswell, 2014), they are ways of making clear the fundamental beliefs the researcher have and how they affect the way the research is conducted (Kuhn, 1970). Creswell (2014) affirms that paradigms have high influence on the direction of a study, and are the philosophical orientation regarding the world and the type of research chosen in a particular study by the researcher. Babbie (2014) stated that researchers adhere to different philosophical stance in order to bring together how they comprehend and conduct social life investigation.

3.4.2.1 Justification for using paradigm

Most of the time, Paradigms are difficult to identify because they are implicit, assumed, and most of the time ignored. Nonetheless, identifying these paradigms are crucial to interpreting of and comprehending the different views of people regarding a particular social phenomenon (Bhattacharjee, 2012). Ways of looking are made available by paradigms, but independently does not clarify, describe or interpret anything, instead they make known the basis with which theories are found (Babbie, 2014).

Paradigms are systems of interconnected ontological, epistemological, and methodological beliefs. Paradigms serve as views that offers a rationale for a study and compels the researcher

to adhere to specific methods of collecting data, observation, and interpretation (Blanche et al., 2006). Paradigms serve as mental models of references which helps to guide the way a researcher reasons when carrying out a particular research project (Bhattarchajee, 2012).

Paradigms are hence vital to research strategy because they tend to have influence on the type of research question or what is going to be investigated and on the way by which the question is to be investigated. When conducting, or designing a research study, the research must maintain the principle of coherence by making sure that the research question and methods employed are logically suitable or appropriate within the paradigm (Blanche et al., 2006). In this study, the three research paradigms explained by Orlikowski (1991) will be discussed in the following sections including the chosen paradigm for this study.

3.4.2.2 Interpretivism

In the case where the researcher prefers obtaining rich understandings of the subjective meanings instead of making law-like generalizations, the interpretivism philosophical stance would more probably be what the researcher will adhere to (Saunders & Tosey, 2013). Interpretivism embroils taking the subjective experiences of individuals seriously as the principle of the meaning they make of reality (ontology) (Blanche et al., 2006). This paradigm involves the study of social phenomena within their natural environment. It also concentrates on carrying out study amongst humans instead of objects, assuming an empathetic perspective in order to comprehend their social world and the meaning they make of it from their perspective (Saunders & Tosey, 2013). Therefore, Interpretivists are most likely to comprehend and make sense of social life the way it is viewed by the humans themselves, hence valuable evidence is rooted in the context of social interactions (Asif, 2014).

Understanding the experiences of these individuals would involve interaction with them and cautiously listening to the information they provide (epistemology) (Blanche et al., 2006). Therefore, interpretivism does not concentrate on detaching and control of variables, rather it concentrates on extending and taking advantage of the strong points of ordinary language and communication in order to assist in making meaning of the social world (Gray, 2004).

Interpretivists are of the belief that when studying facets of the human social world and behaviour, the researcher cannot be rightly objective or absolutely detached from the phenomenon under study. Different values, beliefs, and assumptions regarding people and the world is brought into the research process by the researcher. These tend to influence the nature of research topics and questions the researchers adopt, including the interpretations the researcher attaches to the research data obtained (Thomas & Hodges, 2010). Hence, the data

collection and analysis would possibly involve qualitative data obtained from in-depth investigations with little samples (Saunders & Tosey, 2013), and this implies employing the use of qualitative research techniques for the collection and analysis of information (methodology) (Blanche et al., 2006).

In contrast to the Positivist, the Interpretivist researcher takes research to be more focused on value, the phenomena under study being a result of a specific set of circumstances and people at a particular time (Saunders & Tosey, 2013). With regards to epistemology, interpretivism is related to constructivism, and interpretivism emphasizes that natural reality and social reality are not the same and hence does not use the same approach (Gray, 2004). From the Interpretive perspective of reality, human beings and research are not the same, which is quite contrasting to positivism. Additionally, human beings are the main focus point and tend to create their own world (Asif, 2014).

3.4.2.3 Critical realism

Similar to positivism, realism is a philosophical stance related to scientific enquiry. Realism encompasses the belief that the existence of reality is not dependent on the mind and that the truth is what is revealed to the researcher through his senses, but not neglecting that world views and personal experiences affect the researcher (Saunders & Tosey, 2013). Sarantakos (2005) further asserted that reality exists separately from the mind and experience of people.

The reality existing in the world exceeds the analytical capacity of the mind, and that assumptions are to be measured based on their accuracy and reality (Sarantakos, 2005). Philosophers differentiate between two types of realism which are direct realism and critical realism. A researcher who is of the direct realist stance debates that experience with the senses give a correct representation, while the critical realist is of the belief that the mind subjectively processes what is firstly experienced with the senses (Saunders & Tosey, 2013). This means that for the critical realist researcher, it is important to identify the initial experience and the structures and the underlying relationships. Thus, the collection techniques and process of analysis are not the same employing either or both quantitative and qualitative data (Saunders & Tosey, 2013).

3.4.3 Choice of research paradigm for this study

It is clear that the paradigms explained have different beliefs regarding reality and ways to explore them based on the discussion of paradigms in the previous sections in this chapter, and

the choice of paradigm in different studies may be different and may serve numerous and varied aims.

These aims rely mainly on the paradigm which the study follows (Creswell, 2014). An interpretivist seeks to comprehend and interpret social life as viewed by the individuals themselves, while a critical realist tends to go further than that. More so, explaining and changing the social world tends to be the main aim of a research study from the perspective of a critical realist (Asif, 2014).

The choice of paradigm for this study is positivism. For a Positivist, the main purpose of carrying out a quantitative study is to describe and to predict (Asif, 2014). The Positivist paradigm is typically regarded as an approach to quantitative research (Creswell, 2014). Since various paradigms exist simultaneously, this makes it obtainable for a researcher to employ more than just one paradigm, which is subject on the nature of study being conducted (Blanche et al., 2006) but for this study, the researcher chose positivist paradigm and this is because the theoretical foundations of quantitative research are those of positivism, which tallies with their ontological and the epistemological beliefs (Asif, 2014).

Positivist researchers lean towards objectivity (Asif, 2014), and the matching positivist paradigm seeks to explore, explain, evaluate, predict, and develop or test theories (Sarantakos, 2005). The outcome of the aim of this study is expected to be more objective, which according to (Sarantakos, 2005), reality and truth exist objectively and can be revealed and sufficiently measured. Positivist paradigm which is the chosen paradigm for this study will be further discussed in the next section.

3.4.3.1 Positivism

Ontologically, positivist information systems researchers adhere to an objective stance (Orlikowski, 1991) and believe that reality is made up of separate and distinct happenings which the human senses can observe (Blaikie, 2010). “Positivism is based on the works of French philosopher Auguste comte (1798-1857)” (Bhattacharjee, 2012). The prevailing epistemological paradigm in social science dating from the year 1930s to the 1960s was Positivism, and its main debate was that the social world to a researcher exists externally, and secondly, that directly through observation its properties can be measured (Gray, 2013).

The Positivist also have the notion that that human beings are rational individuals who are guided by social laws, and human behaviour is known through observation and guided by external causes which gives the same outcomes (Sarantakos, 2012). This further means that the

main belief of positivism is that all knowledge emanates from experience which means that knowledge is gotten from what is being observed. The observation in this context does not just mean visual observations, instead in a wider perspective, it also means what can be identified with the whole of our senses or through the instruments available to lengthen and improve them (Perri & Bellamy, 2011). Positivism is most of the time seen to be identical to quantitative research since it comprises of the ontological and epistemological recommendations that outlines how a study can be carried out with the quantitative approach (Sarantakos, 2012).

3.4.3.2 Characteristics of positivism

Positivism emphasizes the significance of accuracy, exactness, and measurement (Sarantakos, 2005). Positivists try to learn about how social world works to enable people to exercise control over it and make accurate predictions about it (Neuman, 2011). This means that the world is deterministic, following strict causal laws, which can be predicted and controlled if the laws happen to be discovered social life (Sarantakos, 2005). We can use that knowledge to alter or improve social conditions (Neuman, 2011).

Positivism claims that knowledge comes through sense experience (Sarantakos, 2005). Positivists make effort to learn about how the social world functions to help people have absolute control over it and make correct presumptions concerning it. Social conditions thereof can be changed or improved with the knowledge. Positivists views research outcomes as tools or instruments that can be used by humans to fulfil their wishes and control the environment (Neuman, 2011).

It also follows the belief of objective reality and complete truth (Sarantakos, 2005). In following the positivist paradigm, the researcher remains unattached, unbiased, and objective as he or she measures facets of social life, examines evidence, and imitates the existing research of other people (Neuman, 2011). It stresses the importance of not adhering to subjectivity in research process particularly in social research (Sarantakos, 2005).

Positivism follows a design which is centred on deduction and provides inductive generalizations (Sarantakos, 2005). This entails integrating deductive reasoning with defined empirical observations of individual behaviour so as to ascertain and confirm a set probabilistic causal laws that can be instrumental for accurate prediction of general patterns of human activity (Neuman, 2011). In order to find out generally applying regularities, positivism combines primarily deductive reasoning with empirical and mainly quantitative approach (Payne & Payne, 2004).

3.4.3.3 Benefits of positivism

A researcher who is focused on the observation and prediction of results can be regarded as a laboratory scientist who is after generalizations of cause and effect; depicting the philosophical stance of a Positivist (Saunders & Tosey, 2013). “Positivism assumes that the world is objective” (Swanson & Holton, 2005). Hence, researchers who favour positivism commonly look for truths in terms of associations between variables. The main effort is put into measuring all required variables to verify that a correlation or association is significant or constant in similar circumstances (Swanson & Holton, 2005).

Observation and measurement of the human and social world can be achieved through the use of related scientific methods and approaches to the ones employed to the studying of the natural world. The consistent patterns can be identified in the human social world or behaviour, together with relationships of cause and effects, and that the consistent patterns have general validity. This typically consists of huge number of quantitative data samples and statistical hypothesis testing. In a situation where the outcome of the study does not confirm a theory, it would be necessary to have the theory revised (Saunders & Tosey, 2013).

With no effect or influence on these consistent patterns, they can be observed or measured, and they remain there notwithstanding if they are being acknowledged or observed by people or researchers. Therefore, only when ideas undergo assessment of empirical experience can it be worth integration into knowledge (Gray, 2004).

3.4.4 Research approach

Each paradigm is grounded on a suitable ontological and epistemological assumptions. As every paradigm is made up of varying ontological and epistemological beliefs; it means that they adhere to varying views regarding reality and knowledge which informs their specific research approach (Scotland, 2012).

Every research approach has exceptional features that is of value to a particular research purpose. Researchers tend to be confused when it comes to making the appropriate choice of research approach. A lot of them tend to make the decision of using either the qualitative approach or quantitative approach. The successfully completion of a research study necessitates that a researcher makes a careful decision of the best research approach that sits well with his study (Holton & Burnett, 2005 cited in Melendez, 2015).

It is conventional to split social research approach into two different types namely; quantitative and qualitative (Payne & Payne, 2004). Quantitative approach is mainly rooted on the positivist

paradigm and qualitative approach is rooted on the interpretive paradigm (Asif, 2014). The decision made regarding data selection and methods of analysis influence the outcomes of a study and not only influenced by the research question and the way it is rooted in its socio-cultural, political, economic, and circumstance (Alasuutari, Bickman & Brannen, 2008). The difference between quantitative and qualitative approaches reveals differences in approaches to research (Blanche et al., 2006).

3.4.4.1 Qualitative approach

The constructed reality of the study participants is the main emphasis of qualitative research. Its distinction from quantitative research lies on its aim, emphasis, methods, and principles for truth (VanderStoep & Johnson, 2008). Qualitative approach involves obtaining data in written or spoken language form, or in observation documented in recorded language form, which the data can be analyzed by ascertaining and putting the themes into appropriate categories (Blanche et al., 2006).

Various qualitative researchers do not function under the same epistemological assumptions with quantitative researchers. To comprehend any phenomenon, a number of qualitative researchers are of the notion that the most appropriate way would be to view it in its context. Qualitative researchers see every quantification to be limited in nature, and instead of taking measurement with the belief of establishing a fixed measuring instrument, qualitative researchers decide to let the questions come up and change as one become more acquainted with the study content (Krauss, 2005).

In the past twenty-five years, qualitative approach is becoming well known and accepted in the social sciences, and this is because of the unfavourable reaction towards the beliefs of quantitative research. Nevertheless, it is not important anymore to compare the views of these two methods against each other and it is important to recognize that qualitative approach can be described as the phoenix that emanated from the ashes of the assumptions of positivism (VanderStoep & Johnson, 2008). The qualitative research approach helps to obtain comprehensive and non-measurable explanations of small groups, looking to make sense of the meanings individuals have of their lives in natural settings, based on the notion that social interactions helps to create an integrated set of relationships that can be comprehended better through inductive procedures (Payne & Payne, 2004). Data obtained from a qualitative research tend to be richer in meaning and more detailed compared to data obtained from quantitative research (Babbie, 2014). Qualitative approach assist researchers in studying issues deeply, and detailed as they ascertain and try to make sense of the categories of information that is gotten

from the data (Blanche et al., 2006). In summary, qualitative approach will not be useful in making quantitative predictions, since qualitative data is usually bulky, outcomes are subjective, and the process requires more time (Everest, 2014).

3.4.4.2 Choice of research approach

This study follows the quantitative approach. Quantitative approach provides refined techniques which helps in the analysis of causal relationships, while the qualitative researchers often try to avoid discussing causal relationships (Alasuutari et al., 2008).

Generally, the choice of paradigm, the designs, and the methods contribute to the research approach followed in a study (Creswell, 2014) which tends to be quantitative in this study. The researcher made the general decision regarding the selection of the appropriate approach for this study. For this study, the philosophical assumptions aided the researcher's decisions regarding the procedures of inquiry, the data collection method, analysis method, and the method used for interpretation.

