

Formulating a bring-your-own-device strategy for higher education institutions in Gauteng

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ABSTRACT

Technology intended for the consumer market has grown exponentially in recent years. Much of the growth can possibly be attributed to the competition created by the companies that develop these technologies for consumers in an attempt to retain and expand their markets. As a result organisations and specifically higher education institutions experience what is popularly referred to as the BYOD phenomenon that originated from what is known as the consumerisation of IT. Various terms and definitions have emerged in recent years to depict the trends and challenges that industry in general currently experience and have to deal with to remain operationally sound and competitive.

The aim of this study was to investigate the effect IT consumerism and BYOD has on higher education IT departments, and whether IT and institutional leadership should join forces from a strategic approach to align IT strategy with institutional strategic goals and objectives. History has shown that technology constantly evolve and does not stop or reverse its effects, thus indicating that the trends might change but the disruptions caused cannot be reverted back to solutions of past.

The initial assumption that sparked interest to conduct the study on the BYOD phenomenon was that higher education institutions tend to have a favourable disposition towards the acceptance and adoption of new technology trends. Especially, technologies that can be utilised towards improving and facilitating teaching and learning. Therefore it was decided to study responses from two prominent higher education institutions in Gauteng, South Africa.

Exploratory research found that institutional employees already use their mobile personal devices to complement their work activities. Employees have certain expectations for bringing and using their own devices; these expectations are currently being managed haphazardly by the institutional IT departments. Strategic intervention was thus required to accommodate the current and future technology trends that might have an impact on institutional strategic objectives and goals.

Recommendations and guidelines towards the development of a strategic framework for strategy formulation were discussed as well as possible alternatives to BYOD, depending on institutional culture and leadership factors.

Key terms: IT consumerism, Consumerisation of IT, BYOD, CYOD, COPE, Higher Education, Strategy alignment.

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LIST OF ABBREVIATIONS

AP	Access point
ASAUDIT	Association of South African University Directors of Information Technology
BRM	Business Relationship Management
BYOD	Bring Your Own Device
BYOE	Bring Your Own Everything
BYOx	Bring Your Own Anything
COBIT	Control Objectives for Information and related Technologies
COPE	Corporate Owned Personally Enabled
CYOD	Choose Your Own Device
EFSS	Enterprise File Synchronization and Sharing
EMM	Enterprise mobility management
HESA	Higher Education South Africa
HOD	Heads of Department
HVD	Hosted Virtual Desktops
IBM	International Business Machines Corporation
ICT	Information and communications technology
IDC	International Data Corporation
ISO 38500	International Standard for Corporate Governance of Information Technology
IT	Information Technology

ITIL	Information Technology Infrastructure Library
ITSM	IT Service Management
KING III	The King Report on Governance for South Africa, 2009
LAN	Local Area Connection
MDP	Mobile Data Protection
NAC	Network Access Control
OS	Operating System
PC	Personal Computer
POPI	The Protection of Personal Information Act
UBICOMP	Ubiquitous computing
Val IT	Value from IT Investments
VM	Virtual Machine
WAN	Wide Area Network
WLAN	Wireless Local Area Network
WLAN IPS	Wireless Local Area Network Intrusion Prevention System

CHAPTER 1

ORIENTATION AND PROBLEM STATEMENT

1.1 INTRODUCTION

The consumerisation of Information Technology (IT) is the specific impact that technologies intended for the consumer market has on industry in general including higher education institutions. The intended purpose of the phenomena is to be able to merge personal and business activities through the use of smart mobile devices and applications. IT consumerism has changed the traditional or rather structured, standardised ways in which IT departments planned for and managed Information and Communications Technology (ICT) (Grajek, 2014:11).

The concept behind the term Bring Your Own Device (BYOD) is the idea of offering employees freedom, choice, and flexibility. Ideally, it could be perceived as an easy concept to adopt, since consumers cannot get enough of these devices that allow them so much flexibility, function and capabilities. In layman's terms, BYOD refers to the use of personally owned employee laptops, smartphones, tablets and other devices in the work environment, department or specific job role. Instead of the IT department assigning specifically procured hardware or software technologies, users have the freedom to choose and use the "gadgets" and platforms they prefer (Emery, 2012:3). For the past few years, employees have been at the forefront of mobile technology trends, blending personal and business tasks, empowering themselves and creating innovative productive environments (Jones, 2012:1).

BYOD has disrupted IT departments with its intent to allow access to almost any type of smart device on the enterprise IT environment. As a consequence, IT departments are now being forced to decide on how to protect the enterprise IT environment, and manage technology that they perhaps did not procure (Grajek, 2013:34-36).

It is important to mention early on, that the term Bring Your Own Device (BYOD) is considered in general to be the more "mainstream" term used to describe the phenomenon. Which resulted from the consumerisation of IT and the impact thereof on business, as a consequence BYOD emerged as a concept linking the phenomenon to business and business practices. Various alternatives with similar intended outcomes to

BYOD have since been introduced, such as, Choose Your Own Device (CYOD), Corporate Owned/Personally Enabled (COPE), and Bring Your Own Anything (BOYx) to name just a few (Citrix, 2015:5).

These alternatives to BYOD attempt to address the initial BYOD challenges from an IT perspective. In theory they appear to make an ideal compromise between privacy, security and control. Essentially, an IT department procures, owns and controls the mobile devices and access to institutional resources, COPE allows for users to access their personal applications and data within certain limits. CYOD and COPE does not necessarily address user experience issues and/or needs better than that of BYOD (Citrix, 2015:5).

The development and formulation of a strategic framework that leverages this mobile trend in alignment with an institution's overarching strategy, mission and vision statements would be of great value to the institution (Emery, 2012:9). Formulating an IT strategy around this consumer driven trend will ultimately have an impact at an institutional level. Increasingly, organisations are embracing mobility as part of their business strategy implementing new IT initiatives to drive revenue, enhance customer engagement, and be more competitive (Unisys, 2013:1).

The intent of this study was to: gain insight into whether an institution is managing the current trend or not; establish whether formal strategic intervention is needed to facilitate alignment between information technology advances and institutional strategic objectives; identify factors that influence BYOD strategy formulation, whether it being challenges, opportunities or leadership issues. Finally to conclude the study, the aim was to make a purposeful recommendation towards formulating a BYOD strategy for higher education institutions.

1.2 CONTEXT

The term BYOD was first coined at the 2005 ACM International Joint Conference on Pervasive and Ubiquitous Computing (UBICOMP) (Emery, 2012:3). The term achieved noticeable popularity as of 2009, by courtesy of Intel when they started noticing an increasing tendency amongst (their) Intel employees bringing and using their own devices at work. Intel employees started using and connecting their personal devices to their (Intel's) enterprise network (Emery, 2012:3). However, it took another two years,

until in early 2011 before the term BYOD achieved significant mainstream acceptance. IT technology companies, and software vendors such as, Intel, Unisys, VMware, and Citrix Systems started to monitor and share their findings and experiences of the emerging trend. The BYOD phenomenon has been characterised as a feature of the "consumer enterprise" where consumer technologies require compatibility and integration with enterprise IT technologies (Emery, 2012:3).

Many believe that the BYOD phenomenon was sparked by Apple's iPhone (Jones, 2012:1). However mobile smart device usage can be traced back to older mobile smart devices for example the Palm range of personal assistants and BlackBerry devices. The iPhone, and later on the iPad, were certainly catalysts that contributed significantly to the accelerated prominence and adoption of BYOD strategies in many organisations (Jones, 2012:1). The concept of users wanting to use their own devices or, use their own personal computer equipment to facilitate work related tasks predates BYOD (Jones, 2012:1). Since the iPhone, a number of notable competitors have taken their place alongside Apple products in the smart phone and tablet industry. These include Google's Android operating system and devices that support it, Hewlett Packard's acquisition of Palm Inc., and Nokia whom is in partnership with Microsoft to run Windows Phone operating systems on their mobile devices (Kim, 2011:1). Recently Windows 8 and now Windows 10 is available on new Nokia smart phone and tablet devices.

A Gartner press release revealed the following; global smart phone sales surpassed 472 million units in 2011, a 58% increase from 2010, and are expected to reach 1.1 billion units by 2015 (Gartner, 2012:1). These projections were already surpassed in 2014 with sales of smartphones to consumers totalling 1.2 billion units (Gartner, 2015:1). The significance of these figures indicates the number of smart phones currently in circulation, not to mention other smart devices. Furthermore, Smartphone shipments to Africa and the Middle East grew at an unprecedented rate of 83 per cent in 2014 (TechCentral, 2015:1).

Considering the staggering current shipment figures and expected future shipment figures mentioned above, it is important to remember that the basic requirement to enjoy full functionality of these smart devices is that an internet connection is required. End-users need to be connected to either a cellular service provider, home or enterprise

network. For the purposes of this study it is important to acknowledge that the institutional network plays a significant role in facilitating connectivity. Employees spend many hours of their day at work, and students spend considerable time on campus, whether for the purposes of their studies or other activities. Therefore end-users have an underlying need for network connectivity to operate and enjoy full functionality of their mobile device/s, for either work or personal use.

The increasing number of consumer grade mobile devices in the work environment is raising new challenges for IT leaders and their departments, and is perceived as a disruption. IT leaders are effectively responsible for delivering efficient reliable and available IT services, and also for developing current up to date IT strategies in the wake of new trends. Lately it is recommended that IT leaders and institutional leaders also realise the importance of aligning IT strategy with institutional strategic objectives, mission and vision statements (Emery, 2012:9). BYOD presents obvious challenges for IT, primarily related to enterprise security, user privacy, governance, policy, infrastructure and other enterprise IT management issues (Emery, 2012:9). But for strategy formulation, “soft issues” should also be considered, such as executive and internal business or institutional relationships and stakeholder engagement. Factors to consider that creates known challenges and opportunities in the development of an institutional BYOD strategy are as follows; (Emery, 2012:3; DeBeasi, *et al.*, 2012:4-5; Willis, 2013: 2-17).

- Perceptions of IT and its institutional value.
- Departmental and employee roles (User and departmental segments)
- IT Infrastructure
- IT Governance
- Policies
- Security
- Support
- User education / user empowerment
- Cost
- Productivity and performance (Innovation)

To clarify and define own devices for the purposes of this study; this study intends to focus primarily on current smart mobile devices such as smart phones, tablets, laptops and similar devices. However other devices can be perceived to be mobile with an equal cause for concern. Other personal employee or student devices often used by staff and students in higher education institutions include the following;

- External/ removable storage devices (various cards, dongles etc.)
- Devices used for facilitating presentations (Pointers)
- Satellite navigation devices and monitoring tools
- Portable devices or computers with user owned personal software and/or operating systems, which is not supported by IT departments.
- Portable gaming consoles etc.

Again, it is important to acknowledge attempts by IT leaders and research entities to address challenges and opportunities presented by BYOD, by the introduction of, or recommendations of alternative programmes such as CYOD and COPE. These alternatives to BYOD aim towards having similar outcomes as BYOD, but with more control in the hands of IT departments with regards to managing, supporting and securing institutional assets. How end-users will react to either proposed solution or combination thereof will remain something that needs to be determined internally.

1.3 IMPORTANCE OF THIS STUDY

An increasing number of organisations are allowing access to their enterprise networks and resources to accommodate consumer grade smart devices, such as Apple and Android smartphones and other smart mobile devices (Ferguson *et al.*, 2011:3). This has resulted in the trend usually referred to as, as IT consumerism or the consumerisation of IT. The term creates even more controversy when employees are permitted to use their own devices for work purposes, effectively disrupting traditional methods of IT support and operations. The trend implies that employees or internal stakeholders prefer using their own personal devices as opposed to those that would otherwise be supplied by their organisational IT department (Ferguson *et al.*, 2011:3). Consumer technology is designed with the intent to be easy to use, entertaining, convenient, and easy to master. It is believed that technology savvy user's favour using

their own devices in the workplace simply because of their familiarity, skill and comfort levels operating their own device/s. However, the lack of a pro-active strategic approach towards IT consumerism and BYOD creates many challenges and concerns with regards to security, legal, financial and management capabilities. Rather than resist these developments, organisations and institutions should embrace mobile technologies to unlock industry and business potential. This requires a strategic approach involving numerous stakeholders to jointly formulate, flexible policies, appropriate security and good governance (Ferguson *et al.*, 2011:3).

An analysis conducted regarding the presence of consumer grade mobile devices in business from a study by Unisys in collaboration with the Industrial Development Corporation (IDC) indicated that in 2011 the term reached mainstream status. Concluding that, roughly 40% of smart mobile devices owned by IT professionals were used to access enterprise resources (Burt, 2011:2). The growing tendency towards employees using personally owned mobile devices in the workplace was expected to continue to grow exponentially (Burt, 2011:1). As a result, some IT leaders are scrambling to make sense of the challenges and opportunities BYOD presents. A strategic approach to IT consumerism starts with a clear understanding of the institution, leadership, and management capabilities (Ferguson *et al.*, 2011:3).

This study was not intended to discuss or predict BYOD adoption within local higher education institutions, or to focus on technical IT issues, but rather to explore the expectations of stakeholders going forward. These technical issues are irrelevant to IT leaders and institutional leaders who will likely be more interested in the possible business challenges and opportunities. It is necessary for leaders to accept that current technology trends are not just considered to be localised phenomenon, and that it has far reaching global effects across many different industries that might impact their institution or organisation.

The opportunity presented itself to conduct this study within higher education institutions whose purpose is to empower and supply global industry with a qualified workforce. Therefore, it is of significance for higher education institutions to consider current and future trends in order to empower the future workforce, whom will be expected to poses the necessary skills, knowledge and experience with regards to technology and trends

utilised in business. Current technology developments and trends should be considered to be important events in Information Technology history going forward.

1.4 PROBLEM STATEMENT

In realising the importance of these new developments from a higher education perspective, it is necessary to acknowledge the problems it presents. Traditionally IT strategies placed emphasis on the standardisation of enterprise IT equipment, software, and services with the intended purpose to deliver a more efficient structured service for the institution and its users. Managed standard IT services, policies and frameworks meant keeping hardware, software and support models as consistent as possible to minimise total cost of ownership. IT consumerism and BYOD initiatives disrupted this ideal permanently, resisting change in this case could spell disaster for organisations and institutions as technology evolves exponentially.