This study deployed quantitative research approach since the study was focused on investigating the aim of this study from the employees' perspective. Payne and Payne (2004) stated that quantitative methods look for regularities in human lives, by splitting the social world into empirical components known as variables which can be denoted mathematically in the form of frequencies or rate, whose relationships with each other can be explored with statistical techniques, and accessed through stimuli presented by the researcher and systematic measurement. Additionally, Kothari (2004) stressed that quantitative method is objective, structured, and relevant for phenomenon that can be quantified, and according to Creswell (2014), when stating the outcomes of a quantitative study, histograms, tables, graphs, graphs, and charts can be used for clarity.

The two main strengths of quantitative research are; the outcomes can be generalized and the data are objective (Blanche et al., 2006). One of the key elements that has been adhered to by many researchers as a virtue that every researcher should endeavour to attain, even though it is now recognized that it is impossible or difficult to attaining a high level of objectivity. Commonly, objectivity is used to lessen personal prejudice and bias and to make sure that social reality is presented unaltered, instead of the way it is interpreted or envisioned by the researcher (Sarantakos, 2012).

For this study, the choice of paradigm helped the researcher in the following ways:

- The positivistic paradigm mostly aligns with the quantitative approach, hence the researcher adopted the quantitative approach. The researcher is of the belief that the paradigm and the chosen methodology will help in obtaining a suitable solution for the problem of this study.
- It provided the researcher with the ability to select the most appropriate techniques and procedures that will contribute to the successful completion of this study. The survey method was deemed appropriate for this study.

The researcher gathered data through questionnaires to answer the research questions formulated for this study. Wisker (2001) revealed that if a researcher wants to gather quantitative data the researcher is most likely measuring variables and validating theories that are already in existence or hypothesis or questioning them.

In this study, apart from the nature of the data, the following as stated by Creswell (2014) determined the researcher's choice of research approach; the researcher's personal experience, the research problem, and the target audience (Creswell, 2014). On the other hand, qualitative research is conducted when a researcher seeks to know meanings, or view, explain and understand experience, beliefs, values and opinions (Wisker, 2001). The chosen research approach for this study is discussed in the next section.

3.4.4.3 Quantitative approach

In this study, the researcher uses the quantitative data. Going by history, social scientists have preferred quantitative data to qualitative data which was because of the general acceptance of positivism. Researchers were of the belief that there exists huge amount of facts in the world to be obtained through objective quantitative measures (Blanche et al., 2006). Quantitative approach is usually focused on detailing subject features stated in quantity, level, or strength, together with ensuring objectivity, correctness, validity and consistency (Sarantakos, 2005). According to Firestone (1987 cited in Patel, 2012), the significant aim is to ensure that the researcher is objective and not biased by trying to find out causal relationships by means of objective measurement and quantitative analysis.

Quantitative researchers seek more of description of behaviour rather than meaning using questionnaire developed for determining characteristics of the population with statistical accuracy (Sukamolson, n.d.). Typically, quantitative research is most suitable when a researcher intends to have a large sample size for generalizing to a large population, which the

primary aim in such situation is to obtain data from large number of people or organizations based on the specific topic under investigation (Myers, 2009).

Commonly, quantitative researchers collect data in numerical form and the data analysis usually employed is the statistical analysis (Blanche et al., 2006). In social research, the dissimilarities between quantitative and qualitative data is mainly the difference between numerical and non-numerical data. Observations tend to be more unambiguous through quantification, and additionally gives room for statistical analysis, starting from simple averages to mathematical models (Babbie, 2014) or complex statistical modelling (Saunders, Lewis & Thornhill, 2009), and other formulas that are very complex (Babbie, 2014).

3.5 RESEARCH DESIGN

Research design encompasses the plans and the procedures that covers the steps from the researcher's comprehensive assumptions and his or her detailed methods of gathering data, analysis, and interpretation (Creswell, 2014). Research design can be defined as the various strategies that can be employed in making inquiry within the existing research approaches (Denzin & Lincoln, 2011). Bhattacharjee (2012) stated that research design covers the general strategy for data gathering in all types of research. Blaikie (2010), stated that research design is a combined report and validation of all the technical resolutions made during the planning of a research project.

In an empirical research study, the research design serves as the detailed strategy for data gathering (Bhattacharjee, 2012). The researcher chose the quantitative survey research for this study. Fowler (2008), stated that survey method studies a sample of a population in order to offer numeric representation of trends, views, and behaviours thereof. Maree (2010) asserted that research design is founded on philosophical assumptions which assists a researcher in choosing respondents for data gathering procedures as well as the statistical and analysis techniques suitable for the study.

Nonetheless, choosing a research design may be determined by the kind of data needed to answer the formulated research questions in the study (Maree, 2010), and positivist study mostly make use of quantitative data (Bhattacharjee, 2012). If a researcher intends to collect data that can be represented in numerical form, he or she is clearly considering the quantitative research approach (Wisker, 2001).

The research design of this study focused on the quantitative approach based on the choice of paradigm which is the positivist paradigm (see section 3.4.3). The research design chosen for this study involved the survey method. The researcher followed the necessary procedures pertaining to survey research as affirmed by Remler and Van Ryzin (2011) that survey research procedure includes identifying the population and sampling strategy, developing questionnaires, pretesting the questionnaires, gathering data, inputting and preparing data for analysis, and the presentation of outcomes. Fowler (2008) stressed that this whole procedure is set on generalizing from the sample to the population of the study.

3.5.1 Survey method

This study required a design which would be more suitable for describing the characteristic of the population under study with regards to the topic of the study. Hence, the survey method was chosen and according to Babbie (2007), surveys are mostly important for describing the characteristics of a large population.

Surveys can be regarded as very old research technique (Babbie, 2014) and survey research is perhaps the suitable method accessible to any social researcher who wants to collect original data for description of a population that is too large for direct observation. The survey population is an important issue researchers must put into consideration when designing a project. This consideration includes the type and number of persons that will be involved in the study (Sarantakos, 2005). Surveys particularly self-administered surveys make it possible to obtain data from large samples (Babbie, 2007), which was the method the researcher used in administering the questionnaires for the study.

Surveys try to ascertain something about a population or specific set of people and organizations, institutions or even nations can be made up of the unit of analysis. Being that populations are sometimes larger, causing the survey to become time-consuming and too costly, we are likely to obtain data from samples, which is just subset of the population (Gray, 2004). In social sciences, the survey technique is a method of observation that is regularly employed. A researcher tends to choose a sample of respondents and provides each respondent with a standardized questionnaire (Babbie, 2014).

Just like this study, surveys are very suitable for measuring attitudes and views in a large population and may be employed for exploring, description, and explanation (Babbie, 2014). Surveys are the best means of determining attitudes and beliefs in a large population (Babbie, 2007). In a case where the researcher decides to study the entire population, it means that the

target population also becomes the survey population. On the other hand, most quantitative researchers make use of the sampling method which involves studying a portion of the population known as sample (Sarantakos, 2005). It is therefore important to discuss population and sampling further.

3.5.2 Characteristics and justification for using survey

Conducting surveys are thriving, and to be on the receiving end of surveys has become a part of modern life. Organizations make use of surveys to measure the attitudes of customers regarding their products and services. Educational institutions use survey to measure the views of students regarding courses and programs to keep up with their quality assurance principles. Surveys are employed by governments and politicians to know the opinions of the masses to ascertain the mood of the masses on different issues (Gray, 2004).

Surveys facilitate the finding of relationships between social, economic and psychological variables and behaviours (Gray, 2004). At times the questions are asked by an interviewer or sometimes put down in writing and administered to respondents to complete (Babbie, 2014). The aim of this study would be a typical subject for a descriptive survey, since according to Gray (2004), descriptive surveys are frequently carried out to ascertain attitudes, values and opinions. Babbie (2014) stated that survey research is particularly best fit for making descriptive studies of a large population and survey data can also be used for explanatory purposes.

A lot of surveys are carried out with the use of questionnaire, however structured observation and unstructured interviews are also applicable. Surveys sometimes involve input from different individuals which entails sharing of tasks between survey designers, interviewers and the people who key in the data into the computer just before proceeding to analysis unlike other research methodologies (Gray, 2004). When done as it should be, surveys can be valuable instrument for social inquiry. Putting into place a useful and trustworthy survey research starts with putting into words good questions and this is because it includes the use of a questionnaire which serves a measuring instrument designed to produce information that will be valuable for analysis (Babbie, 2014).

3.5.3 The population and sampling for this study

Before making use of any sampling technique, it is important to make clear the population which is also referred to as the target population which is where the sample is taken from (Blaikie, 2003). Sarantakos (2005) also revealed that in every study, the target population is

the population from which information is needed, while the survey population is a section of the target population that is under investigation (Sarantakos, 2005). Population can also be defined as the individuals or objects possessing the characteristics that a researcher desires to study (Bhattacharjee, 2012).

Every research study comes to a point where decisions regarding the manner at which data will be obtained from a source or sources. Social researchers most of the time choose to work with samples instead of populations, especially when the population suitable for the study is very large (Blaikie, 2003). Explaining further, sampling is the process of choosing elements of a population for participation in a study (Maree, 2010), and an element is that unit from which data is obtained and which becomes the main core for analysis (Babbie, 2007). The main objective of a survey is to learn about a population based on a sample (Maree, 2010), hence the collection of elements from which the sample is chosen becomes the study population (Babbie, 2007). A sample can be defined as the selected and chosen group of persons on which the study is carried out (Wisker, 2001).

From the given definitions, it can be deduced that population is the bigger pool from which the sampling units or elements are taken from, and to which the outcomes are to be generalized (Blanche et al., 2006). In most cases the total coverage of the population is impossible, hence making it important to use sampling which gives a better option being that it addresses the population under survey within a short duration and yields outcomes that are comparable and very much valid at the same time (Sarantakos, 2005).

Sampling helps a researcher to obtain through his study results that are representative of the entire population by studying just a small section of the target population (Sarantakos, 2005). Random selection is very important to this procedure as each element has the same chance of being chosen not depending on any other event during selection (Babbie, 2007). When a sample is representative of the population, it makes the study more credible (Ahmed, 2008).

The total population of this study were all employees of the NWU which was N= 7833. The three campuses are in three different locations, hence this provided a host of individuals from different backgrounds and perceptions regarding the phenomenon that was being investigated. The procedures and mechanisms which together make up the method of choosing sample are known as the sample design (Greenfield, 2002). In simple terms, a sample design refers to the sampling frame which is made up of lists of units from which the sample will be chosen, based on the specification of the procedures to sample from the frame (Greenfield, 2002). For this

study, the researcher used simple random sampling which according to Wisker (2001) involves choosing of participants at random, and the selection is not based on any particular rules for any exact reason.

The sampling units in simple random sampling are usually independent from each other, and their chance of being chosen is not determined by the choosing of other (Sarantakos, 2005). The study used the following formula which is based on Krejcie and Morgan's (1970), and the representative sample of the population was selected for this study employing work on sample size determination:

$$n = \frac{p(1-p)N \cdot \chi^2_{\alpha}(1)}{d^2(N-1) + p(1-p)\chi^2(1)}$$

Where n =sample,

Proportion, $p = 0.50$ (for maximization),

N = Total population,

d = Error margin (Degree of accuracy) = $5\% = 0.05$,

And $\chi^2_{\alpha}(1) = \chi^2_{0.05}(1) = 3.841$ and $p=5\%=0.05$.

Using the Total population, N , of 7,833, the estimated total minimum sample size is given by:

$$n = \frac{0.5(1-0.5)(7833)(3.841)}{0.05^2(7833-1) + 0.5(1-0.5)(3.841)} = \frac{7521.63825}{20.54025} = 366.2 \text{ to } 1 \text{ d.p}$$

The Sample size was derived from the stated relation above ($n=366$). The researcher adopted the random sampling to select the employees at the NWU.

3.5.3.1 Limitations of sampling

One of the limitations of sampling is that it needs more deep and complex management, preparation, and encoding than saturation surveys. Saturation survey typically comprises of all units within the target population. Another limitation of sampling is that it implies a size decrement of the target population and, therefore, little potential respondents; which brings in doubts regarding the degree of representativeness and generalizations of the outcomes that cannot be (Sarantakos, 2012).

3.5.4 Data collection

This stage involves the method of data collection most related to the survey method. According to Sarantakos (2005), surveys entails collecting data through the use of oral or written questioning.

The data collection procedures, data collection method and analysis method used for this study is discussed in the sections that follows.

3.5.4.1 Data collection procedure

The study involved a pilot study and A pilot study entails field testing which involves administering questionnaires (Creswell, 2014) to assess the quality of the data gathering instrument (Greenfield, 2002). For this study, a separate set of questionnaires were given out to fifteen employees located in one of the campuses of the HEI. The questionnaires for the pilot study were administered based on random sampling. The researcher randomly selected academic and non-academic employees available within the campus.

The aim of the pilot study was to obtain response and clarity regarding the structured questions contained in the measuring instrument to ensure reliability, clarity, and validity. According to Wisker (2001), feedback from a pilot study helps to ensure that questionnaires are perfect to use with the study sample, hence it is important to pilot questions thoroughly before finalizing and administering to the entire study sample.

After the pilot study, the researcher proceeded to distribute the questionnaires in person to the employees of the HEI. The personal distribution of questionnaires by the researcher was based on random sampling. The completed questionnaires were also collected from the respondents by the researcher after administering while some of the respondents were kind enough to scan and send the completed questionnaires via emails.

3.5.4.2 Data collection method

This study employed the use of questionnaire, and the use of questionnaires involve direct collection of information by asking people questions and using them for analysis. Information regarding attitudes, activities, and responses to events are often gathered with questionnaires and usually contains list of written questions (Wisker, 2001). Questionnaires are most of the time used in a survey strategy to obtain descriptive and explanatory data regarding attributes, opinions, and behaviours (Saunders *et al.*, 2009).

Questionnaire refers to a collection of questions which typically consists of variety of statements in the form of questions (Babbie, 2014). The questionnaire for this study was basically designed with the aim of gathering facts and views regarding the phenomenon that was investigated: adaptation of BYOD as a Green IT practice in the chosen HEI. The questionnaire for this study was made up of structured questions in all the sections. According to Babbie (2014), sometimes the researcher wants to identify the degree at which respondents stick to a specific attitude or view.

This measuring instrument is appropriate for questions that are sensitive, and properly designed questionnaires has the effect of ensuring the objectivity of the researcher and somewhat helps to get rid of personal preconceived opinion, biases, and enables anonymity (Greenfield, 2002).

Data collected with a questionnaire are usually analysed using a computer (Saunders *et.al.*, 2009), as confirmed by Myers (2009) that statistical tools and packages are utilized by quantitative researchers for data analysis. Fink (2003) affirmed that statistical analysis is necessary for making sense of survey data obtained from groups of individuals, and close-ended questionnaires assist in obtaining standardized data that can be analysed statistically. More so, Myers (2009) stated that different statistical techniques can be employed in the analysis of collected data.

Thus, closed ended questionnaires was used by the researcher for data gathering. Fink (2003) asserted that it is easy to standardize closed questions and in addition, the response anticipated from the respondents are more obviously defined in closed ended questionnaires, hence the responses have a more tendency of being reliable or consistent over time.

3.5.4.3 Justification for using questionnaire

The definition of questionnaire might seem to be a collection of questions, but a close check of the questionnaire used for this study will show that the questionnaire contained different statements as questions. According to Babbie (2007), researchers have various statements as questions in a questionnaire in order to determine the extent to which respondents favor a specific attitude or viewpoint. Thomas and Hodges (2010) stated that “More positivist-oriented studies tend to favor collecting information from people using carefully designed, structured questionnaires”.

Greenfield (2002) explained that questionnaires are the instruments used to bring to the researcher the information that is required for formulating answers to the research questions. Even though survey data can be collected through different methods, the structured

questionnaire tends to be the most widely used method of getting a structure set of survey data. Like in this study, Bernard (2000) made clear that self-administered questionnaires are suitable when the respondents involved are literate and the researcher is confident of getting up to seventy percent response rate.

The anonymity is most ensured using questionnaires, it also enables researchers to achieve a broader coverage, being that a researcher has less difficulty in approaching respondents unlike other methods. The data inflow is fast (Gray, 2013), hence it is faster to get results with the use of questionnaires coupled with the fact that questionnaires are stable, consistent, and with unvarying measure (Sarantakos, 2005).

There is lack of interviewer bias (Gray, 2013) and questionnaires have the benefit of strongly concentrating on people's thought on particular topics or subjects chosen by the researcher (Thomas & Hodges, 2010). Evidence abound that various interviewers obtain variety of answers because of the way they lay emphasis on specific words in questions and due to the supplementary questions that they support it with (Gray, 2013). More so, time and money are consumed less with questionnaires, therefore, unlike interviews, questionnaires can be sent to a huge number of people at a very fair cost (Gray, 2013).

3.5.4.3.1 Types of questionnaires

Questions can be open-ended allowing respondents to provide their desired answers or closed-ended restricting the respondents to just selection of answers from the list of answers provided (Babbie, 2014).

Open-ended questionnaires

Open-ended questionnaire contains questions for which the respondents are required to give their answers (Babbie, 2007). The open-ended questions give the respondents the freedom to express their answers in the way they deem suitable and in their own words (Sarantakos, 2005).

Closed-ended questionnaires

Fixed alternative questions provide a set of answers from which the respondent should make his or her choice from (Sarantakos, 2005). Responses such as yes or no, true or false, and multiple choice responses are some the most common type of responses found in closed-ended questionnaires (Gray, 2013).

The questionnaire for this study contained only close ended questions and the measure employed is a five point Likert scale ranging from strongly agree (1) to strongly disagree (5). Closed-ended questions are predominantly used in survey research because it gives an increased uniformity of responses (Babbie, 2007) and are simpler to analyze unlike the open-ended questions, and also makes it simpler to weigh the opinions of different groups, but it limits the richness of the alternative responses. Closed questions helps in providing structure to the response of participants (Gray, 2013).

3.5.4.3.2 Questionnaire design and layout

The questionnaire developed for this study was divided into seven sections. Section A focused on demographic information of the respondents thus assisting the researcher in ascertaining the independent variables for the study. The questions in sections B to H helped to achieve the research objectives, and also to answer the research questions.

Table 3.1 shows the questionnaire design and layout for this study and it shows the alignment of the questionnaire sections with the research objectives and the selected constructs of TAM used in the conceptual framework of this study.

Table 3.1: Questionnaire design and layout

SECTIONS	OBJECTIVES	TAM CONSTRUCTS
SECTION B	Objective 1	Actual use
SECTION C	Objective 2	- Actual use - Perceived ease of use
SECTION D	Objective 3	Perceived usefulness
SECTION E	Objective 4	Attitude towards the adaptation of BYOD as a Green IT practice.
SECTION F	Objective 4	Attitude towards the adaptation of BYOD as a Green IT practice.
SECTION G	Objective 4	Behavioral Intention towards the adaptation of BYOD as a Green IT practice.
SECTION H	Objective 3	

3.5.5 Data analysis

Typical social research like this study should be geared towards getting answers to the research questions formulated for the study. Data analysis is an important stage of this research process after the needed data have been collected (Blaikie, 2003). The raw state of a quantitative data provides little or no meaning to most individuals, hence it is important to be analysed to make them valuable. To make these data valuable requires analysis and interpretation which the process involves quantitative analysis techniques (Saunders *et al.*, 2009). This stage of the study is very important, as it makes sense to have data organized, analysed, and interpreted in order to reveal things of interest and importance regarding the social world (Neuman, 2011). The tasks involved in quantitative analysis includes data preparation, data entry, presentation of outcomes, data processing and analysis, interpretation of the findings, and conclusions (Sarantakos, 2005).

In processing quantitative data, advanced statistics can be used and most quantitative researchers carry out statistical analysis with the computer (Sarantakos, 2005). For this study, the data gathered were coded with Microsoft excel and analysed with Statistical Package for Social Science (SPSS) in order to interpret the data. Data preparation involves checking, editing, and coding of the collected data before proceeding to data entry in the computer (Sarantakos, 2005). Data coding process involves translating data into form of numbers (Bhattacharjee, 2012). The researcher began coding of questionnaires for this study in Microsoft Excel application, thereafter the coded data was exported from excel to SPSS. Coding is a process which involves the conversion of verbal responses to codes in number forms (Sarantakos, 2005).

Tables can be used in combination with graphs to present outcomes (Greenfield, 2002) as also stated by Sarantakos (2005) that the outcomes of data from statistical analysis can be presented in graphical forms or tables, and next stage would involve the explanation of the outcomes before finally proceeding to the conclusions which encompasses the answers to the research questions (Sarantakos, 2005). Relationships and trends within data can be explored, presented and described by a researcher using graphs, charts and statistics by a researcher (Saunders *et al.*, 2009). It is important to use graphical representations where possible for easy comprehension and to avoid overloading the readers with excess numbers (Greenfield, 2002). For describing data in this study, the descriptive and inferential statistics were employed and effect sizes were also measured. To determine significance level, correlations were calculated to determine the relationship between the research questions and chosen variables.

3.5.5.1 Data analysis methods

Based on the approach of this study, the suitable data analysis methods were chosen and discussed in the following section:

a) Descriptive and inferential statistics

The analysis of the obtained numeric data in a study can be done quantitatively through descriptive and inferential statistics (Bhattacharjee, 2012). Statistical processing comprises of techniques that assists in comprehensive analysis of the data collected. Descriptive analysis which is also known as descriptive statistics is among the techniques that helps in providing overall descriptions of data (Sarantakos, 2005). They are key and suitable for revealing patterns among collected data, and hence meaning of the data. It is also important to understand that descriptive statistics can only be employed to make description of the population or set of data that is under investigation (Crossman, 2016).

Tests of significance is important in a study to help ascertain if the relationships discovered in the sample are likely to be present in a population (Blaikie, 2003). This makes inferential statistics important as it concentrates mainly on relationships between variables, and they are used to make conclusions regarding relationships between variables (Bhattacharjee, 2012). When conducting a study, the use of inferential statistics helps to carry out test of significance to identify the generalizability of the findings to a larger population. Conducting tests of significance can be done using the T-test (Crossman, 2016) and other related tests. Inferential statistics is suitable when the sample is taken based on random sampling (Blaikie, 2003) just like in this study. Additionally, significance testing allows for identification of the criteria of the target population and the level of generalizations the study can allow (Sarantakos, 2005).

b) Variables

A variable can be defined as measurable or observable characteristic or attribute of a person or an organization, which differs among people or organization that is being investigated (Thompson, 2006). The dependent variable for this study was the adaptation of BYOD as a green IT practice, while the independent variables were gender, campus, post description, and job experience in the institution. According to Creswell (2014), the dependent variables rely on independent variables, while the independent variables are that most likely influence, cause, or have impact on results.

3.6 CHAPTER SUMMARY

This chapter concentrated on the research methodology and the design that the researcher adhered to in order to successfully execute this study. The philosophical orientations, research paradigms and research approach were also discussed including how they relate to this study. The research questions developed for this study were also aligned with the objectives of the study and the TAM constructs contained the conceptual framework of this study. The next chapter discusses the data analysis and outcomes of the study comprehensively.

CHAPTER 4

DATA ANALYSIS

4.1 INTRODUCTION

The previous chapter centred on the research methodology and design for this study, which served as the basis for data collection. Data was collected using questionnaires investigating the adaptation of BYOD as a Green IT practice at the North-West University and the outcomes of the analysis are discussed in this chapter. The questionnaires helped the researcher to collect adequate and useful data which are aimed at getting the answers to the research questions and accomplishing the objectives of the study. The Statistical Package for the Social Sciences (SPSS 23) was used to carry out this analysis successfully. The analysis was based on the data collected, the collected was coded with Microsoft Excel, while the interpretation and discussion were done based on the outcomes of the analysis.

4.2 RESPONSE RATES

The questionnaires were distributed to employees of North-West University (NWU) who make use of computers or mobile devices for their work. Employees who do not use computers or mobile devices for work were not given questionnaires. The number of questionnaires distributed among the employees of the NWU was 366 and the number of questionnaires returned was 302. Serame (2011) points out that valid outcomes and conclusions can be reached when there is a high return rate. The number of questionnaires returned demonstrates that 82.5 percent response rate was attained. 70 or 80 percent response rate is statistically valid for dependable conclusions (Sivo, Saunders, Chang & Jiang, 2006).

4.3 DESCRIPTIVE STATISTICS AND FREQUENCIES ON THE RESEARCH QUESTIONS

The quantitative data analysis of the questions for section A, B, C, D, E, F, G, and H of the questionnaire are done in this section and are presented in the form of descriptive frequencies. The aim of this section is to make known the different views and responses obtained from the respondents through questionnaires and these are presented in percentages in the next section.

4.3.1 Presentation and interpretation of findings

4.3.1.1 SECTION A: Demographic information

The demographic data for the study sample defines the gender, campus which includes the institution, post description of the employee, and number of years in the institution. The

information collected assisted the researcher in making sense of the profile of the respondents and to place the respondents on the appropriate category to aid analysis.

Table 4.1: Demographic information of respondents

Variable	Frequency	Percentage
1. Gender		
Male	180	59.6
Female	122	40.4
TOTAL	302	100
2. Campus		
Mafikeng	114	37.7
Potchefstroom	80	26.5
Vaal	71	23.5
Institutional office	37	12.3
TOTAL	302	100
3. Post description		
Academic	190	62.9
Non-academic	112	37.1
TOTAL	302	100
4. Post description		
Less than 5 years	138	45.7
6-10 years	84	27.8
11-15 years	38	12.6
16-20 years	26	8.6
Above 20 years	16	5.3
TOTAL	302	100

The demographic data of the respondents in Table 4.1, are discussed below:

Table 4.1 reveals that most the respondents were male employees. The percentage of the male respondents is 59.6 percent while the percentage of the female respondents is 40.4 percent. The

highest percentage of respondents per campuses is 37.7 percent which is from the Mafikeng campus, followed by the Potchefstroom campus with a percentage of 26.5 percent. 23.5 percent and 12.3 percent of respondents were from the Vaal campus and the institutional office respectively.

Academic employees made up 62.9 percent of the respondents while 37.1 percent of the respondents were non-academic employees. This was important in determining how many questionnaires were received from the academic and non-academic employees and to determine if there would be a difference in their perceptions.

Most the respondents had been working less than 5 years (45.7 percent) in the institution and the least is 5.3 percent which represents the number of respondents who have worked above 20 years. 8.6 percent of the respondents have worked between 6 to 10 years, and 12.6 percent of respondents have worked between 11 to 15 years. An academic environment could have influence on individuals' perception on certain things and this was important to assist in determining if there would be a significant difference in opinions based on the number of years the employees have worked in the institution.