Research studies indicated that a growing number of dynamic organisations and institutions embrace mobility as a part of their business. Institutions and organisations that realise the opportunities these trends offer can use it to their advantage as a means of gaining competitive advantage over their competitors. Enterprise mobility have certain transformative effects in the way employees perceive and approach their role and function at work, it can drive change and promote innovation in terms of process efficiencies and productivity. However, there is a need for IT leadership to gain a firm grasp on the drivers of change, the overarching scope of its impact (Dimension Data, 2013:5). Business and IT factors affecting strategy formulation need to be considered carefully, offering employees the freedom to choose and use their preferred devices reveals opportunities and challenges.

IT Consumerism and BYOD has effectively caused a reversal in business and IT roles, in that business historically used to be the driving force behind consumer technology, innovation and trends. Identifying these crucial factors affecting the formulation of a mobile friendly IT strategy will reveal some of the opportunities and challenges for the institution going forward (Dimension Data, 2013:5). On a positive note, an opportunity exists through this perceived disruption where better alignment between IT and the institution can be achieved.

The true extent of how integrated current technology has become within business needs to be proved, although the indications have been there for some time. This study will explore the current impact mobile device usage already have within higher education institutions in Gauteng and whether end-user expectations are currently being met. Furthermore, the study intends to reveal whether institutional IT departments currently manage the trend haphazardly to meet expectations or if it was strategically included alongside institutional strategy.

1.5 OBJECTIVES

1.5.1 Primary Objective

To reach the primary objective of this study it was necessary to first investigate whether strategic intervention was required in the wake of the BYOD phenomenon. To prove that strategic intervention was required, a comprehensive literature study was conducted along with empirical research to prove findings from the literature study.

The secondary objectives was intended to establish the need for strategic intervention, and to identify crucial factors IT leaders should consider in the initial development phases of a mobile friendly IT strategy. Once confirmed, the **primary objective** attempts to conclude the study with a framework to assist institutional stakeholders, specifically IT leaders in higher education institutions in formulating a BYOD strategy that is aligned with the overarching institutional strategy, goals and objectives

The formulation of a strategic framework should address and clarify questions, concerns, challenges and opportunities. The increasing trend towards the use of personally owned mobile devices in the work environment raises the bar for IT leaders and IT departments. IT leaders have a responsibility to strategically align IT strategy with the purpose of being a strategic enabler that facilitates meeting institutional strategic objectives and goals (Green, 2007:2).

It is important to note that to reach the primary objective, all institutional stakeholders should be engaged and not just institutional leadership.

1.5.2 Secondary Objectives

The primary objective led to the following secondary objectives:

- Determine how advanced the consumerisation of IT and BYOD was within the institution, including how BYOD is currently managed if no formal BYOD strategy was in place. This information will highlight the need or urgency for strategic intervention.
- Establish user expectations along with which business areas of the institution are likely to excel and benefit from BYOD. Segmenting business areas and user needs in order to compliment strategy formulation and focus areas.
- Consider which mobility program would best suit an academic institution (BYOD, CYOD, or COPE).

Exploratory research will be done in an attempt to answer the secondary objectives that will provide evidence in support of the primary objective of this study. The intent was to explore whether it was at all possible to formulate a reliable strategic framework, higher education institutions could use to facilitate BYOD strategy formulation.

1.6 RESEARCH METHODOLOGY

1.6.1 Research Approach

Since this research was conducted with higher education institutions in mind, much of the literature will be aimed at a higher education environment. To clarify, this research was specifically aimed at the employee population (academic, support and management staff), and not at the student population of an institution.

The research approach was administered in two phases, utilising qualitative and quantitative methods. The purpose of the research was to determine if the academic institution was prepared for the BYOD phenomenon, in terms of strategy, and which factors were important for the implementation of such strategy.

A qualitative approach in which semi-structured interviews was conducted by purposefully selecting senior level institutional stakeholders that included institutional leadership, from both support and academic backgrounds at prominent higher education institutions in Gauteng.

A quantitative approach where data was collected using a structured online questionnaire, aimed at the general population of institutional stakeholders at prominent higher education institutions in Gauteng.

1.6.2 Literature review

A comprehensive literature study was conducted to establish a broad overview of IT consumerism and the BYOD phenomenon, with specific emphasis on the business impact and the necessity of strategic intervention in higher education institutions. Factors for consideration will also be explored in the literature review from similar studies conducted by Information Technology research entities and advisory firms, student theses, academic journals, technology and business articles. Considerable attention will be given towards alternative mobility programmes including CYOD and COPE, which developed as alternatives the BYOD phenomenon but with similar outcomes.

1.6.3 Empirical research

1.6.3.1 Research participants

Two large well established higher education institutions, herein after referred to as **Institution A** and **Institution B** were used for the investigation. Firstly, the research participants in this research were purposefully sampled for participation in semi-structured interviews. Secondly, a hyperlink in the form of a graphical link was distributed to all staff members on both campuses via group e-mail. Therefore participation in the questionnaire was voluntary. Only permanent employees from both institutions were targeted and not students.

For this research, and more specifically the qualitative research approach, purposeful sampling was important. There are several important uses of purposeful sampling. It can be used to explore the perceptions and opinions of individuals who are currently using their own devices for work related purposes, or are using the employer's device for both work and personal use. It can reveal the opinions and perceptions of individuals who want to use their own or employers device for both work and private use but cannot. IT terms and abbreviations are not common knowledge to all areas of business and individuals. It was therefore important to identify influential individuals with a knack

for technology and “gadgets”. It was a much smaller sample which will be systematically selected to get actual and relevant information which has more confidence than information obtained from the average IT user. Purposeful sampling will also eliminate the need to explain or lead participants during interviewing, which could lead participants to response bias.

For the quantitative approach, it was decided to sample by means of voluntary participation sampling methods. The purpose of this approach was to again eliminate participants who has no real interest in the technology trend in question and who could possibly abandon the questionnaire due to frustration with IT terminology. Although fairly warned against online questionnaires and their response rate, an online questionnaire was created along with the traditional method.

The total combined population size of both institutions was estimated to be at around 1000 permanent or fixed term employees. It was believed that most of the population have access to some form of mobile device or smart device.

1.6.3.2 Measuring instrument

To accomplish the research objectives of this study, qualitative data was collected from the results of semi-structured interviews. Quantitative data was collected from the results of an online questionnaire that was sent to departmental heads, secretaries and e-mail groups to reach participants. The interview questions and questionnaire questions were formulated to promote independent responses from the individual participants. The measuring instrument was designed not to reveal any sensitive personal or institutional information. The researcher had no control of or had any means of identifying individual participants, participating in the online questionnaire. For the purposes of qualitative data collection, the researcher was required to make contact with the chosen participants. However, personal information did not form any part in the analysis and this was clearly communicated while participants were required to sign an informed consent document.

Furthermore, the purpose behind the research approach and research instrument was to simulate real-world scenarios that would serve as a means to provide purposeful recommendations to IT leaders interested in the topics covered in this study.

1.6.3.3 Statistical analysis

The statistical analysis was facilitated by relevant institutional research and support units available to the researcher. The available software to produce statistical data for analyses was Statistica and IBM SPSS.

1.6.3.4 Ethical considerations

Working with human participants in research always raises ethical issues. Therefore ethical precautions were made in the form of an approved ethical clearance number, an informed consent document for semi-structured interviews and questionnaires. All participants had the option to opt out or refuse participation. Ethical clearance was obtained from both institutions. The following ethics numbers were obtained as proof of clearance;

- EMS15/02/26-1/09
- 201510.21.5.4

For the purposes of qualitative data collection, the researcher was required to make contact with the chosen participants. Participants were required to sign the informed consent document, and were also allowed to opt out should they feel to do so at any time. No personal information was analysed or discussed. An informed consent option was also made available with regards to the questionnaire; online participants received informed consent details, relevant project information related to the study, and project staff details. Participants were then given the option “Do you want to participate in the questionnaire?” where after they could either select Yes or No. Should the participant have selected No, the participant was directed towards a “Thank you” screen, where after they could close their browser window.

1.7 LAYOUT OF THE STUDY

The mini-dissertation was divided into four chapters, which will be presented as follows:

Chapter1: Introduction and overview

Chapter 1 intends to provide a general orientation to the scope of the study. The motivation for the study and its importance will be stated. Set research objectives will

reflect the objective of the study. A broad overview of the research methodology will be provided by focussing on both the literature study as well as empirical findings.

Chapter 2: Literature study

Chapter 2 will focus on providing an introduction to the topic and will provide clarification of the concepts and factors relevant to the study and the Bring Your Own Device phenomenon including alternative approaches to mobility such as CYOD and COPE.

Chapter 3: Empirical study

Chapter 3 intends to address the research methodology used throughout the study. The research objectives will be stated. The target population, sampling procedures and sample sizes for support and academic staff will be indicated. The design of the research instrument and the collection of data will be discussed. Consideration will be given to the processing of data by means of statistical analysis. Actions taken to ensure validity and reliability of the research will be explained. The role of research ethics and other factors will be explored.

Chapter 4: Conclusions and recommendations

Chapter 4 will provide a conclusion to the study. Recommendations based on the literature and empirical study will follow. Future research options will be identified. The limitations of the study will be reflected upon and finally the value of the study will be considered.

1.8 CONCLUSION

The exponential rate at which technology has advanced especially the consumer technology market and the impact thereof within institutions has been the primary motivation behind this study. These technology advancements bring constant change in the form of trends and phenomena such as the consumerisation of IT and BYOD. In the past organisations, companies and institutions were faced with managing how ICT works for them. Standardisation and governance frameworks were developed through the years that provided guidance on how to efficiently, and effectively balance IT service delivery and support through the most cost effective means.

Currently with the advancements in mobility and smart mobile devices organisations, companies and institutions have been forced to adapt to the inevitable user/employee requirements that accompany these trends. Where organisations, companies and institutions in today's highly competitive markets are required to be innovative to retain its market share, strategic intervention is needed to accommodate these hard hitting current trends. The development of flexible strategies that is sustainable to soften the blow of future trends such as BYOD would be the ultimate goal.

The aim of this study was to identify factors for IT leaders to consider who are faced with the initial decision making and strategic formulation stages of BYOD. In order facilitate the strategic development and goals that accommodate trends such as BYOD. Determine how advanced the trend already was within the different institutions, and how it was managed. Identify likely business divisions or functional areas within the institution that will benefit from mobility and own device usage, which could promote innovation and competitive advantage.

1.9 CHAPTER SUMMARY

This chapter serves as an introduction to the purpose of this study. Firstly, a general introduction was presented towards introducing the main concepts and terms such as BYOD and IT consumerism. The intent was to briefly familiarise the reader with the concepts and topics that were covered throughout the remainder of the study.

Secondly, an attempt was made to prove the importance of the study and the disruptive impact these emerging technology trends impose on organisations in general. The problem statement was discussed concluding that the aim was to study the BYOD phenomena within higher education institutions, to set the scene for the remainder of this study.

Thirdly the primary objective of this study was introduced along with the secondary objectives. The secondary objectives were derived from the need to establish whether strategic intervention was required at higher education institutions in support of the primary objective. The primary objective was to recommend a framework to facilitate BYOD strategy formulation.

Fourthly, the research methodology and approach was introduced to reveal the intended research methods and instruments used to purposefully conclude the study. Lastly, a proposed layout of the study was developed to reveal the structure this study intends to follow.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

The purpose of this chapter was to provide an introduction to the main concepts and ideas covered by this study, which includes IT consumerism and the topics related to BYOD and its alternatives. The intent was to give clarification of the BYOD concept and the opportunities and challenges organisations and institutions face in preparing, planning and implementing BYOD. Furthermore efforts were made to identify factors that are believed to be important in formulating a BYOD IT strategy that aligns with the overarching institutional strategy, vision and mission. The primary objective of this study was to help influential stakeholders such as, IT and institutional leadership with decision making guidelines related to formulating BYOD strategy.

Secondly this chapter aims to explore the impact, risks, opportunities, and challenges IT and institutional leaders are expected to encounter which BYOD has introduced into the IT environment. Since this research will be conducted with higher education institutions in mind, much of the literature will be aimed at the higher education environment. Recommendations will also be presented to the reader, which was sourced from reliable research authorities.

This research aims to advise institutional and IT leaders whose responsibilities involve setting the vision, mission, and strategic direction of the institution, of the factors they should consider for the alignment of strategic goals. These leaders are favourably positioned within the institutional ranks and have access to valuable resources to gather the information needed for BYOD strategy formulation (Tucci, 2011:1).

Strategy alignment is of utmost importance, these leaders have the ability to ensure that IT strategy is aligned with the overarching institutional strategy. It is becoming increasingly important for these leaders to have established partnerships between IT leadership and institutional leadership to develop a collective understanding of what information technology can deliver (Grajek, 2014:18-20).

Higher education institutions such as universities could play a leading role in adopting and investigating new technologies and trends to help determine the benefits and challenges BYOD presents. Higher education institutions are perceived to be favourably disposed towards new trends, especially those that improve teaching and learning. With that being said, higher education institutions like universities compete through innovative teaching and learning programmes, quality and standards of qualifications, and research outputs. Technology has been pushing at the boundaries of traditional higher education business models and has been the cause of learners questioning old teaching and learning methods (The Economist, 2014:1).

Allowing IT departments in higher education institutions to help facilitate quality, innovation and research through new technologies could help realise institutional strategic goals.

2.2 INFORMATION TECHNOLOGY SERVICE MANAGEMENT (ITSM)

According to Ferris (2014:1) “The BYOD Revolution Means ITSM Evolution”. This means that IT responsibilities have shifted from traditional standardised service delivery and support models to be more end-user focused. Consumers are currently faced with an array of new technologies such as mobility, cloud computing, social media etc. This consumer driven shift has influenced IT departments to re-evaluate decisions regarding technology solutions for business needs (Botha, 2013:13). According to Botha (2013:15) “IT service delivery now entails the provisioning of network connectivity and access to organisational resources and content at any time and from anywhere. IT support departments are now expected to provide end-user assistance for multiple devices such as personal computers and laptops, cell phones and tablets with user-owned applications, whilst simultaneously attempting to align IT technologies such as content management, collaboration and social business with good corporate governance.”

Information Technology Service Management (ITSM) is a customer-centric IT management discipline. These users/customers have a universal view of IT services. ITSM in a perfect world is intended to provide high quality services that prioritise customer and business needs when designing IT services in a timely and cost effective manner (Meziani & Saleh, 2010:510). Naturally, it is important to align IT strategy with

the institutional strategic, objectives, vision and mission. IT departments need to determine the institution's strategic goals and priorities, including goals for future growth, employee empowerment, innovative teaching and learning and, technology innovation and adoption. A BYOD implementation should not be pursued just because employees expect to bring their own devices to work. There needs to be a real business benefit and driver such as increased productivity, innovation, financial rewards, competitive advantage and teaching and learning benefits (Ferris, 2014:4).

Further regarding ITSM, there are a number of frameworks and guiding principles designed to complement ITSM such as COBIT, and ITIL. In South Africa, higher education institutions are required to adhere to governance principals such as KING III (Sliep, 2013:26). The increasing pressures in demand from end-user expectations, demanding high quality IT services and support to enhance, institutional productivity and alignment have increased the pressure on IT departments. With new technology trends such as BYOD and the disruptions it causes make it increasingly important for organisations and institutions to utilise best practice frameworks and governance principles (Sliep, 2013:26).

2.3 CONSUMERISATION OF IT

There is a distinctive difference between the terms, consumerisation of IT and BYOD. Gartner defines IT consumerism as the specific impact that the pervasiveness of consumer technologies have on the enterprise IT sector. The consumerisation of IT is not a strategy or something that can be adopted, or rolled out (Gartner, 2013a). Further, quoting from Gartner IT Glossary, Gartner (2013a) "Consumerization can be embraced and it must be dealt with, but it cannot be stopped."

BYOD can be viewed as an effect of the more general phenomenon of IT consumerisation. In BYOD, not only are consumer devices used in the workplace, they are ultimately under the control of the user and not the IT department, organisation or institution. The need for IT leaders to manage these devices from an organisational or institutional perspective, while allowing users to act as owners of their devices, is the main difference between BYOD and the broader concept of the consumerisation of IT (Samsung, 2013:5).

Recent developments surrounding IT consumerism indicate attempts to utilise the mobile smart device trend as a resource that is universal, flexible, responsive and scalable (Ravindran, *et al.*, 2013:1). It is about the consumer choice, which includes all stakeholders, from the institutional executive down to institutional support functions, not excluding the educator or trainer who facilitates teaching and learning through taking advantage of new technologies. Users in all types of organisations and institutions are bringing consumer devices to work, and when they do, most expect access to business applications and information, not just the internet. As briefly mentioned in Chapter 1, users require an internet enabled network connection to enjoy full functionality of these devices.

2.4 BRING YOUR OWN DEVICE (BYOD)

The phenomenon of consumer grade personally owned smart mobile devices originated from the release of Apple's first iPhone in 2007, which was designed with a multi-touch interface (Kim, 2011:1). Noticeable changes and fierce competition in the technology sector or rather smartphone industry have been visible since 2007. For example, Google's introduction of their android operating system, Hewlett Packard's acquisition of Palm Inc., and Nokia Corporation joining forces with Microsoft to host Windows 7 on Nokia smartphone devices (Kim, 2011:1). Other user preferences and devices should also be taken into account, such as other computer operating systems for example Linux and its various versions, Apple OS and applications etcetera. Peripherals such as presentation devices, external drives and recording devices can also be considered mobile devices, however not smart devices. These devices can "travel" with the user and can be used with other devices between work and home environments.

What makes BYOD such a force to reckon with and why does it seem unavoidable? Global smartphone sales reached 472 million units in 2011 and 515 million units in 2012 with projected future shipments estimated to reach 1.1 billion units by 2015 (Gartner, 2012:1). These projections were surpassed in 2014 already with sales of smartphones to end users which totalled 1.2 billion units (Gartner, 2015b:1). The significance of these figures indicates the number of smart phones currently in circulation that users need to be connected to either a cellular service provider, home or workplace network to enjoy full functionality.

Furthermore, Smartphone shipments to Africa and the Middle East according to a press release from International Data Corporation IDC grew at an unprecedented rate of 83% in 2014 (IDC, 2015:1). A significant statement made by Gartner in a press release states that; estimated global shipments of approximately 1 billion smartphones and tablets to be sold in 2014 will force up to 90% of organisations to support enterprise mobility on personal devices (Gartner, 2012:1). It is important to note that these figures only indicate smartphone sales, and no other smart devices.

Smartphones enjoy the largest market share of all mobile smart devices as indicated in the table below, and is expected to grow.

Table 2.1: Worldwide Devices Shipments by Device Type, 2014-2017 (Millions of Units)

Device Type	2014	2015	2016	2017
Traditional PCs (Desk-Based and Notebook)	277	247	234	226
Ultra-mobiles (Premium)	37	44	57	78
PC Market	314	291	291	303
Ultra-mobiles (Tablets and Clamshells)	226	199	208	218
Computing Devices Market	540	490	499	521
Mobile Phones	1,879	1,905	1,960	2,000
Total Devices Market	2,419	2,395	2,459	2,521

Source: Adapted from Worldwide Devices Shipments by Device Type, 2014-2017 Gartner (2015b:1).

While smartphone sales are expected to grow globally as indicated in Table 1. Other device shipments are expected to slow down or decrease. This is due to users of these devices “extending” their device lifetimes, or deciding not to replace the devices at all

(Gartner, 2015b:1). However, past, current and projected shipment figures as indicated in Table 1 emphasises the current abundance of all types of devices globally. The surging demand by consumers of personally owned mobile devices in all areas of industry has created new challenges and opportunities for IT departments which will be discussed in greater detail later in this chapter. IT departments are generally responsible for the development of an institutional-wide IT strategy and have been pressured to bring the BYOD trend in alignment with institutional strategy, mission and vision statements (Green, 2007:2).

As mentioned before, traditional IT strategies focused on standardising IT equipment, software, and services to deliver a more efficient service to the organisation and its users and to minimise total cost of ownership. Enterprise mobility and BYOD could be seen as a disruption to traditional methods. But is also defined as “an alternative strategy” which allows employees, business partners and other stakeholders to utilise a personally selected and procured client device or devices to acquire access to enterprise applications and resources (Gartner, 2013b:1). These usually include smartphones and tablets, but may also include personal computers external storage devices, cloud storage, presentation devices, recording devices, e-readers and more. This is especially true within a higher education environment where lecturers have been using their own peripherals for years, for example pointing devices that integrate with presentation software external storage devices and more.

A Trend Micro report from 2011 found that, there are various reasons why users choose to use their own devices in the workplace, these included ease of use, convenience, mobility etc., which allows them to integrate personal and work-related tasks (Ferguson, *et al.*, 2011:3). A radical future forecast by Gartner in a press release, (Gartner, 2013c:1) suggests that various companies who support BYOD initiatives will require their staff members to supply their own devices for work purposes by 2017.

2.5 BYOD ALTERNATIVES, CYOD AND COPE

According to (Smith, *et al.*, 2014:1) “While BYOD is a growing trend, there are still legal, cultural and practical barriers in many instances. IT leaders will find it helpful to consider a Choose Your Own Device mobile device strategy to maintain greater control and user satisfaction where BYOD is not feasible.” In a CYOD mobile strategy or program, the

institution still owns the employee's device. However, instead of only supplying a small number of highly standardised mobile devices, a broader selection of operating system platforms and device models is made available to employees (Smith, *et al.*, 2014:6). COPE on the other hand attempts to provide a balance between BYOD and COPE programmes where the device is corporately owned and personally enabled. Although literature resources are limited regarding COPE, it seems that it aims to address some of the shortcomings of CYOD programmes by attempting to separate corporate and private data and information (Wallin, 2015:3).

2.5.1 Choose Your Own Device (CYOD)

As an emerging mobile device strategy, Choose Your Own Device (CYOD) is a likely solution to some concerns or barriers BYOD presents. But it is not considered to be an overall solution. Challenges CYOD presents to IT departments include, an accelerated replacement program versus conventional approaches. Meaning device replacement plans running at the cycle speed of the consumer market (Smith, *et al.*, 2014:2). This approach takes the traditional institutionally liable IT program and extends it to a broader range of supported devices which could be extremely costly (Smith *et al.*, 2014:2). In the traditional IT standardised approach, the employee would have little to no choice in their preferred device of manufacturer and model. With CYOD, the employee gets enough choice to find a satisfactory model, even if it might not be the exact device they would choose on the open market. The result is lower overall cost and reduced complexity versus full BYOD, at least for those who would traditionally qualify for an enterprise device (Smith, *et al.*, 2014:2).

Theoretically, CYOD programs can provide an alternative that still meets user demand and expectations for greater choice, without many of the problems associated with BYOD. The institution, could within certain limits, buy a device of the user's choice but retain ownership in order apply a level of control for manageability and security (Smith, *et al.*, 2014:2). However it should not be seen as a total replacement for BYOD. Institutional and business needs have to be taken into account including departmental and employee roles. BYOD makes sense in some areas where CYOD would make sense in other areas. The two strategies or programs could coexist (Smith, *et al.*, 2014:2).

2.5.2 Corporate Owned/personally Enabled (COPE)

Corporate Owned Personally Enabled (COPE) is a term frequently used to describe situations where the organisation is paying for the device through a CYOD plan, but also explicitly or implicitly allowing reasonable personal use and customization of the device. In layman's terms employees are supplied a phone chosen and paid for by the institution, but they can also use it for personal activities. CYOD programs that are extremely strict regarding personal use of mobile devices or end-user selected apps on the device usually result in alienating end-users to the extent that they start carrying two devices. The corporate device used exclusively for work and a personal device used for whatever else. While this separation of concern initially sounds attractive to IT support departments, it could also result in the corporate device being ignored or switched off after working hours. COPE has its drawbacks; where in a COPE programme end-users have concerns regarding their privacy, since IT has ownership, visibility and control of certain functions on the device (Wallin, 2015:3).

2.6 BYOD IN EDUCATION

2.6.1 General

Education is one of the leading forces in the market driving the implementation and adoption of BYOD (Bradford Networks, 2013:3). The BYOD model made its initial appearance at academic institutions, where students with a knack for technology pressured institutional leaders to accommodate their connectivity needs. It was soon recognised that allowing network access to personal devices had potential in terms of competitive advantage. In higher education, BYOD has become part of the fabric of student life (Bradford Networks, 2013:3). An online survey conducted by Trend Micro in June 2011 found the following areas of industry to reflect high BYOD adoption rates, education at 80%, medical at 69% and business services at 67% (Gerlati, 2011:1). Currently students in schools and higher education institutions are the future employees of all different facets of industry and therefore, it is crucial to investigate and determine the challenges, opportunities and trends that are present in the current teaching and learning environment. Thus insuring competitiveness between industries and academic institutions and also developing a competitive and equipped future workforce.

Notably smartphone ownership nearly doubled amongst undergraduate students from 55% in 2011 to 62% in 2012 (Dahlstrom, *et al.*, 2013:6). This is an indication of the growing popularity and interest in BYOD specifically in higher education environments. Mobile devices currently plays a substantial role in student life, where it is used frequently between lecture halls, laboratories, and all across campus in modern innovative areas specifically created for online learning and collaboration (Bradford Networks, 2013:3).

2.6.2 South African context

In a South African context, being a developing country, findings from a survey by Effective Measure, who is a leading provider of digital audience, brand and advertising effectiveness measurement and targeting solutions. In their South African Mobile Report of August 2014, they surveyed 5113 Internet desktop users and found the following (Effective Measure, 2014:2);

- 9 out of 10 South African desktop Internet users access the Internet via their smartphone.
- 21% of smartphone owners do banking and online purchases with their smartphones.
- 35% of these desktop internet users own specifically Apple iPads and Samsung Galaxy tablets (well-known brands).
- Social media is the third most popular activity by South African smartphone users. After email and instant messaging.

Amongst these internet users the survey also revealed that around 65.7% has data plan subscriptions with their respective service providers. More relevant to this study, survey results indicated that around 34.3% of participants chose to access the internet via their smartphones only when free Wi-Fi is available (Effective Measure, 2014:4). As mentioned, instant messaging and email are the most common activities amongst South African smartphone users. The image below provides more detail with regards to different device usage trends.

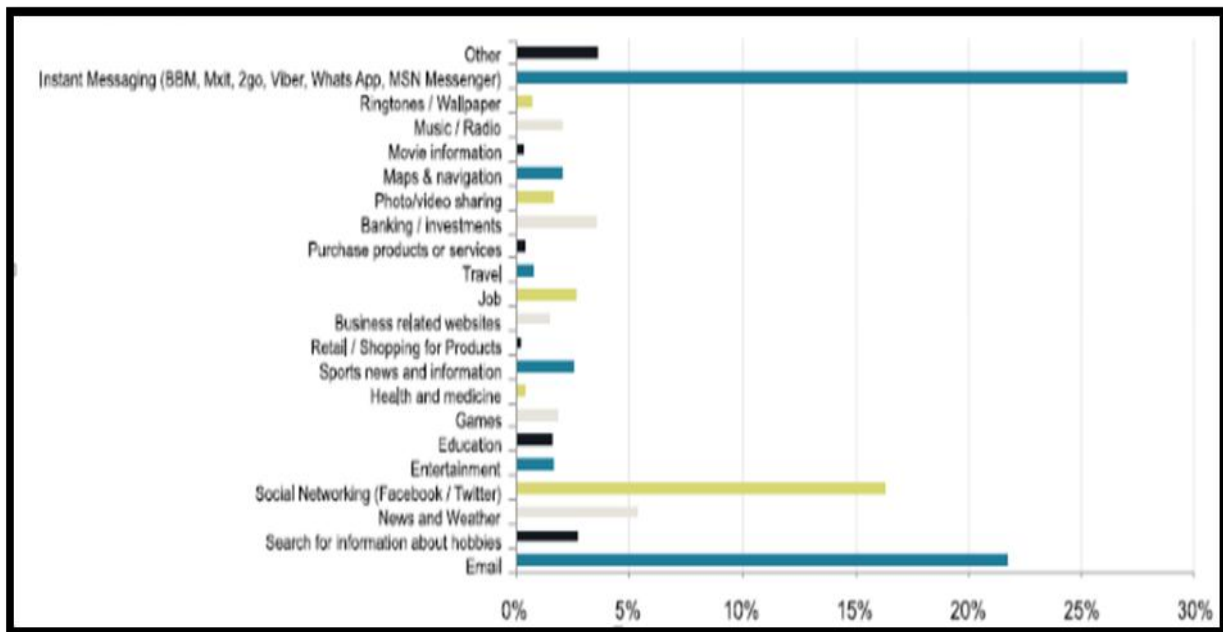


Figure 2.1: Activities mobile phones' browsers are used for

Source: Adapted from Effective Measure (2014:11).