4.3.1.2 SECTION B: Knowledge of BYOD with regards to Green IT

Key: SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree, SD = Strongly Disagree in Table 4.2

Table 4.2: Knowledge of BYOD with regards Green IT

Question No.	Question	SA(%)	A(%)	N(%)	D(%)	SD(%)
5	Before now I have been aware that the acronym GREEN IT means “GREEN INFORMATION TECHNOLOGY”. (N = 302)	38.1	24.2	4.6	17.2	15.9
6	You know that GREEN IT concept involves efficient use of computers and its related devices. (N = 302)	36.1	36.1	8.9	10.9	7.9
7	You know that adhering to Green IT practices would help save the planet. (N = 302)	37.4	36.1	12.9	7.6	6.0
8	You know that substantial monetary savings would be realized through adhering to Green IT practices. (N = 302)	33.1	39.4	15.9	5.6	6.0
9	Before now, I have been aware that the acronym BYOD means “BRING YOUR OWN DEVICE”. (N = 302)	18.9	10.9	9.3	29.1	31.8
10	You know that BYOD concept involves allowing employees of an organization to make use of their personal devices for work and personal purposes. (N = 302)	18.2	14.6	13.2	17.5	36.4
11	You are aware of the meaning of BYOD, Energy conservation and Green Information Technology (Green IT). (N = 302)	28.5	37.1	11.6	13.9	8.9
12	You know that energy consumption has impacts on the environment. (N = 302)	39.4	41.1	7.3	4.6	7.6
13	You know that substantial energy savings can be achieved through the use of one device for both work and personal purposes instead of having different devices. (N = 302)	29.5	32.1	15.9	8.6	13.9
14	You know that BYOD eliminates duplication of devices, which when transferred to the entire work-force in an organization would yield a significant amount of monetary saving and also reduce the environmental impacts of energy consumption. (N = 302)	22.8	13.2	9.9	5.6	48.3

The questions in the Table 4.2) represent the knowledge of BYOD with regards to Green IT. This section was aimed at checking the knowledge of the respondents regarding BYOD with regards to Green IT. The responses had five scales: strongly agree (SA), agree (A), neutral (N), disagree (D), and strongly disagree (SD). The abbreviations of the scales in Table 4.2 which show the frequencies and average response of respondents (employees) in percentage on their knowledge of BYOD with regards to Green IT.

- ✓ In question (no 5), 38.1 percent of the respondents selected SA, 24.2 percent selected A, 4.6 percent selected N, 17.2 percent selected D, and 15.9 percent selected SD.

- ✓ In question (no 6), 36.1 percent of the respondents selected SA, 36.1 percent selected A, 8.9 percent selected N, 10.9 percent selected D, and 7.9 percent selected SD.
- ✓ In question (no 7), 37.4 percent of the respondents selected SA, 36.1 percent selected A, 12.9 percent selected N, 7.6 percent selected D, and 6.0 percent selected SD.
- ✓ In question (no 8), 33.1 percent of the respondents selected SA, 39.4 percent selected A, 15.9 percent selected N, 5.6 percent selected D, and 6.0 percent selected SD.
- ✓ In question (no 9), 18.9 percent of the respondents selected SA, 10.9 percent selected A, 9.3 percent selected N, 29.1 percent selected D, and 31.8 percent selected SD.
- ✓ Question (no 10) shows that 18.2 percent of the respondents selected SA, 14.6 percent selected A, 13.2 percent selected N, 17.5 percent selected D, and 36.4 percent selected SD.
- ✓ In question (no 11), 28.5 percent of the respondents selected SA, 37.1 percent selected A, 11.6 percent selected N, 13.9 percent selected D, and 8.9 percent selected SD.
- ✓ In question (no 12), 39.4 percent of the respondents selected SA, 41.1 percent selected A, 7.3 percent selected N, 4.6 percent selected D, and 7.6 percent selected SD.
- ✓ In question (no 13), 29.5 percent of the respondents selected SA, 32.1 percent selected A, 15.9 percent selected N, 8.6 percent selected D, and 13.9 percent selected SD.
- ✓ In question (no 14), 22.8 percent of the respondents selected SA, 13.2 percent selected A, 9.9 percent selected N, 5.6 percent selected D, and 48.3 percent selected SD.

Discussion of research findings in section B

From the analysis of the section B, it was revealed that before partaking in the study, they have been aware of the meaning of the acronym “Green IT”, but they have not been aware of the meaning of the acronym “BYOD”. This shows how important it is that the employees are taught or made to be aware of BYOD especially with regards to Green IT practice. This further revealed that the responses to the questions in “section B” were based on the little knowledge of BYOD gotten through the introduction provided in the first page of the questionnaire.

Despite the increasing awareness in Green IT, a lot of people are still not familiar with terms relating to Green IT, including experts and ordinary users in this field (Murugesan, 2010). Contrary to this assumption, this study suggests that most of the respondents indicated that before receiving the questionnaire that they have been aware of the full meaning of the acronym “GREEN IT”. 38.1 percent of the respondents selected SA, while 24.2 percent selected A in question 5, but analysis of the BYOD acronym (see question No 9 in Table 4.2) shows that majority of the respondents were not aware of the full meaning of the acronym “BYOD”. 29.1

percent and 31.8 percent of the respondents selected D and SD respectively. Responses to question 14 suggests that the respondents are not aware that “BYOD eliminates duplication of devices, which when transferred to the entire work-force in an organization would yield a significant amount of monetary saving and reduce the environmental impacts of energy consumption” (see Table 4.2). This outcome stresses the importance of awareness in this aspect because according to (Davis et al., 2009), for BYOD to thrive in the aspect of energy saving, it is important to step up the awareness on BYOD as a way of adhering Green IT and similar survey results disclosed that promotional and educational resources should be focused on raising the knowledge with regards to Green IT practices.

Responses to question no 6,7,8,11,12, and 13 (in Table 4.2) purports that despite the lack of knowledge of the respondents regarding the full meaning of BYOD and green IT, the respondents are aware of some of the benefits of Green IT practices. Most of the respondents reported that they are aware that substantial monetary savings can be saved from Green IT practices. This is also evident in their response to question 8 in Table 4.2, where 33.1 percent selected SA and 39.4 percent selected A.

4.3.1.3 SECTION C: The necessity of using personally-owned devices and institution-issued devices

Key: SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree, SD = Strongly Disagree

Table 4.3: The necessity of using personally-owned devices and institution-issued devices

Question No.	Question	SA(%)	A(%)	N(%)	D(%)	SD(%)
15	Most employees in my institution own a personal mobile device. (N = 302)	64.2	26.2	3.3	4.6	1.7
16	I always use a mobile device for work purposes after work hours. (N = 302)	37.4	23.2	6.0	25.5	7.9
17	I have more than two laptops in my office. (N = 299)	36.1	20.9	3.0	19.9	19.2
18	In addition to the laptop(s), I also have a desktop computer in my office. (N = 302)	42.4	20.2	2.6	17.2	17.5
19	At least one of the mobile devices in my possession was issued by my institution. (N = 298)	44.4	25.8	3.3	11.3	13.9
20	It is important that am allowed to always connect to the network of my institution with my personal mobile device. (N = 302)	51.7	22.8	7.9	14.2	3.3
21	I believe that it is important to allow the use of only institution-issued mobile devices for work purposes at the workplace. (N = 302)	21.2	15.6	7.0	7.6	48.7
22	I am allowed to use my personal mobile devices for work purposes at the workplace and this is very important to me. (N = 300)	43.4	27.2	12.3	9.6	7.6
23	I would actually prefer to use my personal device for work to using the devices issued by my institution. (N = 300)	33.1	18.5	15.6	17.9	14.2
24	I think that I can do without the devices issued by my institution. (N =300)	30.8	21.2	9.6	14.2	23.5

The questions in the Table 4.3 represents the evaluation of the necessity of using personally-owned devices and institution-issued devices. The responses had five scales: strongly agree

(SA), agree (A), neutral (N), disagree (D), and strongly disagree (SD). Table 4.3 shows the frequencies and average response of respondents (employees) in percentage on the necessity of using personally-owned devices and institution-issued devices.

- ✓ In question (no 15), 64.2 percent of the respondents selected SA, 26.2 percent selected A, 3.3 percent selected N, 4.6 percent selected D, and 1.7 percent selected SD.
- ✓ In question (no 16), 37.4 percent of the respondents selected SA, 23.2 percent selected A, 6.0 percent selected N, 25.5 percent selected D, and 7.9 percent selected SD.
- ✓ In question (no 17), 36.1 percent of the respondents selected SA, 20.9 percent selected A, 3.0 percent selected N, 19.9 percent selected D, and 19.2 percent selected SD.
- ✓ In question (no 18), 42.4 of the respondents selected SA, 20.2 percent selected A, 2.6 percent selected N, 17.2 percent selected D, and 17.5 percent selected SD.
- ✓ In question (no 19), 44.4 percent of the respondents selected SA, 25.8 percent selected A, 3.3 percent selected N, 11.3 percent selected D, and 13.9 percent selected SD.
- ✓ Question (no 20) shows that 51.7 percent of the respondents selected SA, 22.8 percent selected A, 7.9 percent selected N, 14.2 percent selected D, and 3.3 percent selected SD.
- ✓ In question (no 21), 21.2 percent of the respondents selected SA, 15.6 percent selected A, 7.0 percent selected N, 7.6 percent selected D, and 48.7 percent selected SD.
- ✓ In question (no 22), 43.4 percent of the respondents selected SA, 27.2 percent selected A, 12.3 percent selected N, 9.6 percent selected D, and 7.6 percent selected SD.
- ✓ In question (no 23), 33.1 percent of the respondents selected SA, 18.5 percent selected A, 15.6 percent percent selected N, 17.9 percent selected D, and 14.2 percent selected SD.
- ✓ In question (no 24), 30.8 percent of the respondents selected SA, 21.2 percent selected A, 9.6 percent selected N, 14.2 percent selected D, and 23.5 percent selected SD.

Discussion of research findings in section C

The findings revealed that most of the respondents are aware that most of the employees own personal mobile devices and most of the respondents indicated that they do work with their mobile devices after normal office hours. This shows that most of the employees of this institution are tech savvy or depend on the use of computer for the completion of most of their tasks beyond the walls of the institution, hence there is need for them to own a mobile device. 64.2 percent and 26.2 percent of respondents selected SA and A respectively in question (no 15 in Table 4.3). This means that most of the respondents are of the belief that most of their

colleagues own a mobile device, and this is evident in question (no 16 in Table 4.3) where 37.4 percent and 23.2 percent selected SA and A respectively. This can be further explained to mean that most of the respondents are in possession of a mobile device which is either their personally-owned device or issued by the institution. 44.4 percent and 25.8 percent of the respondents selected SA and A respectively in question (no 19 in Table 4.3) which implies that most of the employees are in possession of mobile devices issued by the institution in addition to their personal mobile devices. This corresponds with the research findings of Cisco (Noik, 2014) which suggests that a lot of employees in South Africa come to the work place with at least one of their personal devices.

Duplication of devices is reduced where BYOD is implemented, and this may entail that users should make use of their personal devices or technology for both work and personal purposes (Ferris, 2012). Thus, it is evident that duplication of devices was revealed in the analysis in this section as 36 percent and 20 percent of the respondents selected SA and A respectively in question 17 (Table 4.3). Here the response from respondents indicated that most of them make use of more than two devices concurrently. This should be one of the reasons to consider the implementation of BYOD as a Green IT practice in the institution and more so the analysis revealed that most of the respondents have desktop computers in their offices in addition to the laptop(s) in their possession (see question 18 in table 4.3).

There is also evidence that there is high dependency on the use of ICT by the employees in the institution. 37.4 percent and 23.3 percent of the respondents selected SA and A in question (no 16 in Table 4.3). This is an evidence that most of the respondents rely so much on mobile device since they work beyond work hours which can take place beyond the walls of the institution. The respondents also indicated that it is of value to them to make use of their personally-owned devices for work, as question (no 23 in Table 4.3) shows that 33.1 percent and 18.5 percent of the respondents selected SA and A respectively. In addition, most the respondents are of the belief that they can do without the devices issued by the institution. This is evident in question (no 24 in Table 4.3) where 30.8 percent and 21.2 percent of the respondents selected SA and A respectively. In question (no 21 in Table 4.3), most of the respondents did not favour the use of only institution-issued devices for work purposes.

4.3.1.4 SECTION D: Perceived behavioural control

Key: SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree, SD = Strongly Disagree

Table 4.4: Perceived behavioral control

Question No.	Question	SA(%)	A(%)	N(%)	D(%)	SD(%)
25	The use of mobile device increases my productivity and flexibility. (N = 302)	47.4	37.1	8.3	2.6	4.6
26	The use of my personal mobile device increases my effectiveness. (N = 302)	45.0	31.5	13.9	8.9	0.7
27	The use of mobile device is much better than using a desktop computer. (N = 302)	37.1	32.5	14.2	12.3	4.0
28	I am more comfortable working with my mobile device. (N = 302)	36.8	33.1	11.6	16.2	2.3
29	When using my mobile device at work, I can easily connect to the network of my organization to gain access to the internet and other necessary resources. (N = 301)	41.4	39.7	9.9	5.6	3.0
30	I can easily get support from IT department when using my personal device at work. (N = 302)	35.8	33.4	14.6	10.6	5.6
31	My personal device is compatible with the network of my organization, and has compatible applications and software to complete my daily work and personal tasks. (N = 301)	38.4	34.1	12.3	10.9	4.0

The responses the questions in Table 4.4 had five scales: strongly agree (SA), agree (A), neutral (N), disagree (D), and strongly disagree (SD). Table 4.4 shows the frequencies and average response of respondents (employees) in percentage on their perceived behavioural control.