A similar study was conducted by World Wide Worx, whom is an independent South African technology research and strategy organisation, with research focusing on technology in business strategy. The following findings were adapted from their partial executive summary reports available online. Their full research reports could not be obtained due to the high purchase cost, and the reports not being available through the university's online libraries. In their executive summary of the 2015 report on the South African Social media landscape they reveal the following;

A significant finding that, of a total of 11,8 million South African Facebook users which accounts for 22% of the population, 8,8 million users access it via their mobile phones (World Wide Worx, 2015:2). Although this study is not interested in the social media landscape, it is an indication of the possession of mobile smartphone and smart devices in circulation in South Africa. An earlier study conducted by World Wide Worx released in 2014, suggests that mobile network service providers are seeing a decline in voice sales, finding that younger users are leading the change towards increased data sales. Students and entrants into the workforce between the ages of 19 and 24 prefer to spend money on data rather than voice (air-time) (World Wide Worx, 2014:1). This finding is relevant for the purposes of this study as it indicates smart device users/owners need to

have an Internet connected device to obtain full functionality to device features and applications. One can also assume that these users would prefer to connect to a more cost effective option to gain internet access such as institutional Wi-Fi networks.

Further analyses of the World Wide Worx 2015 report by TechCentral, an online resource which is a member of the Interactive Advertising Bureau (IAB SA) found the following. The survey indicated that Wi-Fi hotspots are student's most preferred form of connecting to the internet and online resources, further indicating that their campus was the most prevalent location for connecting (TechCentral, 2015b:1). More importantly 25% of student respondents indicated that, they allow their smartphones and social networks to have priority over studying for tests and exams (TechCentral, 2015b:1). However, the vast majority, 9 in 10 students reported that technologies such as smartphones, Internet resources and social media help them research more efficiently. Another 67% of student respondents said it helps them acquire knowledge of the subject they are studying (TechCentral, 2015b:1). Other strong benefits revealed in the report were that it helped collaboration and the sharing of information, and creating a medium or platform for discussions with lecturers and groups (TechCentral, 2015b:1).

Regarding this study, the above should paint a fairly clear picture of smart device usage in South Africa, especially taking into account academic institutions. These indicators show that there is a clear need for BYOD especially by young individuals at undergraduate level or young individuals entering the workforce. From a higher education and institutional perspective it also indicates the need for strategic IT intervention. For example, reviewing current educational content delivery methods used by academics to keep students engaged.

2.6.3 Facilitating Teaching and Learning

To continue from the previous point, and keeping in mind the usage patterns, and devices being used by current students and new workforce entrants, BYOD can facilitate teaching and learning in different ways. Content can be shared and delivered to various mobile devices through a mobile web browser, a custom application or client that is installed on the device. The innovative use of mobile applications is replacing traditional teaching and learning methods including textbooks with new collaborative models (Bradford Networks, 2013:4). Interactive teaching and learning environments

are being created by academic staff members, and even students as they use their personal devices, applications and cloud based technologies more regularly (Dahlstrom, 2013:7-8). The increasing use and availability of mobile devices and technology being used for work-related and educational purposes make BYOD unavoidable (Dahlstrom, 2013:7-8). BYOD brings with it exciting opportunities, and at the same time it creates challenges for institutional IT departments who are required to strategically facilitate the drive and manage the service (Bradford Networks, 2013:4). These challenges will be discussed later in this chapter.

2.7 CHALLENGES AND OPPORTUNITIES IN GENERAL

2.7.1 Overview

The relentless development of mobile technologies has accelerated the change in the traditional relationship between IT departments and end-users. Historically, IT departments had the exclusive technical expertise and experience to know which technologies were both feasible and useful, whereas users did not. IT departments had the tools, time and authority to establish and develop the required management and monitoring infrastructure to support enterprise technologies. However, IT departments no longer exclusively have the tools, time or authority it had in the past (DeBeasi, *et al.*, 2012:1). Ready to use, easily accessible and affordable technologies allow Bring Your Own Everything (BYOE) as a standard concept for the modern enterprise IT environment (Dahlstrom, 2013:7-8).

Some organisations perceive BYOD to be a strategy for cost reduction, financial gains and productivity enhancement. While IT departments and security specialists consider the potential disruption and risks BYOD may introduce to the organisation and the lack of control over its data, potentially leaving sensitive areas highly exposed to security threats. End-user expectations for support increases due to the enormous growth in the volume and variety of devices, platforms and applications (Ravindran, *et al.*, 2013:4).

The trend in smart mobile devices has empowered owners of such devices and radically increased their technical knowledge and skills. Interestingly, current end-users often have a better sense of which mobile products and services are feasible in their work role to some extent more than IT departments, the exponential growth in IT

consumerism, end-user expectations and sophistication has resulted in a powerful force for change (DeBeasi, *et al.*, 2012:6).

It is therefore necessary for IT leaders have to find purposeful solutions to support the technological surge. However, IT department's first need to be fully aware of and understand user expectations with regards to own device usage and also where the challenges as well as the opportunities reside.

2.7.2 Business / Industry perceptions of IT

A popular management theory "structure follows strategy" as proposed by historian Alfred Chandler comes to mind. Current BYOD research seems to focus primarily on pure ICT related challenges and opportunities and barely focuses on the bargaining power of IT departments and/or IT leaders within their respective industries to formulate strategy. These entrenched perceptions of IT could prove to be a challenge in terms of strategy formulation. However the opportunity in this case could be changing perceptions of IT through proving the value of IT as a strategic enabler with the implementation a successful BYOD strategy.

IT leaders tend to prioritise the delivery of IT services over profit, innovation and growth. For example, IT leaders are twice as likely to prioritise IT service delivery over transforming IT from a cost centre to a profit centre or investing in new technologies. This entrenched organisational or institutional perspective from other internal business leaders may act as a restraint on those IT leaders looking to pursue growth (Deloitte, 2014:11).

Technological innovation and trends are changing the way businesses operate; firms have the opportunity to align their operating models and strategies to reflect the emerging digital economy. IT leaders are regularly associated with maintaining core IT systems for businesses, but a key question is whether they should also take more responsibility for harnessing technology innovation to drive business growth (Deloitte, 2014:4).

In the current competitive business environment, there is constant pressure to demonstrate and support business growth, a lot is to be gained from forming strong relationships or partnerships with business leaders. Business leadership's attitude to

risk is the biggest constraint in making riskier IT investments for innovation and growth (Deloitte, 2014:17-23).

In short, it is highly unlikely that any strategy or initiative will succeed without proper partnerships, executive backing and constant stakeholder engagement.

2.7.3 Perceived industry wide factors

The following are regularly encountered challenges and/or opportunities that enterprise mobility and BYOD present which general industry and higher education institutions are more likely to focus on.

2.7.3.1 Governance

The definition for IT governance is in most cases defined as follows. "IT governance includes the people, processes, and structures necessary to guide decision making around technology issues" (Grama, 2015:1). IT governance consists of relevant decision making processes that ensure the efficient and effective use of IT. IT governance should effectively enable an organisation or institution to achieve its planned strategic objectives. The intent of effective IT governance programs is to ensure that technology focused initiatives, strategies, and policies align with institutional objectives (Grama, 2015:1).

Further, related to IT governance is the term Information Governance and the Protection of Personal Information (POPI) (Act 4 of 2013). The protection of personal information is a requirement of the King III Act. All companies and/or Institutions regardless of their size, and/or industry segment are expected to treat personal information as an important business asset (IT Governance Network, 2010:1). In short, the constant advances made in information and communications technology are not without a growing number of risks and dangers to institutions and the rights of individuals (IT Governance Network, 2010:1).

The significance of information governance with regards to this study was that, more data and information is stored on computers and mobile devices than ever before due to the emergence and constant development of the electronic and mobile environment (Coetzee, 2015:2). Furthermore, Coetzee (2015:2) reasons that "the organisational

environments are now enveloped by “Big Data”, via processes such as enterprise resource management, group application software and so forth.” It is therefore important that institutional leaders are aware of the legislative requirements the institution needs to adhere to regarding decision making processes surrounding the formulation of new IT strategies.

The general decision making authorities and levels of collaboration from these will vary based on each institution's culture, but all IT governance programs should include a broad base of stakeholder input (Grama, 2015:1).

The following are components of IT governance programs as suggested by Grama (2015:1) for EDUCAUSE.

- Decision-making and advisory bodies at different levels of the institution or organisation such as board of trustees, Management counsels which includes academic staff members, campus-wide project units etc.
- Resource management (technological, financial, and human resources)
- Project portfolio management
- Service portfolio management
- Institutional data standards and management
- Risk management
- Regulatory and institutional policy compliance oversight

IT leaders and their respective teams need to effectively evaluate the risks, challenges and/or opportunities. In addition it is essential that they receive input and collaboration from executive stakeholders, and the general population of institutional stakeholders. Thus highlighting the need for IT departments and IT leaders to be perceived as partners in terms of organisational structure, as mentioned in 2.5.1.

IT Governance in South Africa, specifically in higher education institutions are required according to the Higher Education Act (101 of 1997) to adhere to good corporate governance and accountability as any other organisation. This is because the act constitutes that a public higher education institution is classified as a legally independent corporate institution. Therefore the highest management bodies of

universities and institutions deemed higher education institutions must ensure that the institution applies to the content and recommendations of King III (Botha, 2012:16-18). IT governance is incorporated in Chapter 5 of King III which states the following according to King III (quoted by Botha, 2012:22), “Effective IT frameworks and policies, as well as the processes, procedures and standards that these involve, should be implemented to reduce IT risk, deliver value, ensure business continuity, and assist the company to manage its IT resources efficiently and cost effectively”

COBIT, ITIL, the Value IT Framework (Val IT) and the ISO 38500 standard are mainly IT governance related standards, frameworks, and recommended best practice publications. These frameworks provide and assist different ICT focus areas for governing its operations (Botha, 2012:22-23).

Further to the above mentioned, other cooperative governance, inter-institutional governance structures such as the Higher Education South Africa (HESA), its communities of practice and the Association of South African University Directors of Information Technology (ASAUDIT) have also been created, however these structures are not required in terms of the Higher Education Act (Botha, 2012:17).

2.7.3.2 Infrastructure

A suitable definition in layman’s terms for what IT infrastructure entails, is the following by Technopedia (2010:1): “IT infrastructure refers to the composite hardware, software, network resources and services required for the existence, operation and management of an enterprise IT environment. It allows an organisation to deliver IT solutions and services to its employees, partners and/or customers and is usually internal to an organisation and deployed within owned facilities.”

For the purposes of this study, infrastructure was deemed to include the wireless local area network (WLAN) technologies such as Wi-Fi access points (AP’s) and cellular equipment/towers, which is the foundation upon which mobile solutions are built. Furthermore, infrastructure also includes wired network technologies (LAN and WAN), and other physical infrastructure for example server infrastructure. The infrastructure of an organisation is considered to be the centre of its wellbeing. Wi-Fi is perceived as a necessity rather than a ‘nice-to-have’. Wireless technology has increasingly become the

basic requirement of institutions as mobility and BYOD evolve (DeBeasi, *et al.*, 2012:4-5).

2.7.3.3 Security

Enterprises still protect corporate data by controlling the endpoint, but it may not be as easy to place controls on the endpoint in a BYOD environment (DeBeasi, *et al.*, 2012:8). Current mobile trends have not changed the traditional types of information security risks that enterprises are confronted with. Institutional IT departments have only limited control over the hardware and software which employees own on their personal devices. Risks such as malicious software, loss/theft of intellectual property and physical security (theft) of devices have existed prior to current mobile trends. Mobile devices are mobile, compact, lightweight and are easily lost or stolen. They can become a channel or distribution method for malware, viruses and rogue apps unless data is encrypted. Information and data is susceptible to interception especially when the user is on a public WIFI network (Ferris, 2014:17).

The freedom and choice mobile device users have and the ways in which the devices are used creates security risks. Haphazard application installations and improper security updates may lead to devices being more susceptible towards traditional and new threats. Compared to devices that are procured by the institution on which the institution can enforce controlled policies, standards and access control. Haphazard management of BYOD could expose corporate networks to virus, malware and other threats whenever infected end-user devices are granted access to connect to the institutional network without the necessary intrusion prevention, access and authentication controls on the organisation or institutions enterprise network (DeBeasi, *et al.*, 2012:8-10).

Other challenges introduced by BYOD include abundance of operating systems, short device life cycles, and management and security tools that has not reached maturity in the market (DeBeasi, *et al.*, 2012:6-7). Similar, research concluded that organisations need better, more integrated options and solutions for managing threats and risks originating from their own and employee devices that are accessing enterprise resources. These technology options or solutions should contain the full spectrum of protection layers: policy, user awareness, management and technical controls

(Johnson, 2012:14). Interestingly, user education and empowerment seems to be an effective method of controlling BYOD risk, second to access control and authentication controls (Johnson, 2012:11).

2.7.3.4 Technology alignment (Device types, applications, operating systems)

Mobile users such as employees, customers and partners increasingly expect to be able to integrate their personal and professional information on their mobile devices. Nowadays Work flexibility is a necessity, not an option and the flexibility on offer to work and play anywhere is desirable. As a result, institutions are required to procure or develop solutions that enable employees to access institutional data, applications, information and even social media platforms. User expectations are becoming increasingly refined and more complex forcing organisations to acquire and/or develop applications that deliver a controlled and secure end-user experience (DeBeasi, *et al.*, 2012:6).

Leading smartphone and tablet brands, like the Apple, Samsung, and Blackberry devices are preferred in terms of support on the relevant networks. It is easier to allow the most popular/mainstream brands on the network, as they are popular and the most used, with support from manufacturers (Bradford Networks, 2013). Therefore ITSM support models can be formulated around the most popular mobile devices on the market. Different levels of support could be proposed and regularly re-assessed. The following is an extremely simple approach to delivering support in a BYOD scenario and can be vastly improved upon depending on institutional needs.

- **Full support:** Device is well known, tested, with documented specification's which can be supported fully.
- **Limited support:** Device is known, new, with documented specification's, but not tested, IT management can dictate how much time should be spent on limited support efforts.
- **No support:** Unknown or outdated devices, devices from unknown manufacturers, or devices known and tested that does not comply with requirements.