- ✓ In question (no 25), 47.74 percent of the respondents selected SA, 37.1 percent selected A, 8.3 percent selected N, 2.6 percent selected D, and 4.6 percent selected SD.
- ✓ In question (no 26), 45.0 percent of the respondents selected SA, 31.5 percent selected A, 13.9 percent selected N, 8.9 percent selected D, and 0.7 percent selected SD.
- ✓ In question (no 27), 37.1 percent of the respondents selected SA, 32.5 percent selected A, 14.2 percent selected N, 12.3 percent selected D, and 4.0 selected SD.
- ✓ In question (no 28), 36.8 percent of the respondents selected SA, 36.8 percent selected A, 11.6 percent selected N, 16.2 percent selected D, and 2.3 percent selected SD.
- ✓ In question (no 29), 41.11 percent of the respondents selected SA, 38.73 percent selected A, 10.61percent selected N, 6.9 percent selected D, and 2.65 percent selected SD.
- ✓ Question (no 30) shows that 35.8 percent of the respondents selected SA, 33.4 percent selected A, 14.6 percent selected N, 10.6 percent selected D, and 5.6 percent selected SD.
- ✓ In question (no 31), 38.4 percent of the respondents selected SA, 34.1 percent selected A, 12.3 percent selected N, 10.9 percent selected D, and 4.0 percent selected SD.

Discussion of research findings in section D

IT leaders pointed out in an Educause survey that rising faculty and employee satisfaction and productivity as the two most influential factors leading to granting access to employees to make use of their own technologies (Dahlstrom & Difilipo, 2013). This makes sense as most of the respondents in this study are of the belief that the use of mobile device improves their productivity and makes them more flexible. Question (no 25 in Table 4.4) revealed that 47.4 percent and 37.1 percent of respondents selected SA and A respectively, and question further revealed that the use of mobile device increases their effectiveness (see question no 26 in Table 4.4). This is true according to Loucks, Medcalf, Buckalew and Faria (2013), who stated that employees are ready to procure personal devices which adds value to their work and output as well as innovativeness in their office duties.

The analysis also showed that respondents are more comfortable working with mobile devices (see question no 28 in Table 4.4) and prefers using mobile devices to desktop computers (see

question no 27 in Table 4.4). While some employees still favor the use of organization-issued devices and on the other hand, the readiness of employees to assist in the procurement of their devices does not certainly imply that organizations must allow employees to bring their own mobile devices to work (Loucks, Medcalf, Buckalew & Faria (2013), but there is evidence from the analysis that there is an element of BYOD in the institution which was confirmed in question 29 (see Table 4.4) where most of the respondents indicated that they can easily connect to the network of the institution in order to have access to the internet and other necessary resources. In addition to this, most of the respondents reported that they get support from IT department easily when using their mobile devices in the institution (see question 30 in Table 4.4). This could be because most of their personal devices are compatible with the network of the institution and contains compatible applications and software which assist them in carrying out their daily work and personal tasks (see question 31 in Table 4.4).

4.3.1.5 SECTION E: Environmental Concern

Key: SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree, SD = Strongly Disagree

Table 4.5: Environmental concern

Question No.	Question	SA(%)	A(%)	N(%)	D(%)	SD(%)
32	I think environmental problems as a result of energy consumption of computers and mobile devices should not be ignored. (N = 302)	47.4	40.7	6.0	3.6	2.3
33	I think we should care about environmental problems caused by energy consumption of the multiple devices we own and use at the same time. (N = 302)	49.0	44.7	5.3	1.0	0
34	I think we should be concerned about environmental problems caused by duplication of devices and energy consumption. (N = 302)	45.0	44.7	9.3	1.0	0

This section contains questions regarding environmental concern. The responses to the questions in Table 4.5 had five scales: strongly agree (SA), agree (A), neutral (N), disagree

(D), and strongly disagree (SD). The abbreviations of the scales were used in Table 4.5 shows the frequencies and average response of respondents (employees) in percentage on environmental concern.

- ✓ The result of the analysis shows that none of the respondents selected SD in question 33 and question 34.
- ✓ Question 32 suggests that 47.4 percent selected SA, 40.7 percent selected A, 6.0 percent selected N, 3.6 percent selected D, and 2.3 percent selected SD.
- ✓ In question 33, 49.0 percent of the respondents selected SA, 44.7 percent selected A, 5.3 percent selected N, and 1.0 percent selected D.
- ✓ In question 34, 45.0 percent of the respondents selected SA, 44.7 percent selected A, 9.3 percent selected N, and 1.0 percent selected D.

Discussion of research findings in section E

For BYOD to thrive in the aspect of energy saving, it is important to increase awareness on BYOD as a way of supporting Green IT. Survey results reveal that promotional and educational resources should be focused on raising the knowledge regarding sustainable practices (Davis et al., 2009). For this study, majority of the respondents support that environmental issues because of energy consumption of computers and mobile devices should not be ignored. This is shown in their response to question 32 in Table 4.5 where 47.4 percent and 40.7 percent of respondents selected SA and A respectively. The outcome of the analysis also suggests a positive perception regarding environmental issues and can be seen in Table 4.5 where the analysis of question 33 revealed that 49.0 percent and 44.7 percent of respondents selected SA and A respectively. There was also more positive response to a related question in Table 4.5, which most of the respondents indicated that it is important to be concerned about environmental issues. The outcome put forward that employees should be concerned about environmental problems that can result from duplication of devices and energy consumption. 45.0 percent and 44.7 percent of the respondents selected SA and A respectively to this particular question (see question 34 in Table 4.5). This clearly means that there is a high possibility of considering any initiative that would help save the environment.

4.3.1.6 SECTION F: Attitude towards the adaptation of BYOD as a Green IT Practice

Key: SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree, SD = Strongly Disagree

Table 4.6: Attitude towards adaptation

Question No.	Question	SA(%)	A(%)	N(%)	D(%)	SD(%)
35	For me, adopting BYOD as a green IT solution is satisfactory. (N = 302)	32.19	38.79	21.9	5.54	1.58
36	For me, using my own device for work and personal purposes as a means of eliminating duplication of devices and reducing energy consumption is appropriate. (N = 302)	35.1	41.4	15.9	6.6	1.0
37	For me, adopting a green information technology solution that will improve my productivity and flexibility is very remarkable and will suit my lifestyle. (N = 302)	37.1	48.7	12.6	0.7	1.0
38	For me, adopting BYOD as a green IT solution is appropriate. (N = 301)	37.1	38.7	17.5	4.0	2.3
39	I will be more motivated to purchase or use my own device if I get monetary support from my institution. (N = 301)	50.3	38.4	8.9	1.3	0.7

This section contains questions regarding the respondents' (employees) attitude towards the adaptation of BYOD as a green IT solution or practice. The responses to the questions in Table 4.6 had five scales: strongly agree (SA), agree (A), neutral (N), disagree (D), and strongly disagree (SD). The abbreviations of the scales were used in Table 4.6 and which shows the frequencies and average response of respondents (employees) in percentage on their attitude towards the adaptation of BYOD as a green IT solution or practice.

- ✓ Question 35 seeks to find out if the adaptation of BYOD as a green IT solution would be satisfactory to the respondents, and majority of the respondents (38.79 percent) selected A, 32.19 percent selected SA, 21.9 percent selected N, 5.54 percent selected D, and 1.58 percent selected SD.
- ✓ In question (no 36), 35.1 percent of the respondents selected SA, 41.4 percent selected A, 15.9 percent selected N, 6.6 percent selected D, and 1.0 percent selected SD.
- ✓ In question (no 37), 37.1 percent of the respondents selected SA, 48.7 percent selected A, 12.6 percent selected N, 0.7 percent selected D, and 1.0 percent selected SD.
- ✓ In question (no 38), 37.1 percent of the respondents selected SA, 38.7 percent selected A, 17.5 percent selected N, 4.0 percent selected D, and 2.3 percent selected SD.
- ✓ Lastly in question (no 39), 50.3 percent of the respondents selected SA, 38.4 percent selected A, 8.9 percent selected N, 1.3 percent selected D, and 0.7 percent selected SD.
- ✓ Most of the respondents acknowledged through the outcome of the analysis in table 4.6 that adopting BYOD as a green IT solution is satisfactory. The findings purports that 32.19 percent and 38.79 percent of respondents selected SA and A respectively in question 35, and additionally the analysis also revealed that the respondents support the use of their own devices for work and personal purposes in order to reduce duplication of devices and to save energy (see question no 36 in Table 4.6).

Discussion of research findings in section F

The perfect employee according to Dawson (2012), is an employee who is innovative, resourceful, focused and with the ability to accomplish tasks successfully from any location. This can be regarded as one of the ideas leading to the move towards BYOD (Dawson, 2012) and technology advancement has also amplified the demand to integrate personal computing devices into the workplace (Lee, Crossler & Warkentin, 2013). The analysis of question 38 (see table 4.6) revealed that respondents deem appropriate the adaptation of BYOD as a green IT practice. Du Buisson and Naidoo (2014) stated that the increasing dependency on ICT and its energy consumption has become an issue and it is thought that employees would certainly adhere to various Green IT practices. The outcome of the analysis in this section suggests that the respondents would consider the adaptation of any green IT practice that would improve their productivity, and flexibility (see question 37 in Table 4.6). According to Baroudi (2011), allowing employees to bring together their work and personal lives one personal device of their choice will positively influence their productivity. The analysis also revealed that the respondents would also be more motivated to purchase or stick to the use of their own devices

if they get financial support from the institution. This was revealed in their response to question (no 39 in Table 4.6) where 50.3 percent and 38.4 percent of the respondents selected SA and A respectively.

4.3.1.7 SECTION G: Intention towards the Adaptation of BYOD as a Green IT practice

Key: SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree, SD = Strongly Disagree

Table 4.7: Intention towards the Adaptation of BYOD as a Green IT practice

Question No.	Question	SA(%)	A(%)	N(%)	D(%)	SD(%)
40	I am likely to recommend the adaptation of BYOD as a green IT solution to my colleagues when necessary. (N = 302)	37.1	39.4	17.5	4.0	2.0
41	I intend to adopt BYOD as a green IT solution if implemented in my institution. (N = 302)	30.1	50.3	12.9	5.3	1.3
42	I intend to support BYOD adoption as a green IT solution in every way possible. (N = 302)	29.1	47.4	18.2	5.0	0.3
43	I will definitely adopt BYOD as a green IT solution. (N = 296)	30.5	41.4	20.9	4.6	0.7

This section covers questions regarding the respondents' (employees) intention towards the Adaptation of BYOD as a green IT solution or practice. The responses to the questions in Table 4.7 had five scales: strongly agree (SA), agree (A), neutral (N), disagree (D), and strongly disagree (SD). The abbreviations of the scales were used in Table 4.7 shows the frequencies and average response of respondents (employees) in percentage on their intention towards the adaptation of BYOD as a green IT solution or practice.

- ✓ Question 40, shows that 37.1 percent of the respondents selected SA, 39.4 percent selected A, 17.5 percent selected N, 4.0 percent selected D, and 2.0 percent selected SD.
- ✓ In question 41, 30.1 percent of the respondents selected SA, 50.3 percent selected A, 12.9 percent selected N, 5.3 percent selected D, and 1.3 percent selected SD.

- ✓ In question 42, 29.1 percent of the respondents selected SA, 47.4 percent selected A, 18.2 percent selected N, 5.0 percent selected D, and 0.3 percent % selected SD.
- ✓ In question 43, 30.5 percent of the respondents selected SA, 41.4 percent selected A, 20.9 percent selected N, 4.6 percent selected D, and 0.7 percent selected SD.

Discussion of research findings in section G

The intention of the respondents towards the adaptation of BYOD is positive. This is revealed in Table 4.7 where majority of the respondents selected both “Strongly Agree” and “Agree” to the listed questions. The analysis of question 40 in Table 4.7 shows that 37.1 percent and 39.4 percent of the respondents selected SA and A respectively, and this indicates that majority of the respondents are likely to recommend the adaptation of BYOD as a green IT practice to their colleagues. In addition, Table 4.7 discloses that the respondents intend to support and adopt BYOD as a green IT practice (see question no 41, 42, and 43 in table 4.7).

4.3.1.8 SECTION H: Organisational support

Key: SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree, SD = Strongly Disagree

Table 4.8: Organizational support

Question No.	Question	SA(%)	A(%)	N(%)	D(%)	SD(%)
44	Guidance from my institution regarding the adaptation of BYOD as a green IT solution will encourage me. (N = 302)	47.0	40.7	9.9	2.3	0
45	I am very pleased that my institution allows the use of any personal mobile device on its network. (N = 302)	44.4	39.1	12.6	2.0	2.0
46	I will be more motivated to purchase or use only my personal device for work if I get monetary support from my institution. (N = 302)	39.1	38.4	11.9	7.6	3.0
47	I am very sure that my institution is comfortable with the use of any mobile device at the workplace. (N = 301)	41.1	38.7	12.9	6.3	0.7

This section covers questions regarding the respondents' view on organizational support. Organizational stands as a facilitating condition for the adaptation of BYOD as a Green IT practice. The responses to the questions in Table 4.8 had five scales: strongly agree (SA), agree (A), neutral (N), disagree (D), and strongly disagree (SD). The abbreviations of the scales were used in Table 4.8 which shows the frequencies and average response of respondents (employees) on organizational support.

- ✓ Question 44, shows that 47.0 percent of the respondents selected SA, 40.7 percent selected A, 9.9 percent selected N, 2.3 percent selected D, and none of the respondents selected SD.
- ✓ In question 45, 44.4 percent of the respondents selected SA, 39.1 percent selected A, 12.6 percent selected N, 2.0 percent selected D, and 2.0 percent selected SD.
- ✓ In question 46, 39.1 percent of the respondents selected SA, 38.4 percent selected A, 11.9 percent selected N, 7.6 percent selected D, and 3.0% selected SD.
- ✓ In question 47, 41.1 percent of the respondents selected SA, 38.7 percent selected A, 12.9 percent selected N, 6.3 percent selected D, and 0.7 percent selected SD.

Discussion of research findings in section G

A survey for educational institutes in US and UK revealed that students and employees are allowed access to the network by 85 percent of the institutes surveyed. The survey also revealed that personal devices are utilized for educational and personal purposes almost at the same rate (Afreen, 2014). The analysis of this study in Table 4.8 further proved that there is an element of BYOD in the institution, which the respondents seem to be comfortable with. This is shown in question (no 45 in Table 4.8) where 45.89 percent of the respondents selected SA and 37.93% of the respondents selected A (see Table 4.8). This is also in line with the findings of Cisco (Noik, 2014) which revealed that 63 percent of employees in South Africa are given the liberty to have access to the network at the work place.

Jiang and Klein (2000) explained that the degree at which an organization encourages its employees to adopt a specific technology or system will also affect technical innovation. This is evident in the outcome of this study where question (no 47) revealed that the institution is comfortable with the use of mobile devices in the institution. A similar survey as stated in the literature review suggests that most of IT leaders specified that their institutions have supportive environments for faculty and employees personally-owned technologies (Dahlstrom & Difilipo, 2013). This outcome is also in line with the outcome of a study by Lee et al (2005)

which revealed that organizational support has an important role to play in adoption. The analysis of this section also shows that guidance from the institution regarding the adaptation of BYOD as a green IT practice would be necessary. This is evident in question (no 44 in Table 4.8) where 46.68 percent and 41.38 percent of the respondents selected SA and A respectively.

4.3.2 TESTING FOR SIGNIFICANT CORRELATIONS BETWEEN VARIABLES

For this study, correlation assisted in determining if there is significant correlation or relationship between any two chosen variables.

4.3.2.1 Test for significance between job experience (question 4) and the general views of respondents

The spearman's rho test was used for the test of significance between job experience in Table 4.1 and views of respondents regarding the adaptation of BYOD as a Green IT practice. Emphasis is placed more on the outcomes with strong correlations.

This test is concerned with the relationship between two ranked variables (X and Y). The relationship is statistically significant if the p-value is less than 0.05 level of significance.

The coefficient of Spearman's rank correlation is given by

$$r = 1 - \frac{6 \sum D^2}{N(N^2 - 1)}$$

Where

D = differences of ranks of corresponding values of X and Y

N = number of paired values in the data

$$-1 \leq r \leq 1$$

Table 4.9: Spearman’s rank correlation between job experience (question 4) and views of respondents on the adaptation of BYOD as a Green IT practice

Views		
You know that adhering to Green IT practices would help save the planet (question 7). N = 302	Correlation coefficient (r)	-0.157
	p – value	0.006
You know that BYOD eliminates duplication of devices, which when transferred to the entire work-force in an organization would yield a significant amount of monetary saving and also reduce the environmental impacts of energy consumption (question 14). N = 302	Correlation coefficient (r)	0.117
	p – value	0.041

SPSS 23 was used to perform the correlation analysis and the results are shown in Table 4.9. Since all the p-values are less than 0.05 level of significance, then the correlation between the job experience and views of respondents about the questions listed in Table 4.9 is significant. Positive correlation coefficients imply that more experienced respondents tend to disagree with the listed questions, whereas less experienced respondents tend to agree. Negative correlation coefficients imply that more experienced respondents tend to agree with the listed questions, whereas less experienced respondents tend to disagree. See Figure 4.1 below.

Figure 4.1 (a): Views of respondents versus job experience ($r < 0$)

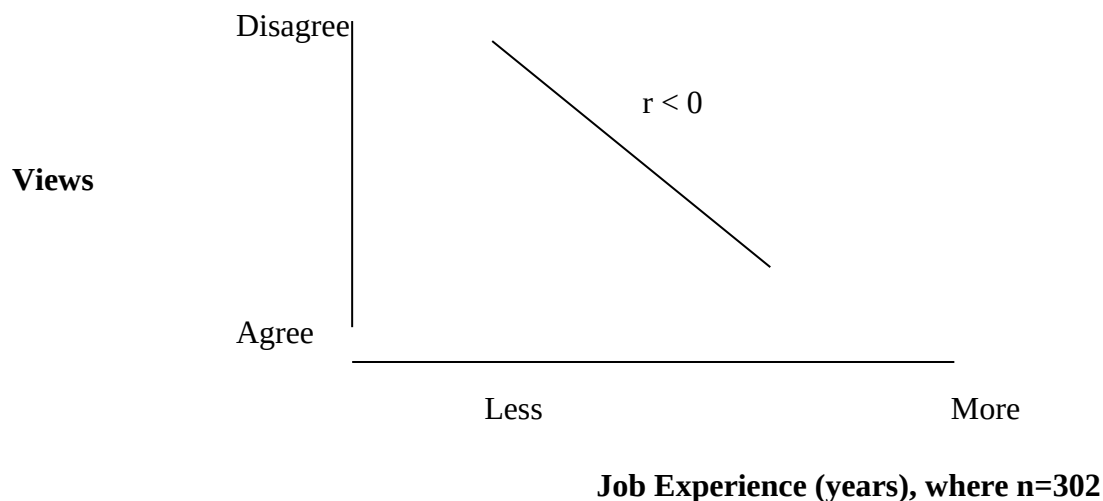
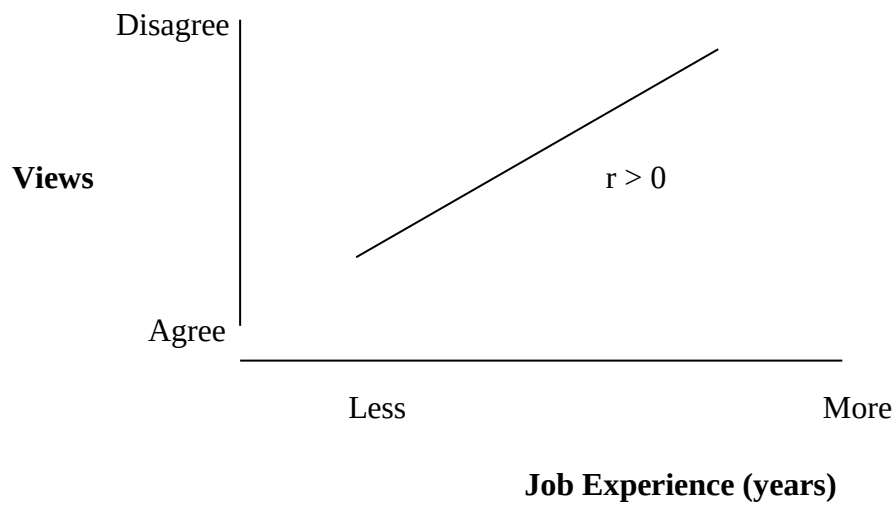


Figure 4.2 (b): Views of respondents versus job experience ($r > 0$)



4.3.2.2 Using T – Test between two Independent Samples

The purpose of the t-test is to compare the average responses of two populations. Samples are selected randomly from these populations and the variances of the populations' responses are assumed to be equal. The populations' responses are also assumed to be normally distributed. The difference of opinions (views) between the two populations is statistically significant if the p-value is less than 0.05 level of significance.

Table 4.10: Comparison between academic and non-academic respondents concerning the adaptation of BYOD as a Green IT practice

Ques tion No.	Views	Post Description	Sample Size	Mean	p- value
5	Before now I have been aware that the acronym GREEN IT means “GREEN INFORMATION TECHNOLOGY”.	Academic Non-academic	190 112	2.34 2.73	0.031
11	You are aware of the meaning of BYOD, Energy conservation and Green Information Technology (Green IT).	Academic Non-academic	190 112	2.24 2.62	0.012
16	I always use a mobile device for work purposes after work hours.	Academic Non-academic	190 112	2.23 2.79	0.001
23	I would actually prefer to use my personal device for work to using the devices issued by my institution.	Academic Non-academic	190 112	2.33 3.11	0.000
29	When using my mobile device at work, I can easily connect to the network of my organization to gain access to the internet and other necessary resources	Academic Non-academic	190 112	1.73 2.15	0.000
30	I can easily get support from IT department when using my personal device at work.	Academic Non-academic	190 112	1.99 2.46	0.001
35	For me, adopting BYOD as a green IT solution is satisfactory.	Academic Non-academic	190 112	1.96 2.29	0.004
36	For me, using my own device for work and personal purposes as a means of eliminating duplication of	Academic Non-academic	190 112	1.85 2.18	0.003

	devices and reducing energy consumption is appropriate.				
37	For me, adopting a green information technology solution that will improve my productivity and flexibility is very remarkable and will suit my lifestyle.	Academic Non-academic	190 112	1.71 1.95	0.009
46	I will be more motivated to purchase or use only my personal device for work if I get monetary support from my institution.	Academic Non-academic	190 112	1.85 2.18	0.007

SPSS 23 was used to perform this t-test between two independent samples (academic and non-academic respondents) in Table 4.10. Since the p-values are less than 0.05 level of significance, it means that there is a significant difference of opinions concerning the listed questions. The mean scores of the academic respondents are lower than those of the non-academic respondents. This indicates that academic respondents tend to strongly agree with the questions listed in Table 4.10, whereas non-academic respondents tend to slightly agree.

Comparing perceptions (views) of male and female respondents concerning the listed questions.

Table 4.11: Views of male and female respondents

Question No.	Views	Post Description	Sample Size	Mean	p-value
20	It is important that am allowed to always connect to the network of my institution with my personal mobile device.	Male	180	1.76	0.001
		Female	122	2.23	
23	I would actually prefer to use my personal device for work to using the devices issued by my institution.	Male	178	2.29	0.000
		Female	122	3.09	
27	The use of mobile device is much better than using a desktop computer.	Male	180	1.97	0.003
		Female	122	2.38	
29	When using my mobile device at work, I can easily connect to the network of my organization to gain access to the internet and other necessary resources.	Male	180	1.71	0.000
		Female	121	2.15	
36	For me, using my own device for work and personal purposes as a means of eliminating duplication of devices and reducing energy consumption is appropriate.	Male	180	1.84	0.004
		Female	122	2.16	
37	For me, adopting a green information technology solution that will improve my productivity and flexibility is very remarkable and will suit my lifestyle.	Male	180	1.72	0.034
		Female	122	1.91	
39	I will be more motivated to purchase or use my own device if I get	Male	180	1.52	0.001
		Female	121	1.80	

	monetary support from my institution.				
43	I will definitely adopt BYOD as a green IT solution.	Male	175	1.90	0.005
		Female	121	2.19	
46	I will be more motivated to purchase or use only my personal device for work if I get monetary support from my institution.	Male	180	1.76	0.000
		Female	122	2.29	
47	I am very sure that my institution is comfortable with the use of any mobile device at the workplace.	Male	179	1.74	0.004
		Female	122	2.05	

The SPSS 23 was used to perform a t-test between two independent samples (male and female respondents) in Table 4.11. Since the p-values are less than 0.05 level of significance, it means that there is a significant difference of opinions concerning the adaptation of BYOD as a green IT practice. The mean scores of the male respondents are lower than those of the female respondents. This indicates that male respondents tend to strongly agree with the questions listed in Table 4.11, whereas the female respondents tend to slightly agree.

4.5 CHAPTER SUMMARY

The findings that emerged from the quantitative analysis were presented and discussed in this chapter. The data analysis involved descriptive and inferential statistics using SPSS statistical software. The analysis methods concentrated on providing answers to the research questions outlined in chapter one of the study. The next chapter will present the conclusions and recommendations for this study.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

The previous chapter focused on the presentation, interpretation and discussion of quantitative data collected through questionnaires that aimed at providing answers to the research questions for this study. This study argued for adopting BYOD as a Green IT practice. The prospective gains of adopting BYOD as a Green IT practice are evident because of its increasingly valuable nature and this makes it important for organizations to start taking advantage of it.

This chapter is a the summary of the entire study and the findings with regards to the research objectives established in Chapter one and the conceptual framework developed on the basis of TAM in the Chapter two of this study. The employees' perceptions regarding the adaptation of BYOD as a Green IT practice are explained and recommendations for further studies are provided in this chapter.

5.2 CONCLUSIONS

Based on the literature reviewed in this study in Chapter two and through the statistical findings of the study contained in Chapter four, aided by the data analysis methods explained in Chapter three, it can be concluded that the researcher answered the research questions, as outlined in Chapter one, together with realising the objectives of the study, as also outlined in Chapter one of this study. Hence, this indicates that the aim of this study was achieved.

5.2.1 The contribution of the study

Higher Education is a major segment of South Africa as it contributes immensely towards advancement of the country through teaching and learning. This makes it important that green initiatives be rooted in this sector as it serves as a base for transferring knowledge and awareness regarding environmental sustainability and that of the society. BYOD is viewed as an artifact and practice that provides solutions to energy saving aspect of Green IT, hence this study also contributes to the developing literature on BYOD with regards Green IT by highlighting the benefits of BYOD energy saving practices.

The aim of this study was to investigate employees' perceptions regarding the adaptation of BYOD as a Green IT practice at the NWU and the findings pinpoint that there is an existing form of BYOD at the North-West University which may not have been implemented as a Green IT practice. There is need for the management to consider the adaptation of BYOD as a way

of contributing towards protecting the environment. Achieving the aim of the study required answering research questions established for this study in Chapter one. There was one main question and four minor research questions.

5.2.2 Conclusions based on the conceptual framework of the study

This section presents the conclusions of the study based on the conceptual framework of this study that was presented in the Chapter two. It summarises the views of the respondents on the TAM constructs in the framework as it pertains to the study.