It is critical to ensure that challenges and issues are addressed and planned for, current as well as future challenges. With the exponential rate at which the mobility landscape evolves, a strategic BYOD program must be flexible enough to fulfil institutional operational, academic and strategic objectives and still appeal to end-users (Cavoukian, 2013:9).

2.7.4 Perceived industry wide opportunities

2.7.4.1 Financial

Originally capital expenditure costs are reduced as device procurement, maintenance and data plans are the responsibility of the employee. However these savings may be neutralised by the cost involved in infrastructure, implementation and planning, expansion, application development, and scalability. In addition, employee awareness programs and training, programme management, and compliance issues are other prominent items on the BYOD expense sheet (Ravindran, *et al.*, 2013:4).

There are countless articles, studies and surveys available online, each with different cost, and cost saving findings. The cost of BYOD is likely to vary from institution to institution. Various financial advantages could come from the transition towards electronic communications from a company to an employee, while measurable productivity gains will ultimately depend on the temperament of individual employee or end-user and how much more they are willing to work when all barriers have been removed (Ackerman, 2013:1).

2.7.4.2 Empowerment

BYOD can result in an abundance of additional devices being supported by the institution's IT infrastructure and IT department. User and IT staff empowerment can dramatically improve the quality of the services offered and ease the transition into new technology trends (Ravindran, *et al.*, 2013:6). The figure below represents a continual service improvement model with regards to end-user empowerment.



Figure 2.2: Continual Service Improvement Model.

Source: Adapted from Ravindran, *et al.*, (2013:6).

User empowerment with regards to IT BYOD policies is also important and seems to be an effective method of controlling BYOD security risks (Johnson, 2015:11).

The figure below sourced from a SANS White paper illustrates the importance of user education and empowerment.

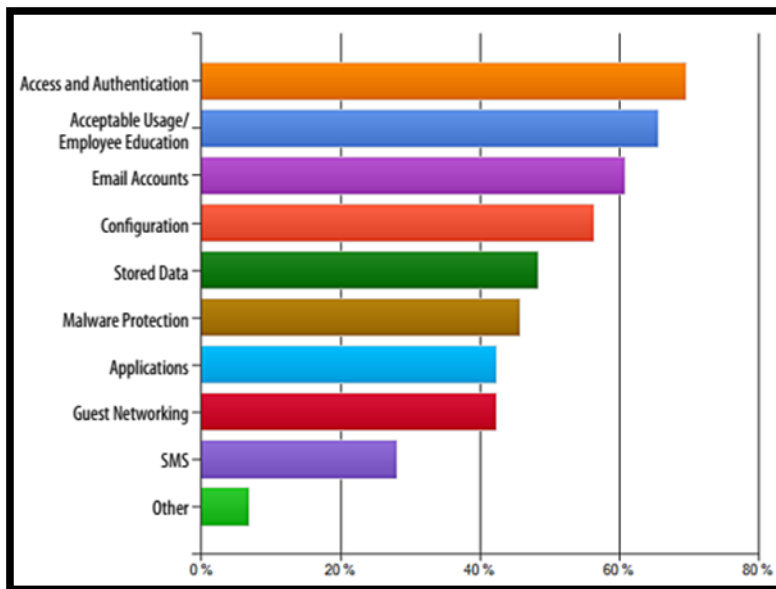


Figure 2.3: Topics Covered by Mobile Policies.

Source: Adapted from Johnson (2015:11)

A large segment of participating enterprises in the study conducted by SANS indicated that they relied heavily on user education as a method of controlling BYOD risk. As much as 73% of participating organisations included BYOD education and empowerment initiatives as part of their policies (Johnson, 2015:11).

2.7.4.3 Professional Effectiveness and Innovation

Mobility has impacted how employees interact with their work environment. Rather than using a single supplied desktop PC to do everything. Employees now have the choice of performing certain tasks on one device and another task on another device. Employees can decide on using the best device for the current task (DeBeasi, *et al.*, 2012:10). Employees now work at any time, from anywhere and expect IT services to be available 24/7, contradictory to the historical “normal” working practices of fixed working hours. They often integrate personal and organisational tasks using their mobile smart devices on their own wired and/or wireless networks at home to combine these tasks (DeBeasi, *et al.*, 2012:10-11).

An Intel IT Centre report has shown that employee efficiency and productivity improved by between 20 and 30 percent. The figure below is an extract from a graphic representation from a study conducted by Intel across four countries.



Figure 2.4: Top Benefits Expected from a BYOD Programme.

Source: Adapted from Intel IT Center (2012:7)

The challenge is for organisations to ensure that the user experience is not affected. As user experience impacts productivity and innovation, this in itself has become one of the toughest challenges facing IT departments (Ravindran, *et al.*, 2013).

2.8 CHALLENGES AND OPPORTUNITIES IN HIGHER EDUCATION

2.8.1 Overview

The challenges and opportunities in higher education institutions is much the same as those faced by industry in general which was discussed in the previous section. This section intends to explore factors more closely more specific to higher education institutions.

EDUCAUSE annually publish a top ten list of relevant IT issues in higher education institutions. As reflected in the 2012 Top Ten IT issues list, “supporting the IT consumerisation and BYOD”, trends were ranked in second place on the list (Grajek, 2012:39). This issue moved to the eighth position on the 2013 Top Ten IT list, placed first in 2013, was “leveraging the wireless and device explosion on campus” which is directly related to BYOD (Grajek, 2013:34). In 2014 “Addressing access demand and the wireless and device explosion” was ranked in position number 7 (Grajek, 2014:12). Most recently in the top ten issues, 2015 BYOD related issues featured in positions two, seven and eight. What is interesting is that BYOD issues can be directly or indirectly linked to most issues identified throughout the four years mentioned here. It is a clear indication BYOD is here to stay. Leadership and “soft issues” constantly feature within the top 10 IT issue lists.

2.8.2 Leadership challenge, establishing working partnerships

2.8.2.1 Institutional perceptions of IT

The role and impact of IT in higher education institutions is becoming more and more critical. This perception is often shaped by the role IT has in the development, provision, and support of hardware and software. The wrong perception can create significant barriers to IT leaders working towards a role as a strategic partner. The perceived role of the IT function at an institution could have a direct impact on the strategic effectiveness and development of IT strategies going forward (Educause, 2015:1). This recurring

theme, suggest forming working partnerships between IT leadership and institutional leadership. Establishing sustainable partnerships between IT leadership and institutional leadership and other stakeholders to develop a collective understanding of what information technology can deliver (Grajek, 2014:12). Working partnerships can reveal the true value of IT within an institution. As highlighted in the 2015 article, by (Grajek, 2015:14) “Demonstrating the business value of information technology and how technology and the IT organization can help the institution achieve its goals”. This compliments the establishing of partnerships statement of 2014, and can be demonstrated by a sustainable BYOD strategy. The following advice to re shape the image of IT is recommended (Educause, 2015:1):

- **Campaign for a seat at the top table:** Demonstrate with intent, how IT provides value to all aspects of the institution. The IT leader needs to paint a compelling picture of the value IT brings. Executive peers often have a limited understanding of IT and technological issues.
- **Speak their language:** Often perceptions exist that IT leaders are technologists by trade. Start off by talking about the business value instead of the technology.
- **Coach executive-level staff:** Don't just mentor IT staff, coach non-IT campus leaders, or face significant barriers going forward.
- **Build credibility:** Deliver on the promises you make, take ownership, talk the talk and walk the walk.

The ability to effectively engage with executive and non-executive stakeholders is key. In purposefully using the four points from above as a guide, IT leaders should in theory be able to establish sustainable partnerships.

2.8.3 Challenges influencing strategy formulation

In order for institutions to implement, and support BYOD, they need to consider the following challenges. Please note challenges concerning BYOD are not limited to the challenges listed below, and different institutions might have their own known or unknown challenges in terms of strategy formulation.

2.8.3.1 End-user segmentation, establishing requirements

It is important to understand that there are different segments of users and departments within any organisation or institution with different needs and key performance indicators. The first step in preparing for BYOD strategy formulation is to organise or group your institutions employees into segments (Cavoukian, 2013:8). Identify natural usage patterns, employee location, mobility requirements, and business requirements by segmentation. The following are general segments that cover most business areas;

- Job criticality
- Value derived from mobility
- Data access
- Systems access
- Frequent traveller
- Home office employee
- Day extender
- Field employee
- VIP or other influential staff members

Users within their respective roles within the institution have different needs. It is therefore essential for IT leaders to have working partnerships with other departments/faculties and operational areas within the institution. BYOD strategy formulation should be a central activity carried out by a mobile or BYOD governance committee. If the institution does not have a similar governance committee, it is important to establish one prior to the strategic formulation process (Cavoukian, 2013:9). These committees are typically made up of end-users from each segment, area or division of institutional management, and IT management (Cavoukian, 2013:9). These committees can only be effective through effective partnerships and perceptions of ICT as stated in 2.7.2.

2.8.3.2 IT Infrastructure

Although IT infrastructure has been covered in the previous section some details can still be discussed with regards to higher education institutions. Wi-Fi now plays a prominent role within organisations and has become a necessity rather than being a nice-to-have add-on. Wireless technology has effectively become the minimum requirement of organisations as BYOD is gaining popularity (Baron, 2015:1).

One area that is often overlooked is the deployment of wireless local area network (WLAN) access points (AP's) on institutional campuses to support the proliferation, of mobile smart devices. As Wi-Fi access points can only accommodate a certain amount of users. IT leaders should keep in mind a plan for the growth in student and staff numbers to provide enough access points to accommodate all users (Cavoukian, 2013:10). For the purposes of this study it is safe to assume that the institutions in question have certain infrastructure in place to provide wired and wireless network services to employees and students. However limitations exist with regards to how many devices a wireless access point (AP) can accommodate. The figures below does not indicate how many AP's are available per Wi-Fi hotspot and remains unknown and specific to the institution. A quick Internet search with regards to what wireless facilities these institutions offered confirmed this.



Figure 2.5: Wi-Fi hotspots, Institution A

Source: Adapted from google maps

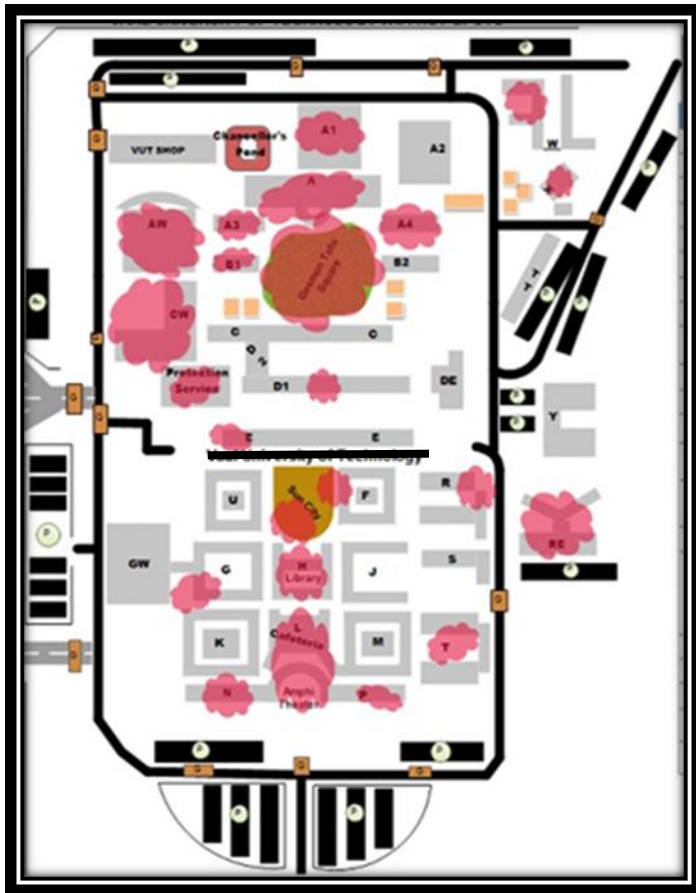


Figure 2.6: Wi-Fi hotspots, Institution B

Source: Adapted from the website of Institution B

2.8.3.3 Technology alignment (Device types, applications, operating systems)

It is increasingly evident that the integration of information and communications technology into higher education is no longer optional but, rather, essential. It is being seen as a component of continuance of delivery environments and methods. A strategy that combines quality and competence in the use of new technologies in education is becoming standard practice (Grajek, 2014:20-22).

Faculty leadership are driven by many varying factors. The overarching factor of whether technology should be integrated and used as a learning tool is decided on whether they believe technology will have a positive effect on students to learn (Grajek, 2014:20). If Lecturers adopt technology it has an effect on students, therefore including all faculty and staff members and not just enthusiasts is important. Students change and

adapt to conditions and trends, it would be wise for faculty to also adapt. Technology enhanced educational approaches yield positive outcomes for students, and faculty members can actually track academic success through analytics (Grajek, 2014:22).

2.8.3.4 Policy development

When deciding upon the notion that a BYOD strategy will exist within an institution, it is essential to establish the acceptable behaviours for both the employees and/or students as early as possible (Cavoukian, 2013:10). Policies must be created and validated with key stakeholders, the institutional business units, governance committees, legal counsel and ultimately the individuals or institutional stakeholders who will be required to comply with the policy (Cavoukian, 2013:11). Mobile policies must be in place and in-line with IT governance guidelines (Sliep, 2013:37).

Due to the rate of change and development in mobile technologies, it is important to manage the policy lifecycle and review the policy regularly to ensure that it meets the needs and requirements of the institution and stakeholders. This task should involve all key stakeholders within the institution (Cavoukian, 2013:11).

2.8.3.5 Security

Security is one of the most common concerns when developing a BYOD program and poses a significant challenge. Managing risk and raising user awareness through policy and empowerment initiatives are critical to any academic institutions well-being. Once again the security challenges are much the same as in the global context mentioned in 2.6.2.3. The freedom of choice in the ways in which the devices are used poses a risk. Haphazard application installations and irregular security updates may lead to devices being more susceptible to traditional and new threats. However, risk management and information security practices in higher education to protect institutional IT resources are a top issue (Grajeck, 2014:12). Severe security breaches or information leakage at higher education institutions could prove to be embarrassing and could affect the institutions image (Shullich, 2011:14).

Further, laptop and/or mobile device theft is a common type of security incident or breach. When considering the significant costs of losing and/or recovering from theft,

data breaches, and possible penalties related to negligence, mobile device security should be considered and dealt with diligently (Cavoukian, 2013:13).

Political factors such as labour and student unrest can also be a cause for concern in terms of IT assets, these include damage to physical IT infrastructure such as IT data centres, fibre optic network infrastructure, Wi-Fi equipment etc. Recent student unrest across South Africa about student fees proves this. The following links are provided in support of this statement.

<http://www.bdlive.co.za/indepth/feesmustfall/>

<http://edition.cnn.com/2015/10/27/africa/fees-must-fall-student-protest-south-africa-explainer/>

Both the above internet links were provided should the reader need background information regarding the student protest actions that were in some instances destructive towards institutional infrastructure.

2.8.3.6 Support

The non-standardised nature of BYOD is the overarching challenge, it will initially cause an increase in the frequency of support calls and user requests. Processes and IT capabilities need to be established early on to ensure adequate support (Cavoukian, 2013:18). End-user segmentation as mentioned in 2.7.3.1 plays a critical role in defining the support levels that will be required as part of BYOD strategy formulation.

Support strategies should through policy incorporate the BYOD environment to address the difference between self-help support and IT service desk support. Empowering lecturing staff, support staff and students to use their own devices and standard university approved devices and applications to optimise the learning environment and managing expectations, clear support models should be developed to accommodate standard and nonstandard devices and services and applications (Grajek, 2014:22).

2.8.4 Opportunities specific to higher education

2.8.4.1 Innovation

Adopting mobile technologies for teaching and learning purposes to maintain competitive advantage is of great importance to higher education institutions. Offering employees and academics the freedom of choice to explore the latest trends in education presents an opportunity with benefits to staff as well as students (Sliep, 2013:37). It is inevitable for institutions keep the pace with technology innovations such as e-learning and BYOD offerings, to use it as a competitive advantage. Business practices have steadily evolved as well, and certain practices are increasingly being viewed as both foundational to any well-run institution and highly relevant to higher education institutions (Grajek, 2013:32).

2.8.4.2 Cost

The objective of BYOD in education should not really be about saving money. According to Sweeney (2012:15), “it is really about delivering education in new ways”. Thus retaining and or promoting competitive advantage. There are countless articles, studies and surveys available online, each with different cost, and cost saving findings. The reality is that the cost of BYOD is likely to vary from institution to institution. In most cases the cost advantages will come from transferring communications related expenses from an institution to an employee or student. Institutions can expect to offset cost savings towards other IT initiatives created by BYOD (Ackerman, 2013:1).

2.9 RECOMMENDATIONS DERIVED FROM LITERATURE

There is no specific solution or strategic framework for institutions to facilitate BYOD strategic implementation. The intent of this study was to explore and identify factors IT managers and institutions should consider. Various best practice models are available for meeting and overcoming BYOD challenges, mostly concerning pure ICT related issues. Although some recommendations have been made throughout the literature review, it will be wise to list the best practices recommended by research institutions such as Gartner and SANS information security training institute.

In order for higher education institutions to realise a sustainable BYOD strategy, which is in alignment with institutional strategy, vision and mission statements certain factors needs to be considered. Many of the available resources emphasise factors concerning pure ICT related issues such as security, infrastructure and, policy development. However, “softer issues” is of significant importance such as employee needs, user segmentation, and institutional management factors. These “soft issues” influence strategy formulation from the start, such as the perceived value of IT, and the position IT holds within the institutional structure influencing its bargaining power etc.

These factors all affect strategy formulation, and they are not exclusive to higher education institutions but in industry in general. For instance, apart from pure ICT related issues, Business Relationship Management (BRM) is critical in the initial formulation of a BYOD strategy (Ferris, 2014:6). BRM is crucial for the purposes of determining overall business needs, in this case, why employees would want to use their own devices. BRM should empower the institution to identify business efficiencies and technology advances that can benefit core business interests (Ferris, 2014:6). Is it just a new passing “fad” or is there a real business driver? If there is not a core business benefit to be gained, or strategic institutional objective to be met why do it in the first place?

The factors, relevant to industry and higher education institutions as mentioned throughout this study can be listed here in short in the following table factors listed throughout this study.

Table 2.2: Factors for consideration affecting strategy formulation

ICT factors	Leadership factors
<ul style="list-style-type: none"> • IT Governance • IT Infrastructure • IT Policy development • IT Security • Technology alignment • IT Cost • IT Empowerment (Training) • IT / Business productivity needs. • IT Innovation 	<ul style="list-style-type: none"> • Establishment of governance committees (Partnerships) • Perceptions of IT and its value. • Bargaining power, position within institutional structure. • End-user segmentation. • End-user / Employee, Innovation and productivity needs. • Cultural environments.

Source: Compiled from the literature above.

2.10 BEST PRACTICES FOR BYOD IMPLEMENTATION

The following are best practices for implementing successful BYOD programmes from results of various research studies conducted (Willis, 2013: 2-17).

a) Define your strategic objectives and ensure executive leadership buy-in

Ensure that executive stakeholders or sponsors are part of your strategic formulation process. It is crucial to secure leadership buy-in for support, financial, legal and human resource requirements to see the strategy through. Support and further stakeholder engagement will be possible with executive leadership buy-in. Thus, by acquiring executive buy-in, broad acceptance by the organisation can be expected.

b) End-user segmentation, define BYOD Users

Define your eligible users and/or business units. The term “eligible” should be used lightly as the intent of BYOD and its alternative strategies is no longer to be perceived as the exclusive privilege of only a few. The opportunity BYOD offers is for every employee to benefit from flexibility, efficiency and improved productivity. Knowing where it will be beneficial as a business diver is recommended. Any end-

user should be considered a stakeholder as key insights can be used and measured.

c) Define your IT policy

For best practice, involve cross functional teams of IT, leader and end-user stakeholders, legal, security, and human resources in the creation of your BYOD policy. Privacy and security is an increasingly valid concern for end-users and institutions alike. Enterprise solutions available to address these concerns, these will be discussed at a later stage in this chapter.

d) Communicating your IT policy

Policy documents in general are often lengthy and populated with legal jargon. Effective policy is measured by user adoption. In ensuring policy compliance and adoption, create a policy document that is understandable (simple), which can be repeated through end user communication and training.

e) Run a pilot program

Even though BYOD might already be managed haphazardly it is wise to identify a pilot roll-out solution. Executive stakeholders and governance committees can identify pilot groups and departments that could provide valuable insights to potential barriers, training and IT readiness.

f) Technology alignment

Decide what to allow and what not to allow, which is why alternatives to BYOD strategies have been developed such as CYOD and COPE. Depending on certain policy factors, an institution can decide how to handle any and all devices and applications or allow approved devices and applications.

g) Define an end-user support

Since BYOD refers to the fact that many devices could be user owned, IT no longer carries the burden of owning the device, and the responsibility of maintaining such device. Best practices tend to lean towards the implementation of a self-service model and offering IT support on all institutionally approved apps for institutional users. In many cases, devices could still be institutionally owned such as in a CYOD

or COPE strategy, where IT support efforts will be increased. A clear policy derived from cross functional stakeholders will facilitate the development of a support model. The combination of BYOD, CYOD, and COPE strategies should be considered.

h) Monitoring

By defining the success metrics of a BYOD strategy in advance by the relevant leadership and stakeholders to align with institutional strategy and goals. The success or failure of the strategy can be measured. Monitoring should begin as early as the pilot stage, continue throughout implementation and after implementation.

In short, have clear institutionally aligned goals from the beginning of a BYOD strategy, since the goal will impact the implementation strategy, governance, policies and other factors. Ensure thorough planning and assessment of factors related to BYOD, as it will have multiple implementation phases and impacts multiple stakeholders. Use caution in calculating potential losses or gains, costs or savings, as have been stated numerously stakeholder input is important. Decide on one, or a combination of known mobility programmes and technologies. Constantly monitor with the intent to improve strategy, goals, user expectations and engagement.

2.10.1 Enterprise Technologies and Solutions.

Enterprises need technologies that can securely accommodate and support mobile device use and facilitate productivity gains, while ensuring that enterprise data is protected. Enterprises should choose solutions based on viability, maturity and security capabilities, and most importantly user experience (Zumerle & Girard, 2015:3).

Unfortunately there is not a single mobile security technology that is mature enough at this stage to address the needs and requirements of the entire workforce. Compatibility issues exist between current mobile security solutions and traditional enterprise solutions to interoperate effectively with existing infrastructure. As a result, a variety of technologies coexist in an enterprise to address mobility and security needs (Zumerle & Girard, 2015:3). Basically, there is no single product that can solve all security and privacy concerns at this stage. Institutions will be required to select the right mix for their

institutional needs, derived from the initial analysis and needs assessment stages of institutional stakeholders.

In the following section, some enterprise mobile security technologies will be covered. The current list of technologies is extensive with many unlikely to feature as mainstream solutions, with low perceived business benefit ratings. It is interesting to note that none of the technologies have reached market maturity as yet.

2.10.1.1 Enterprise Mobility Management Suites

Enterprise Mobility Management (EMM) suites help to integrate mobile devices into enterprise security frameworks and systems. EMM tools are used to perform the following functions for their users (Cosgrove, *et al.*, 2015:1);

- EMM suites configure devices and applications for enterprise use.
- EMM suites have auditing, tracking and reporting functions to audit and track compliance with policies.
- EMM Security or defensive capabilities apply technologies to encrypt data, control the flow of data and remotely revoke user access to mobile applications and information.
- EMM suites facilitate support, enabling IT departments to troubleshoot mobile device issues via inventory, analytics and remote actions.

Although EMM suites are not considered to be a mature technology yet, it seems like they provide very broad functionality across multiple devices and changing operating system platforms. It is expected that enterprises who experience an increasing number of mobile device usage will eventually lead to them using a broader set of features that EMM suites offer (Zumerle & Girard, 2015: 41). Analysts give EMM suits a high benefit rating for enterprises, with current market penetration estimated to be between 20% to 50% (Zumerle & Girard, 2015: 42).

2.10.2 Containerisation (Mobile Containers)

By definition, Gartner identifies two types of mobile containers namely, management containers the focus is on policy enforcement to protect corporate networks and data, and development containers where the focus is on enhancing applications.

Containerisation allows the institution to manage applications and secure associated data, while respecting user privacy, effectively minimising the impact of policies and management activity on user's private and personal applications and data (Rossi, 2014:1). Containerisation effectively separates user digital assets (applications, data and media) from enterprise digital assets. The use of mobile containers provides institutions with a means to deploy apps and distribute data to mobile device users while ensuring security and privacy regardless of app, platform or device (Zumerle & Girard, 2015:31). Analysts give Mobile container technology a high benefit rating for enterprises with current market penetration (enterprise adoption) at an estimated 5% to 20% (Zumerle & Girard, 2015: 31). It is important to note that Mobile containers are meant to function within an Enterprise Mobility Management (EMM) environment.

2.10.3 Enterprise File Synchronization and Sharing (EFSS)

Enterprise file synchronization and sharing (EFSS) refers to a range of cloud-based capabilities. EFSS intends to enable end-users to synchronise and share documents, media and files across multiple devices, such as smartphones, tablets and PCs etc. This sharing of information and media can happen within the organisation or outside of it, for example with partners and customers. Security and collaboration capabilities are the driving aspects for enterprises and institutions to adopt EFSS (Zumerle & Girard, 2015: 49).

EFSS is believed to facilitate higher productivity and collaboration for mobile device end-users who tends to use multiple mobile devices. Organisations investing in EFSS capabilities will in theory enable a modern and collaborative real-time workplace, while reducing or minimising the inherent security and/or compliance risks of personal cloud services. Perceived benefits include cost savings and increased productivity (Zumerle & Girard, 2015: 49). Analysts give EFSS technology a high benefit rating for enterprises with current market penetration at an estimated 5% to 20% (Zumerle & Girard, 2015: 49).

2.10.4 Hosted Virtual Desktops

A hosted virtual desktop (HVD) by definition is a dedicated user operating system run as a virtual machine (VM) accessed remotely on a server. Technically HVD

implementations are made up of server virtualisation software to host desktop or device software. Some reasons to deploy HVDs include the following,

- Enabling or accelerating Windows operating system migrations
- Enabling bring your own device (BYOD) and device choice
- Facilitating the need to deliver on business continuity requirements
- Focus on security and compliance issues

HVD's provide mechanisms for centralising a thick-client PC or device without having to re-engineer each application for centralised or institutional execution. A thick client by definition is a device that can function without being connected to a network, however it is only regarded a client when it is connected to a network or enterprise server. This thick client approach appeals to enterprises due to HVD's manageability and data security functions (Zumerle & Girard, 2015: 52). Analysts give HVD technology a high benefit rating for enterprises with current market penetration at an estimated 5% to 20% (Zumerle & Girard, 2015: 53).

To conclude this section on technologies and solutions that is available to institutions and organisations. It is important to note that there are approximately 34 known technologies and solutions institutions and organisations can choose from when planning, implementing or extending their BYOD strategies. This research has only briefly touched on four of these solutions, which was selected due to the perceived high probability that these technologies could see mainstream adoption in the next two to five years. These four technologies are expected to benefit organisations positively with flexibility and management tools.

More mainstream technologies that have high or legacy maturity levels in the industry have not been listed as their market penetration at this stage is believed to be at more than 50% adoption. These technologies include the following as indicated by (Zumerle & Girard, 2015: 53- 58);

- **Network access Control (NAC).** NAC solutions are used to identify and profile devices, and assess their configuration, therefore controlling device and user access.

- **Mobile Data Protection (MDP).** MDP tools have existed since the 90s to encrypt information and manage protection policies for fixed and removable storage. And more recently to encrypt and regulate access to enterprise data stored on mobile devices.
- **WLAN intrusion prevention systems (WLAN IPS).** WLAN intrusion prevention is the capability to perform continuous monitoring, vulnerability assessments and blocking of wireless attacks. Wireless intrusion prevention has been and will remain important in the original scope of Wi-Fi.

2.11 CONCLUSION

There is no specific solution or strategic framework for institutions to facilitate BYOD strategic implementation. The intent of this study was to explore and identify factors IT managers and institutional leadership should consider before embarking on a strategic BYOD journey. Various best practice models or guidelines are available for meeting and overcoming some BYOD challenges, but it remains mostly guidelines concerning pure ICT related issues. Many of the factors have been discussed throughout this chapter from a general industry perspective and a higher education perspective. The fact that not one institution is the same in terms of culture, leadership, size and other factors, indicates that the process should start with “soft issues”. From the literature it was clear that mobility, BYOD and other terms for the phenomena is unavoidable. Therefore to eliminate a haphazard approach to strategy formulation and implementation, it was suggested that BYOD strategy formulation starts with creating and maintaining business relationships. Stakeholder engagement is essential from executive level downwards in forming partnerships, to ultimately analyse, and interpret employee and business needs and requirements. Having favourable institutional business relationships will enable successful and sustainable strategy formulation that aligns with other institutional strategies and objectives.