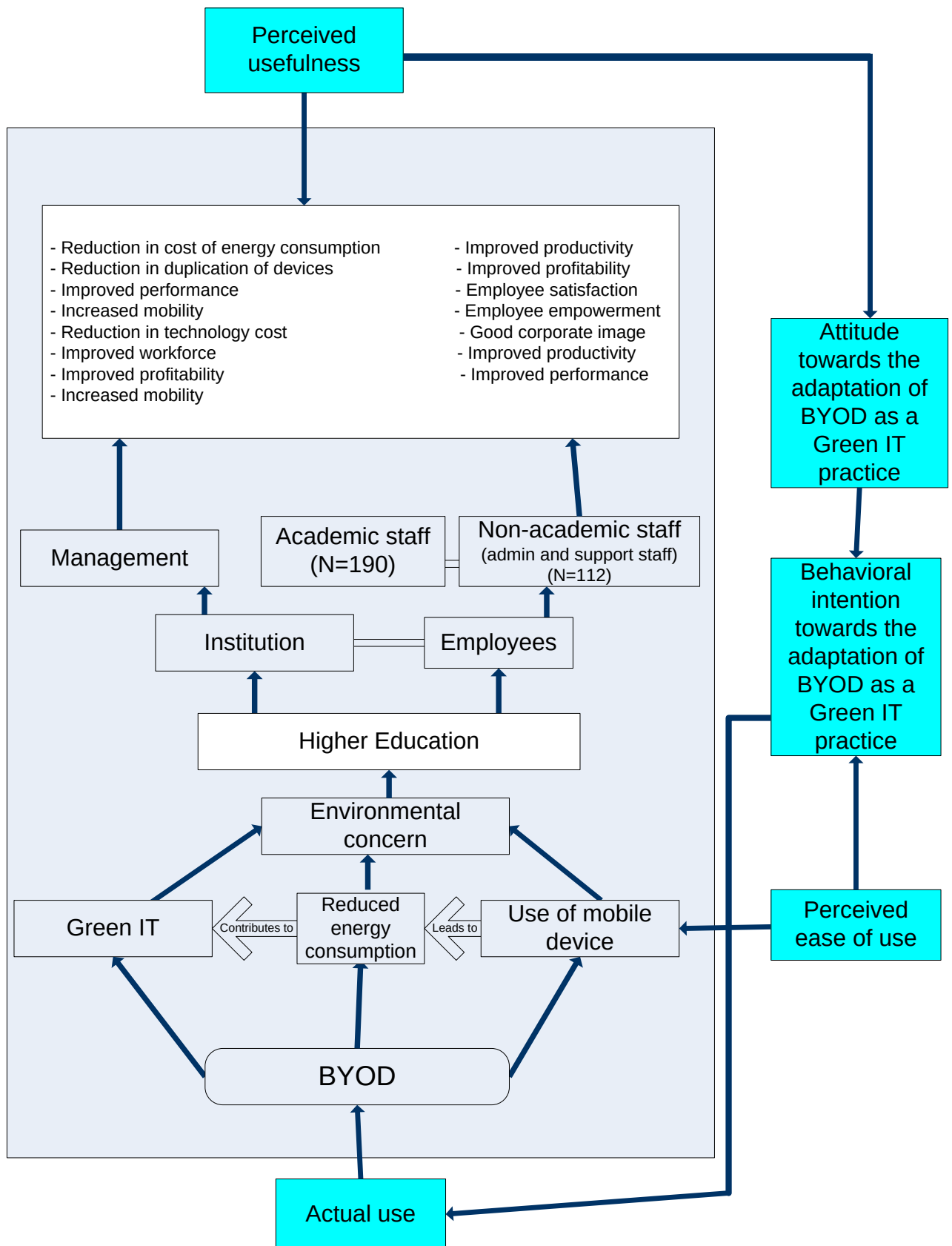


Figure 5.1: Presentation of the conceptual framework of the study

5.2.2.1 Perceived usefulness

The outcome of this study proved that the respondents perceive that the use of mobile devices increases their productivity and flexibility. This corresponds with the notion of Davis (1989) that people are likely to accept technology based on how much they believe it helps them in fulfilling their tasks better. In addition, the findings of this study revealed that respondents' effectiveness is increased by their dependency on mobile devices. This finding is in line with the expected benefit of BYOD adoption as explained by Capgemini Consulting (2013) that BYOD assists in simplifying tasks for employees, increases employee satisfaction, productivity, and contributes to workforce mobility.

5.2.2.2 Perceived ease of use

Despite the perception of potential users regarding the usefulness of a technology, it is also important to note that the difficulty in usage and the performance gains of usage affect the use or adaptation of that technology (Davis, 1989). The ease of use of BYOD extends to the ability it gives the employees to perform their tasks from any location beyond the workplace (Blizzard, 2015). Remarkably, the findings in this study revealed that most of the respondents carry out their work tasks even after work hours with their mobile devices. The findings suggest that most of the respondents (33.1 percent and 18.1 percent selected "strongly" and "agree" respectively in question 23 in Table 4.3 in Chapter four) prefer to use their personal mobile devices over institution issued devices as they are comfortable working with their personal mobile devices. The findings also revealed that they find no difficulty in connecting to the network of the institution to have access to the internet and other resources they deem important (see question 29 in Table 4.4 where 41.4 percent and 39.7 percent selected "strongly" and "agree" respectively). There is availability of support from the IT department making BYOD experience in the institution an easy one for the respondents. This means that if BYOD is perceived as easy to use, it will be easier for the employees to adopt any other form of BYOD introduced by the institution, and more competitive edge would be achieved the institution over their rivals. Loucks, Medcalf, Buckalew and Faria (2013) explain that in organizations where IT departments make provision for employees to make use of devices they are comfortable with for their jobs, the organizations tend to achieve a substantial competitive edge.

5.2.2.3 Attitude towards the adaptation of BYOD as a green IT practice

Attitude can be explained as an individual's perception regarding indulging in a certain behaviour (Ajzen & Fishbein, 1980), and the findings of this study suggest that the respondents are willing to adopt BYOD as a green IT practice. Ajzen and Fishbein (1980) also highlight

that attitude involves the perception of individual regarding whether the behaviour would be beneficial or not. The findings of this study suggest that the respondents have a very favourable perception regarding the need to tackle environmental issues (see question 33 in Table 4.5 in Chapter four where 49.0 percent and 44.7 percent of respondents selected “strongly” and “agree” respectively). They believe it is important not to ignore environmental issues that could result from the energy consumption of the computers and mobile devices they use at the same time (see question 32 in Table 4.5 in Chapter four where 47.4 percent and 40.7 percent of respondents selected “strongly” and “agree” respectively). The findings of this study are encouraging as they point out that the respondents are willing to adopt a green IT practice that will have a positive impact on their productivity, flexibility, and compatible with their lifestyle (see question 38 in Table 4.6 in Chapter four where 37.1 percent and 48.7 percent of respondents selected “strongly” and “agree” respectively).

Ajzen and Fishbein (1980) express that attitude also involves the perception of an individual regarding motivation geared toward consenting to a certain behaviour. This is evident in this study as the respondents are of the perception that they would be more motivated to purchase or use their personal devices if they obtained financial support from their institution.

5.2.2.4 Behavioural intention towards the adaptation of BYOD as a green IT practice

For this study, behavioural intention to adopt BYOD as a Green IT practice is viewed as a person’s intent to carry out an actual usage behaviour aimed at energy saving. The findings of this study revealed that most of the respondents are likely to recommend to their colleagues the adaptation of BYOD as a green IT practice (see question 40 in Table 4.7 in Chapter four where 37.1 percent and 39.4 percent of respondents selected “strongly” and “agree” respectively). Convincingly, the findings show that the respondents’ intention towards the adaptation of BYOD as a green IT practice is very positive. This is a very important factor to consider in implementing BYOD as a green IT practice, as Venkatesh *et al.*, (2003) notes that behavioural intention to adopt a particular technology affects the usage behaviour.

5.2.2.5 Actual use

BYOD in the institution is used for aiding mobile connectivity for employees, students, and guests to the network of the institution (NWU, n.d.). This supports the perception of the respondents that they are very sure that the institution is comfortable with their use of their mobile devices. The findings also revealed that most of the employees own mobile devices. The findings also show that the respondents actually deem it important to have access to the network of the institution

with their personal mobile devices. They also have the perception that they really need the freedom given to them to use their personal mobile devices for work purposes within workplace. The finding further revealed that the current BYOD practice in the institution has resulted to duplication of devices as some of the respondents indicated that in addition to the laptops in their possession they also have desktop computers in their offices. The respondents are knowledgeable in Green IT but are not aware that the current form of BYOD in the institution contributes to duplication of devices which in turn adds to energy consumption and defeats the aim of green IT. This necessitates that the HEI that is dedicated to improving energy efficiency considers the huge untapped potential to realise massive savings in merely considering the power management aspect of the use of mobile devices (Department of Environment, Heritage, Water and the Arts, Canberra, 2009) through the integration of various functions into one device (Revenaugh & Schweigert, 2013) as this would assist in reduction of utility costs (Ferris, 2012).

5.2.3 Conclusions based on objectives of the study

Based on the objectives of the study, the following can be concluded from the results obtained in Chapter four of the study.

5.3.3.1 To evaluate NWU employees' level of knowledge regarding BYOD in relation to Green IT.

This question was answered through the outcomes from the questionnaire analysis in Chapter four. The outcome suggests that employees are more knowledgeable about Green IT than they are of BYOD, especially with regards to energy saving. The findings point out more effort needs to be channelled towards educating employees in the institution about BYOD and its usefulness with regards to Green IT.

5.3.3.2 To evaluate NWU employees' usage level of mobile devices.

The findings revealed that the use of mobile device is necessary to the employees. It also shows that the employees are willing to stick to the use of their personal devices. This was made known through their responses where most of the respondents indicated that they can do without the devices issued by the institution (see question 33 in Table 4.3 in Chapter four where 30.8 percent and 21.2 percent of respondents selected “strongly” and “agree” respectively). This outcome shows that the employees of the institution are somewhat ready to shift towards the next level of BYOD adoption since there is an already existing form of BYOD in the institution. The institution already allows the employees to access the network of the

institution for both work and personal purposes. This partially shows that the institution is technically ready for BYOD, hence it may not be a tough task for the institution to adopt BYOD as a way of contributing towards Greening their IT. This is necessary because the existing form of BYOD in the institution has given rise to duplication of devices which contributes to increased energy consumption. From the findings, the employees own personal laptops, and institutional-issued laptops as well which they bring to work and use concurrently (see question 17 in Table 4.3 in Chapter four). In addition to the two mobile devices, some of the respondents have desktop PCs in their offices (see question 18 in Table 4.3). This duplication of devices highlights the need for the adaptation of BYOD as a Green IT practice. Looking at BYOD from the perspective of Green IT will help reduce the duplication of devices and in the long term reduce energy consumption.

5.3.3.3 To investigate the current state of BYOD adoption and implementation at the NWU.

The findings revealed that employees perceive that they can easily get support from the IT department when using their personal mobile device. They also revealed that most of their personal mobile devices are compatible with the network of the institution, hence they can easily connect to the network of the institution to access the internet and other important resources. The findings again point out that BYOD thrives in the institution, since the employees' level of control over mobile usage is high and most of the employees perceive the use of mobile device as much better than the use of the desktop PCs.

It is important to know from the employees' perspective what they perceive regarding the willingness of their institution to allow the use of their personally-owned devices for work. This section further proved that there is an existing form of BYOD which the institution has under control. The findings suggest that the employees perceive that their institution is comfortable with the use of any mobile device on its network and they are very pleased about that. Moreover, the respondents also highlighted the need to get guidance from the institution regarding the adaptation of BYOD as a Green IT solution or practice.

5.3.3.4 To determine NWU employees' level of interest regarding the adaptation of BYOD as a Green IT practice.

There is a positive perception towards caring for the environment, as the findings suggests that the employees believe that environmental issues resulting from energy consumption of computers and related mobile devices should not be ignored. This implies that the institution

is made up of employees with the right mind-set towards environmental sustenance. The use of multiple devices adds to the number of devices consuming energy in any organization, and the employees think that it is necessary to care about environmental issues that could result from this reckless practice (see question 32 in Table 4.5 in Chapter four where 49.0 percent and 44.7 percent of respondents selected “strongly” and “agree” respectively).

Overwhelming majority of the respondents responded positively to the questions in this section(see question 35 in Table 4.6 in Chapter four where 32.19 percent and 38.79 percent of respondents selected “strongly” and “agree” respectively). The findings reveal that the adaptation of BYOD as a Green IT practice is an appropriate and satisfactory initiative to the employees. Organizational support as a facilitating condition might play a big role in this aspect. Even though a BYOD survey by Loucks, Medcalf, Buckalew and Faria (2013) which revealed that users are ready to procure devices they consider crucial to their effectiveness at work, which is supported by TAM that individuals use such systems to improve their output in the office (Wati & Koo, 2012), but the findings in this study further revealed that there could be financial motivation in this regard. The findings made it bare that most of the employees can do without the device issued by the institution, but also highlighted that financial support would contribute to their willingness to buy and use of their personal devices for both personal and work purposes.

Again, the respondents indicated that they are willing to adopt BYOD as a Green IT practice. This further means that their intention towards this initiative is positive, as most of the respondents also indicated that they are likely to recommend the adaptation of this initiative to their colleagues when necessary. The need to have employees or individuals that would have a positive intention towards partaking in green initiatives is very critical, and fortunately the respondents are very much willing to be part of this green initiative. Furthermore, they also indicated that they intend to support BYOD adoption as a Green IT practice in every possible way. The respondents indicated that they would definitely adopt BYOD as a Green IT solution (see question 43 in Table 4.7 in chapter four where 30.5 percent and 41.4 percent of respondents selected “strongly” and “agree” respectively). This suggests that if eventually the institution decides to adopt this initiative, they are likely to become willing employees that would engage in the practice.