Thereafter other factors concerning pure IT related challenges and opportunities can be identified and dealt with, with the institutional culture and related factors in mind. The right technology solution or combination of technologies can then be identified to purposefully formulate and implement strategy.

2.12 CHAPTER SUMMARY

In this chapter the various mobility terms and concepts were firstly defined. An attempt was made to indicate the significant mobile device ownership statistics, figures and projected future consumer mobile growth patterns. Thereafter the focus shifted from providing global statistics and figures surrounding the impact IT consumerism have on global industry, towards the South African context. Further attempts were made to investigate device ownership and usage statistics regarding BYOD in education, specifically higher education institutions. Literature findings indicated a sharp rise in mobile device usage in South Africa, especially young adults. It was discovered through the literature study that current young adults tend to consume more internet data than voice data, indicating that current end-users will use Wi-Fi when the opportunity presents itself.

Secondly the universal challenges and opportunities were defined from literature, again from a global industry perspective where after, emphasis was placed on higher education institutions. The intent was to clearly highlight that the approach to a successful strategy was to start with leadership challenges, and institutional stakeholders, after which the more prevalent BYOD factors should be considered.

Thirdly, recommendations were made from the literature study in an attempt to provide guidelines based on research to overcome certain challenges with regards to BYOD strategy formulation. A best practice framework was presented of findings from influential research advisory firms. Further recommendations were made regarding enterprise technologies and solutions available to industry and higher education institutions. These enterprise solutions aim to provide that measurable and manageable solutions to the various challenges BYOD presents. It is noteworthy to mention that there are many different types of enterprise technologies and solutions available to the market. The researcher intended to recommend the most popular or rather mature technologies and solutions that was available, including enterprise technologies that technology research firms expect to have various business benefits.

CHAPTER 3

RESEARCH METHODOLOGY AND FINDINGS

3.1 INTRODUCTION

This chapter sketches the research methodology, research approach, and findings of this study. The literature review in Chapter 2 of this study provided an overview of IT consumerism and the different concepts and factors that impacts general industry and higher education institutions. Specific attention was given to the impact, opportunities and challenges from a higher education perspective. The focus of this chapter was on the research methodology followed to obtain data to assist in meeting the research objectives specified in Chapter 1.

It became apparent in chapter 2 that BYOD brings with it certain factors for IT leaders and institutional leaders to consider in aiding strategy formulation. The impact, risks, opportunities and challenges were covered to some degree, on order to aid decision making. The abundance of information surrounding the BYOD phenomenon is so extensive that it was a challenge in itself to remain focused on the specific objectives of this study. To put into perspective the disruption BYOD has caused globally. A quick google search of the term Bring Your Own Device (BYOD) retrieved approximately 143 million results.

3.2 RESEARCH APPROACH

It became apparent in the early stages of the literature review that “soft issues” with regards to institutional leadership and management functions played an important role, if not the most important role in formulating strategy. Executive buy-in and institutional partnerships are key components of the initial development stages of any institutional strategy formulation process. Therefore, the decision was made to divide the qualitative and quantitative methods into two phases and deal with them separately. The intent was to conduct the research such that the approach simulates real world scenarios which can be put forward as possible recommendations in Chapter 4. This “real world” approach would reveal shortcomings and limitations in the research methodology that could be addressed in future studies.

The idea was to use semi-structured interviews as a means of making contact with institutional leadership and influential individuals to reveal their opinions and perceptions the BYOD trend. Thereafter, the aim was to include all other stakeholders within an institution by means of a structured survey questionnaire. The intent here was to reveal end-user perceptions and expectations and to engage with stakeholders who are familiar and comfortable with the topic.

In fewer words;

- **Qualitative method:** Semi-structured interviews were conducted by purposefully selecting participants from leadership and/or influential roles within the institution.
- **Quantitative method:** A structured questionnaire, was electronically distributed to institutional employees via group e-mail. The sampling method used was intended to allow for voluntarily or willing participation.

3.3 PROCEDURE AND SCOPE OF THE QUALITATIVE RESEARCH

The empirical study focused on two higher education institutions in Gauteng, located in the Vaal Triangle. The study attempted through qualitative methods to establish how influential individuals experience IT consumerism and BYOD from within their institutional roles downward. Attempts were made throughout the interview to determine their views on IT's institutional role, factors regarded as important for strategic formulation, and opinions on available IT facilities and infrastructure. It was important for the researcher to determine their expectations regarding BYOD to establish whether IT should continue to manage the trend, or if strategic intervention was required.

The semi-structured interviews gave the researcher a chance to formally engage with leadership and influential individuals with the intent of simulating possible real-world scenarios, in order to provide purposeful recommendations to conclude the study.

3.4 PROCEDURE AND SCOPE OF THE QUANTITATIVE RESEARCH

The intent of the online survey questionnaire was to engage with stakeholders across the institution, again to simulate real-world scenarios. The survey was divided into five main themes. The first theme focused on the demographic profile of respondents. Internal institutional demographics are considered to be important as it will facilitate user

and departmental segmentation, one of the secondary objectives. However, Due to ethical considerations, for the purposes of this study it was decided not to request in-depth user and departmental information. The themes that followed were designed to determine the following:

- **Technology comfort and usage:** Attempts to measure how end-users perceive their ability to use and integrate their devices in their personal and work environments.
- **Bring Your Own Device:** Attempts to measure device ownership, expectations towards institutionally supplied equipment and concerns related to policy, privacy, security and infrastructure. Also which resources and features end-users intend to use their devices for?
- **Personal development:** Aims to measure perceived barriers, user empowerment and support.
- **Teaching and learning:** Aims to measure the perceived value BYOD can offer in teaching and learning environments.

The intended purpose of the empirical research was to answer the secondary objectives of this study through the statistical analysis of the data retrieved from the qualitative and quantitative research methods. This information would provide the necessary evidence in support of the primary objective to determine whether an Institution should consider strategic intervention.

3.5 POPULATION AND SAMPLE

Saunders, *et al.*, (2009:212) describes a population simply as a “full set of elements from which a sample is taken”. In other words, the population consists of the total group of potential participants to whom a researcher would want to generalise the findings of an empirical study (Welman, Kruger & Mitchell, 2010:55). For the purpose of this study the population was **permanent and fixed term employees** of Institution A and institution B as indicated in Chapter 1. The total population was therefore estimated to be approximately 1000 employees. Although it is important to calculate sample size to ensure scientific and statistically significant results when utilising quantitative methods, it would not have been feasible in this study. The researcher wished to perform

exploratory research to achieve the objectives in Chapter 1. It would be unfair to assume that the population in question would have been knowledgeable about the general IT terms and technology trends covered in this research. The researcher thus decided to use non-probability sampling methods.

Qualitative research focuses more on the quality of the information gathered rather than on the size of the sample while the goal is not to generalise findings (Saunders, *et al.*, 2009:324). For the purposes of the qualitative research method used, it was decided to take a non-probability purposive sample from the population. The researcher required information from senior level staff members who was familiar with the concepts and terms used throughout this study. Therefore influential individuals known to the researcher was contacted at both institution A and B to develop an initial list of potential participants, thereafter a list was compiled for each institution. Each institution A had six potential candidates, and Institution B had eight potential candidates, each potential candidate were requested to participate via and email invitation. From institution A all six candidates accepted and from Institution B Five candidates accepted the invitation. It was decided to interview these candidates first before considering adding more candidates. Data saturation was visible from the early interviews onwards and the researcher was empirically confident that sampling more data would not lead to any new properties or information being revealed. Therefore no attempt was made to further pursue qualitative research participants.

For the purposes of the quantitative research method, the researcher decided to utilise non-probability convenience sampling. Taking into account the population size and the topics this study covered, it was unfair to assume that everyone in the population would be familiar with the concepts to purposefully respond to the questionnaire. The intent was to allow voluntary participation to ensure that respondents familiar with the concepts and topics complete the entire questionnaire to the best of their ability. At both institution A and B potential respondents were invited to participate by distributing an electronic email request to all members of the population. An attempt was made to spark interest in the population to participate by designing a graphical hyperlink that potential respondents could click on to direct them towards the survey questionnaire. The researcher believed that a graphical hyperlink would draw more interest than text

links which are barely visible in general. The figure below is an example of the graphical hyperlink used.

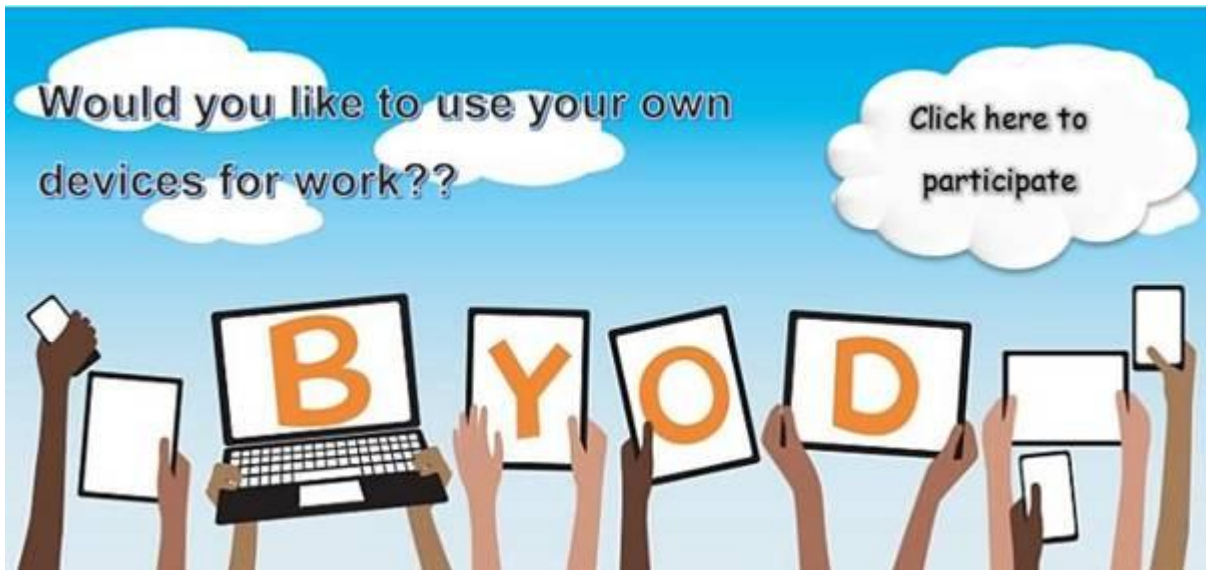


Figure 3.1: Example of the graphic, adapted by the researcher to create a graphical hyperlink

3.6 RESEARCH INSTRUMENT

A mixed-method methodology was selected for the purposes of this study, namely quantitative and qualitative methods.

3.6.1 Qualitative

The **qualitative** research approach is a descriptive form of research and is subjective in the sense that the researcher interprets the data such as the answers from interview questions made by participants in this study (Welman, Kruger & Mitchell, 2010:55). Interviewees were guided through the interviews with a set of standard questions. All interviewees were encouraged to add remarks or comments that they felt was relevant to the discussion. The semi-structured interview questions was grouped into the following four themes;

Warm-up questions:

- **Q1 – Q2:** The role of the department or division within the institution and the interviewee's role within the department or division.

- **Q3 – Q4:** The interviewee's comfort level with IT technology and which technologies the interviewee uses on a daily basis.

Research questions:

- **Q 2.1:** The interviewee's perceptions of their institutional IT department, is IT perceived to be an institutional partner or rather a cost centre?
- **Q 2.2:** The interviewee's understanding of IT consumerism and BYOD.
- **Q 2.3:** Perceptions surrounding whether BYOD is strategically implemented or if it is managed haphazardly.
- **Q 2.4:** Perceived influence on current institutional strategy.
- **Q 2.5 – Q2.7:** Questions related to infrastructure.

Factors concerning BYOD strategic implementation:

- **Q 3.1:** Perceptions regarding factors that influence BYOD strategy formulation. Factors identified in literature namely, infrastructure, governance, policy, security, support, cost and innovation.

Closing Questions:

- **Q 4.1:** Are current user expectations being met?
- **Q 4.2:** Remarks or comments from interviewee's.

The warmup questions were intended to establish basic demographics, technology comfort level and device ownership, and to set the scene for the research questions that followed. The questions thereafter intended to provide findings in support of the primary objective as indicated in Chapter 1. The intent of the qualitative research was to gain perspective from institutional leadership and their perceptions of IT and important factors that influence strategy formulation.

3.6.2 Quantitative

The **quantitative** method has an objective approach and attempts to achieve accurate measurement and analysis; it is also less time consuming (Welman, Kruger & Mitchell, 2010:55). Some questions in the survey will include biographical details, opinions,

beliefs and convictions about and attitudes regarding the BYOD phenomenon. Typical scales like 1=strongly disagree, 2=disagree, 3=neutral, 4=agree and 5=strongly agree or 1=not important at all, 2=not important, 3=neutral, 4=important and 5=very important will be used (Welman *et al.*, 2012:152). However, many questions intend to explore device ownership, usage patterns and intended activities which cannot be measured on typical scales. The remaining questions were intended to test frequency distributions as a simple method to prove the secondary objectives.

The survey questionnaire was grouped into the five sections below:

Demographics:

Intended to segment respondents into the following categories;

- Institution
- Academic or support staff
- Institutional function or division
- Age group
- Daily routine (Between meetings, Behind a Desk, On the road or Lecturing)

Technology comfort:

Was an attempted to measure the perceived comfort levels of respondents using Information Technology. Mobile device usage for personal and work related purposes, and the perceived ability to integrate personal technologies in the work environment.

Bring Your Own Device:

Intended to explore end-user personal device ownership, institutionally supplied devices and which devices end-users would like to own or choose. Furthermore, end-user attitudes and concerns were measured towards bringing and using their own devices and work related activities they intend to perform using their mobile devices.

Professional development:

Intended to measure end-user attitudes towards empowerment, how the institution supports, communicate and enable BYOD and end-users, and also perceived barriers towards successful integration of mobile technology in their roles.