5.2.4 Conclusions from the statistical analysis

A number of other significant findings emerged from the study. To start with, it was found that the correlation between the job experience and views of respondents about the questions listed in Table 4.9 is significant since all the p-values are less than 0.05 level of significance. The questions are also listed below:

- You know that adhering to Green IT practices would help save the planet (question 7).
- You know that BYOD eliminates duplication of devices, which when transferred to the entire work-force in an organization would yield a significant amount of monetary saving and also reduce the environmental impacts of energy consumption (question 14).

Secondly, a comparison of the perceptions of academic and non-academic employees using the T-Test revealed that there is significant difference of opinions between them since the p-values are less than 0.05 level of significance. The academic respondents tend to strongly agree more on the questions listed than the non-academic respondents who tend to slightly agree (see table 4.10 in Chapter four which contains question 5, 11, 16, 23, 29, 30, 35, 36, 37 and 46).

Another key finding that emerged is there is a significant difference between male and female opinions since the p-values are less than 0.05 level of significance. The finding suggests the male respondents tend to strongly agree more on the questions contained in the questionnaire while the female respondents tend to slightly agree. The questions are contained in table 4.11 in Chapter four and they are question 20, 23, 27, 29, 36, 37, 39, 43, 46 and 47.

Generally, these significant findings indicate that there is a very high positive perception among the employees regarding the adaptation of BYOD as a Green IT practice, hence there is strong positive attitude and intention towards the initiative as the findings revealed.

5.3 RECOMMENDATIONS FOR FURTHER RESEARCH

Based on the literature and findings of this study, the adaptation of BYOD as a Green IT practice is not sufficiently explored and used by HEIs. It will be worth conducting a similar study in another HEI site from the perspective of the employees and the management or the decision makers of the institution, and thereafter conducting a comparative study to measure the effectiveness of BYOD among different institutions in South Africa.

The researcher recommends that future study should engage a larger sample which should encompass more higher education institutions in South Africa in order to address some of the limitations in the current study, and for determining the behavioural intention and actual usage

of BYOD as a Green IT practice in higher education institutions in South Africa. This could help in obtaining more varying biographical data as well as varying findings regarding the phenomenon under study and the underlying concepts. In so doing, a lot more interesting relationships could be established based on the larger sample employed and raise more interesting conclusions that could be generalised to a larger population.

5.4 LIMITATIONS OF THE STUDY

The limitations of this study are stem from the researcher and the chosen methodology. Additionally, there is not much published scholarly papers specifically on the use of BYOD as a Green IT practice in Higher Education in SA, hence this posed a challenge for the researcher in interrogating robust literature for this study. To assist in overcoming this limitation, the researcher used a rather large number of related and relevant materials to help establish the link between BYOD and Green IT; and its energy saving aspect which is more of the underlying aspect of the study. Another limitation encountered was time based on the chosen methodology which involved distribution of questionnaires to respondents. In order to get enough questionnaires back, the researcher personally administered and collected the questionnaires over a period of two and half months, except for a few that were returned via electronic mail. Despite this effort, there was still delay in returning questionnaires, including some that were never retrieved.

5.5 CONCLUSION

This study aimed at investigating employees' perceptions regarding the adaption of BYOD as a Green IT practice at the North-West University. Despite the limitations of the study, some valuable and promising findings were discovered which future research might use as a basis for further investigation. As per the findings of the study, the adaptation of BYOD as a Green IT practice would be a favorable initiative to implement not only in HEIs but in other corporate organizations. Hence researchers are encouraged to investigate other possible factors that could affect adaptation of BYOD as a Green IT practice and the actual usage behaviour. For the management and decision makers in HEIs, the findings suggest that Green initiatives and campaigns should specifically highlight the negative impacts of duplication of devices. In conclusion, academic employees who may already have more knowledge of green IT could be engaged to take the lead on the adaptation of this initiative, adding more knowledge and awareness to others and to themselves regarding the problems of energy consumption and the advantages of integrating BYOD into Green initiatives.

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ANNEXURE A: QUESTIONNAIRE



NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
MAFIKENG CAMPUS

FACULTY OF COMMERCE AND ADMINISTRATION
School of Economic and Decision Sciences
Department of Information Systems

VOLUNTARY QUESTIONNAIRE

For an Academic Research in Computer Science and Information Systems

Title: The adaptation of Bring Your Own Device as a Green Information Technology practice at the North-West University

Researcher: AGU NELSON TOCHUKWU

Email: nelson4best@yahoo.com

Cell: 0842208817

Dear Respondents,

I am a Masters student in Computer Science and Information Systems in the Faculty of Commerce and Administration, North-West University, Mafikeng Campus. I am undertaking a research study as titled above towards the fulfilment of the requirements of my degree.

This research seeks to acquire evidence from employees in Higher Education in line with the adaptation of BYOD as a green IT solution in their institutions.

BYOD (*Bring Your Own Device*) refers to the use of your personally-owned devices for work purposes in your institution. It also extends to the freedom given to employees to bring their personally-owned devices to the work place, and still have access to the institution's network.

Green Information Technology (Green IT) refers to the practice of environmentally sustainable computing or the use of computing resources in an eco-friendly manner.

Partaking in this survey is not compulsory and your responses to these questions are strictly for educational purpose and high confidentiality of information given is assured.

Thank You for your kind assistance

TOCHUKWU NELSON AGU

SECTION A: DEMOGRAPHIC INFORMATION

Please respond by putting a cross (X) on the relevant box.

1. Gender:

Male	Female

2. Campus:

Mafikeng	Potchefstroom	Vaal	Other

3. Post description:

Academic	Non-Academic

4. How many years have you been employed in your institution?

Less than 5	6-10 years	11-15 years	16-20years	Above 20 years

SECTION B: Knowledge of BYOD with regards to Green IT

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
5.	Before now I have been aware that the acronym GREEN IT means "GREEN INFORMATION TECHNOLOGY".					
6.	You know that GREEN IT concept involves efficient use of computers and its related devices.					
7.	You know that adhering to Green IT practices would help save the planet.					
8.	You know that substantial monetary savings would be realised through adhering to Green IT practices.					
9.	Before now, I have been aware that the acronym BYOD means "BRING YOUR OWN DEVICE".					
10.	You know that BYOD concept involves allowing employees of an organization to make use of their personal devices for work and personal purposes.					
11.	You are aware of the meaning of BYOD, Energy conservation and Green Information Technology (Green IT).					
12.	You know that energy consumption has impacts on the environment.					
13.	You know that substantial energy savings can be achieved through the use of one device for both work and personal purposes instead of having different devices.					
14.	You know that BYOD eliminates duplication of devices, which when transferred to the entire work-force in an organization would yield a significant amount of monetary saving and also reduce the environmental impacts of energy consumption.					

SECTION C : To Evaluate the Necessity of Using Personally-Owned Devices and Institution-Issued Devices.

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
15.	Most employees in my institution own a personal mobile device.					
16.	I always use a mobile device for work purposes after work hours.					
17.	I have more than two laptops in my office.					
18.	In addition to the laptop(s), I also have a desktop computer in my office.					
19.	At least one of the mobile devices in my possession was issued by my institution.					
20.	It is important that am allowed to always connect to the network of my institution with my personal mobile device.					
21.	I believe that it is important to allow the use of only institution-issued mobile devices for work purposes at the workplace.					
22.	I am allowed to use my personal mobile devices for work purposes at the workplace and this is very important to me.					
23.	I would actually prefer to use my personal device for work to using the devices issued by my institution.					
24.	I think that I can do without the devices issued by my institution.					
SECTION D: Perceived Behavioural Control						
		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
25.	The use of mobile device increases my productivity and flexibility.					
26.	The use of my personal mobile device increases my effectiveness.					
27.	The use of mobile device is much better than using a desktop computer.					
28.	I am more comfortable working with my mobile device.					
29.	When using my mobile device at work, I can easily connect to the network of my organization to gain access to the internet and other necessary resources.					
30.	I can easily get support from IT department when using my personal device at work.					
31.	My personal device is compatible with the network of my organization, and has compatible applications and software to complete my daily work and personal tasks.					
SECTION E: Environmental Concern						
		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
32.	I think environmental problems as a result of energy consumption of computers and mobile devices should not be ignored.					

33.	I think we should care about environmental problems caused by energy consumption of the multiple devices we own and use at the same time.					
34.	I think we should be concerned about environmental problems caused by duplication of devices and energy consumption.					
SECTION F: Attitude Towards the adaptation of BYOD as a Green IT Solution						
		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
35.	For me, adopting BYOD as a green IT practice is satisfactory.					
36.	For me, using my own device for work and personal purposes as a means of eliminating duplication of devices and reducing energy consumption is appropriate.					
37.	For me, adopting a green information technology practice that will improve my productivity and flexibility is very remarkable and will suit my lifestyle.					
38.	For me, adopting BYOD as a green IT practice is appropriate.					
39.	I will be more motivated to purchase or use my own device if I get monetary support from my institution.					
SECTION G: Intention Towards the adaptation of BYOD						
		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
40.	I am likely to recommend the adaptation of BYOD as a green IT solution to my colleagues when necessary.					
41.	I intend to adopt BYOD as a green IT practice if implemented in my institution.					
42.	I intend to support BYOD adoption as a green IT practice in every way possible.					
43.	I will definitely adopt BYOD as a green IT practice.					
SECTION H: Organisational Support						
		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
44.	Guidance from my institution regarding the adaptation of BYOD as a green IT practice will encourage me.					
45.	I am very pleased that my institution allows the use of any personal mobile device on its network.					
46.	I will be more motivated to purchase or use only my personal device for work if I get monetary support from my institution.					
47.	I am very sure that my institution is comfortable with the use of any mobile device at the workplace.					

John H. Johnson

Dr M.L.Hove

Original details: Dr M L Hove (22055215) C:\Users\22055215\Desktop\Hove.docx
6/1 November 2016



NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT

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ANNEXURE C: ETHICAL CLEARANCE APPROVAL



Private Bag X6001, Potchefstroom
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Tel: (018) 299-4900
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Institutional Research Ethics Regulatory Committee

Tel +27 18 299 4849
Email Ethics@nwu.ac.za

ETHICS APPROVAL CERTIFICATE OF PROJECT

Based on approval by the **Human Resource Research Ethics Committee, Mafikeng Campus**, the North-West University Institutional Research Ethics Regulatory Committee (NWU-IRERC) hereby approves your project as indicated below. This implies that the NWU-IRERC grants its permission that, provided the special conditions specified below are met and pending any other authorisation that may be necessary, the project may be initiated, using the ethics number below.

Project title: An investigation into the use of BYOD as a green IT solution in Higher Education.																																											
Project Leader: Prof AK Kadyamatimba & Mrs Mavetera																																											
Student: NT Agu																																											
Ethics number:	<table border="1"><tr><td>N</td><td>W</td><td>U</td><td>-</td><td>0</td><td>0</td><td>2</td><td>7</td><td>7</td><td>-</td><td>1</td><td>5</td><td>-</td><td>A</td><td>9</td></tr><tr><td colspan="3">Institution</td><td colspan="3">Project Number</td><td colspan="3">Year</td><td colspan="3">Status</td></tr><tr><td colspan="15">Status: S = Submission; R = Re-Submission; P = Provisional Authorisation; A = Authorisation</td></tr></table>	N	W	U	-	0	0	2	7	7	-	1	5	-	A	9	Institution			Project Number			Year			Status			Status: S = Submission; R = Re-Submission; P = Provisional Authorisation; A = Authorisation														
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Institution			Project Number			Year			Status																																		
Status: S = Submission; R = Re-Submission; P = Provisional Authorisation; A = Authorisation																																											
Approval date: 2015-07-07	Expiry date: 2020-07-06																																										
Category	N/A																																										

Special conditions of the approval (if any): None

General conditions:

While this ethics approval is subject to all declarations, undertakings and agreements incorporated and signed in the application form, please note the following:

- The project leader (principle investigator) must report in the prescribed format to the NWU-IRERC:
 - annually (or as otherwise requested) on the progress of the project,
 - without any delay in case of any adverse event (or any matter that interrupts sound ethical principles) during the course of the project.
- The approval applies strictly to the protocol as stipulated in the application form. Would any changes to the protocol be deemed necessary during the course of the project, the project leader must apply for approval of these changes at the NWU-IRERC. Would there be deviated from the project protocol without the necessary approval of such changes, the ethics approval is immediately and automatically forfeited.
- The date of approval indicates the first date that the project may be started. Would the project have to continue after the expiry date, a new application must be made to the NWU-IRERC and new approval received before or on the expiry date.
- In the interest of ethical responsibility the NWU-IRERC retains the right to:
 - request access to any information or data at any time during the course or after completion of the project;
 - withdraw or postpone approval if:
 - any unethical principles or practices of the project are revealed or suspected,
 - it becomes apparent that any relevant information was withheld from the NWU-IRERC or that information has been false or misrepresented,
 - the required annual report and reporting of adverse events was not done timely and accurately,
 - new institutional rules, national legislation or international conventions deem it necessary.

The IRERC would like to remain at your service as scientist and researcher, and wishes you well with your project. Please do not hesitate to contact the IRERC for any further enquiries or requests for assistance.

Yours sincerely

Linda du Plessis

Digitally signed by Linda du Plessis
DN: cn=Linda du Plessis, o=NWU,
ou=Vaal Triangle Campus,
email=linda.duplessis@nwu.ac.za,
c=ZA
Date: 2015.07.29 14:51:11 +0200

Prof Linda du Plessis

Chair NWU Institutional Research Ethics Regulatory Committee (IRERC)