Academic:

Participants who indicated that they were academic/faculty staff members were required to complete two more questions. These questions briefly explored their attitudes towards students using mobile technologies in the classroom and what they perceive students are using their devices for in the class room or on campus.

The intent of the quantitative research was to gain insight from the broader community of institutional stakeholders specifically to provide answers to the secondary objectives of this study as indicated in Chapter 1. The findings from the secondary objectives were intended to support the primary objective in determining whether strategic intervention was required.

3.7 QUALITATIVE DATA ANALYSIS

As indicated earlier, fourteen potential participants were identified from which eleven agreed to participate in the semi-structured interviews, six participants from institution A and 5 Participants from institution B. The sample consisted of various influential **senior members** of staff from each institution that was familiar with the Bring Your Own device concept. The reasoning behind this sample was to align the research approach with recommendations and findings from the literature study in order to provide purposeful recommendations in the concluding chapter. The analysis of the qualitative data from the semi-structured interviews will be split into the four themes mentioned in section 3.6.

3.7.1 Casual information of participants

Section 1: The warm-up questions

The first section intended to set the scene for the research themes and questions that followed. The first two questions explored the role of the department or division within the institution and the interviewee's role within the department or division. Analysis of

the first two questions confirmed that all participants were in fact senior level staff members that occupied the following institutional roles:

- Academic Dean/s
- Directors of IT and institutional support services
- Heads of Departments (HOD's)
- IT Managers
- IT Architects and;
- Senior academic lecturing staff

The remaining two questions intended to explore perceived comfort levels using IT technologies, and personal device ownership and usage. From the eleven (11) participants nine (9) indicated that they were **very comfortable** with ICT technologies, one (1) believed to be an **expert** and one (1) leaned towards being **somewhat comfortable** with ICT technologies.

All respondents indicated that they use a combination of ICT technologies on a daily basis. The technologies that featured the most were in order of preference; Laptop Smartphone, tablet and desktop PC. Interestingly, only one participant preferred using a tablet rather than a smartphone, which resulted in laptop PC's being the most widely used device on a daily basis.

Section 2: Research questions

The second section aimed at gathering valuable information in support of the objectives of this study, especially with regards to executive stakeholder perceptions towards of IT and current IT facilities that would accommodate BYOD integration. One of the questions in this section confused most participants and will not be included as part of the analysis. The question was intended to test the participants understanding towards the differences between IT consumerism and BYOD, all participants had a fair understanding of BYOD. The addition of the term "IT consumerism" confused participants resulting in the interviewer having to lead the discussion. Therefore it was decided to abandon further analysis of the question. The remaining questions of this theme will be discussed, separately analysing each institutions combined responses.

Question 2.1: What is your perception towards your IT department, do you perceive it to be a partner or cost centre amongst other divisions?

Institution A

Four participants perceived IT to be a partner with some elaborating that IT plays an enabling role and is a crucial support function. The remaining two responses indicated that IT should be perceived as an active partner but is currently in their opinion still seen as a cost centre, but with critical importance.

Institution B

The overall perception of the institution's IT department was that it was considered to be a cost centre in its current state. Some of the participants elaborated, one believed that IT is an absent partner; another two indicated that it should be a partner due to its increasing role of enabling institutional core business functions.

Question 2.3: In your opinion, do you think that IT has a current strategy in place for BYOD or is it managed haphazardly?

Institution A

All participants believed that BYOD was managed haphazardly or was not aware of any formal communicated strategy. Three (2) participants indicated that it was managed on an ad-hoc basis as per user request.

Institution B

All participants believed that BYOD was managed haphazardly, participants from the IT department saw BYOD as a disruption and, that attempts are being made to investigate the matter. Another two participants indicated that WIFI usage was being promoted across campus.

Question 2.4: Does BYOD or IT consumerism have a noticeable effect influence or impact within your division?

Institution A

Four (4) participants responded with an outright yes, one (1) participant described that the impact is more noticeable in the classroom and, the remaining participant indicated that it is noticeable to some degree.

Institution B

All five participants indicated that they notice their peers and subordinates increasingly make use of personal devices. Three participants indicated that they believe end-users use their own devices to escape IT support procedures and waiting times.

Question 2.5: Do you find that cellular network coverage is adequate on campus?

Institution A

Five (5) participants did not find the cellular network coverage to be adequate on campus, with one (1) responding that it is adequate depending on your location on campus.

Institution B

Respondents from this institution found that cellular network coverage was in most cases adequate. As a matter of interest, two of the respondents confirmed that there are three cell towers (masts) on campus but due to the layout and close proximity of buildings the signal deteriorates significantly in such areas of the campus grounds.

Question 2.6: Do you find IT facilities regarding network connectivity to be adequate?

Institution A

All respondents (6) indicated that facilities are mostly adequate but that there is much room for improvement between different areas on campus especially lecture rooms (Core business impact).

Institution B

Four of the five participants found that Wi-Fi was not adequate where they are situated on campus, and another felt that Wi-Fi was adequate but not while roaming the campus. The layout and close proximity of the buildings could have a similar effect on Wi-Fi as it has on cellular signal.

Question 2.7: Do you find your Wi-Fi coverage to be adequate, in terms of location and availability (Limited to hotspots or campus wide “blanketed” effect)?

Institution A

All participants believed that Wi-Fi is mostly limited to certain hotspots on campus. Two (2) of the participants indicated that between buildings in close proximity of each other a blanketed effect is experienced due to Wi-Fi signal spill over.

Institution B

All participants indicated that Wi-Fi coverage was limited to certain hotspots on campus. Several participants elaborated that Wi-Fi hotspots can be visually identified by the number of people gathering around areas with coverage. Most participants were aware of current plans to expand the Wi-Fi network within the next year.

Section 3: Factors concerning strategic BYOD implementation:

This section intended to gather information about certain IT factors that will have an influence on strategy formulation, some of the factors discussed in the literature study will feature herein in to support aligned strategy formulation. By finding what factors is perceived to be important from senior stakeholders, participants were asked to rate the following factors and elaborate where they felt necessary. The combined responses from institution A and B will be discussed below from the viewpoints of the individual responses.

Question 3.1: The following factors influence BYOD strategy formulation, would you rate the following important and why?

Institution A

- **IT Infrastructure:** All participants unanimously agreed that infrastructure is critical to facilitate BYOD, and that infrastructure must be compatible with new technologies.
- **Security:** Participants regarded security to be very important, and identifies concerns such as physical device security, theft, information leakage, hacking etc. One (1) participant mentioned that too much security is disruptive, referring to constant authentication between different institutional systems.
- **Support:** Overall, participants regarded support to be very important. Some participants elaborated, one believes that it will place a high burden in IT departments and that policies should define support levels. One (1) participant indicated that users are empowering themselves and should only be assisted to connect their device to the network, after which limited support could be offered.
- **Governance and Policy:** Participants regarded governance and policy to be important. The interviewer sensed a reluctance to elaborate from participants, one participant indicated with intent that policies must be updated to accommodate BYOD. Another two participants admitted that they have not seen or is unaware of current IT policy.
- **Cost implications:** Cost implications are not perceived to be important. Most indicated that savings would be offset against other areas BYOD creates.
- **Innovation driver or not:** Participants believed that innovation is an important driver for BYOD. Most indicated that innovative use of technology will be more valuable for academic purposes.

Institution B

- **IT Infrastructure:** All participants unanimously agreed that infrastructure is critical to facilitate BYOD, and that Wi-Fi infrastructure is the basic need to facilitate BYOD requirements.
- **Security:** Security was regarded as very important, but the majority of participants were more concerned about the physical security of their devices and indicated that

theft was a major problem. One participant added that safeguarding sensitive institutional information should be a priority. Another participant also indicated that current access control seems to be “too secure”, referring to multiple login and authentication requirements.

- **Support:** The majority of participants regarded support to be somewhat important, two participants considered IT support to be important when a problem affects critical systems or a large number of users and/or departments. Another considered supporting students to be more important.
- **Governance and Policy:** In general participants found policy development to be very important to guide users in bringing and using their own devices for work purposes. Several participants indicated that they have never given much attention to IT policies and that new policies should be interesting and needs to be communicated.
- **Cost implications:** Most participants indicated that cost is not that important as long as the core business of teaching and learning can benefit from BYOD. Several participants elaborated that the institution could save by not having to procure devices, but that it could be offset against new requirements created by BYOD.
- **Innovation driver or not:** Participants were somewhat reserved in answering this question although four out of five believed that BYOD would drive innovation but only when it is implemented correctly.

Section 4: Closing Questions

The last section of the questionnaire intended to indicate the end of the interview. The interviewer attempted to conclude the interview with a closing question that could lead the interviewee to further add comments and remarks.

Question 4.1: Do you think that current expectations are being met in terms of BYOD?

Institution A

None of the respondents really felt that current user expectations are being met. One respondent indicated that Wi-Fi access on campus is a move in the right direction.

Another respondent thinks that users aren't fully aware of the fact that they can use Wi-Fi for their own devices, while the rest indicated that services can vastly improve.

Institution B

All participants responded that expectations are not being met, one participant elaborated that, they frequently help each other out or support each other. Another asked whether expectations will ever be met with the current rate of advancement in technology.

Question 4.2: Any further remarks or comments?

Institution A

Two respondents did not have any further remarks and the rest will be listed in the following bullets;

- Two respondents shared the same concern: physical device security should be improved in that theft is a problem.
- Personal and institutional privacy concerns (POPI Act).
- One respondent asked "when will it be implemented because we are behind as an institution".
- Another indicated that BYOD can be nightmare if not managed.
- The researcher finds the following comment valuable, "Not enough integration between institutional departments".

Institution B

Only two participants had further remarks which are listed below;

- Keeping up with the development of consumer devices is a problem for IT departments and infrastructure.
- Proper research must be done before considering BYOD implementation.

3.8 QUANTITATIVE DATA ANALYSIS

As indicated earlier, the intended purpose of the quantitative research was to involve the general population of institutional stakeholders specifically to prove the secondary objectives of this study as indicated in Chapter 1. The survey questionnaire was distributed electronically to all permanent staff members of each institution where after, these employees could choose to partake in the study. The findings from the secondary objectives are intended to be utilised in support of the primary objective in determining whether strategic intervention was required.

The questionnaire was designed with five sections attempting to explore the following;

- User and institutional segments, age and how time is spent at work.
- User comfort levels and ability to integrate.
- Device ownership, usage patterns and concerns.
- User empowerment, needs and barriers,
- Academic perceptions on student device usage and expectations.

It is **important to note** that the questionnaire was designed to be simplistic, in a sense that no complicated IT jargon was used that might deter participation. The idea was to promote participation, limit the likelihood of abandonment and reduce bias in a limited timeframe. As a result, the researcher found that the majority of questions largely produced descriptive statistics that could be effectively analysed through frequency distributions.

Although some attempt was made to produce data to analyse via factor analysis methods, the researcher observed that respondents were likely to pass on to the next “easier to answer” question with a seemingly less confusing design.

3.8.1 Section 1: User and institutional segments, age and how time is spent at work

3.8.1.1 Question 2: Please indicate your institution

Table 3.1: Please indicate your institution

	Frequency	Percentage
Institution A	82	59.9%
Institution B	55	40.1%
Non-responses	2	1.4%
Total	139	100%

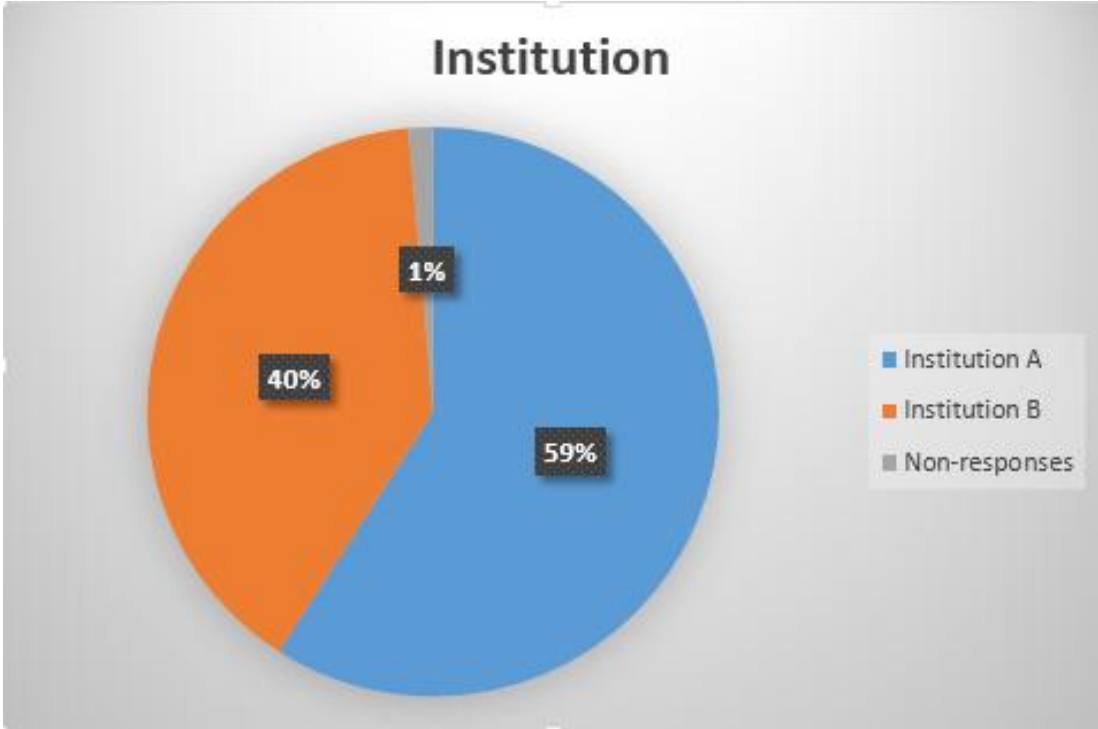


Figure 3.2: Institution

Comments

The first question indicated that the most responses was obtained from Institution A (59%). Institution B accumulated around 40% of the responses. Different policy regulations on electronic communication methods meant that the distribution of the

electronic questionnaire varied slightly. This will be discussed in more detail as a limitation later on in this study.

3.8.1.2 Question 3: Are you an academic or support staff member?

Table 3.2: Primary institutional function area

	Frequency	Percentage
Academic	71	51.45%
Support	67	48.55%
Non-responses	1	0.7%
Total	139	100%

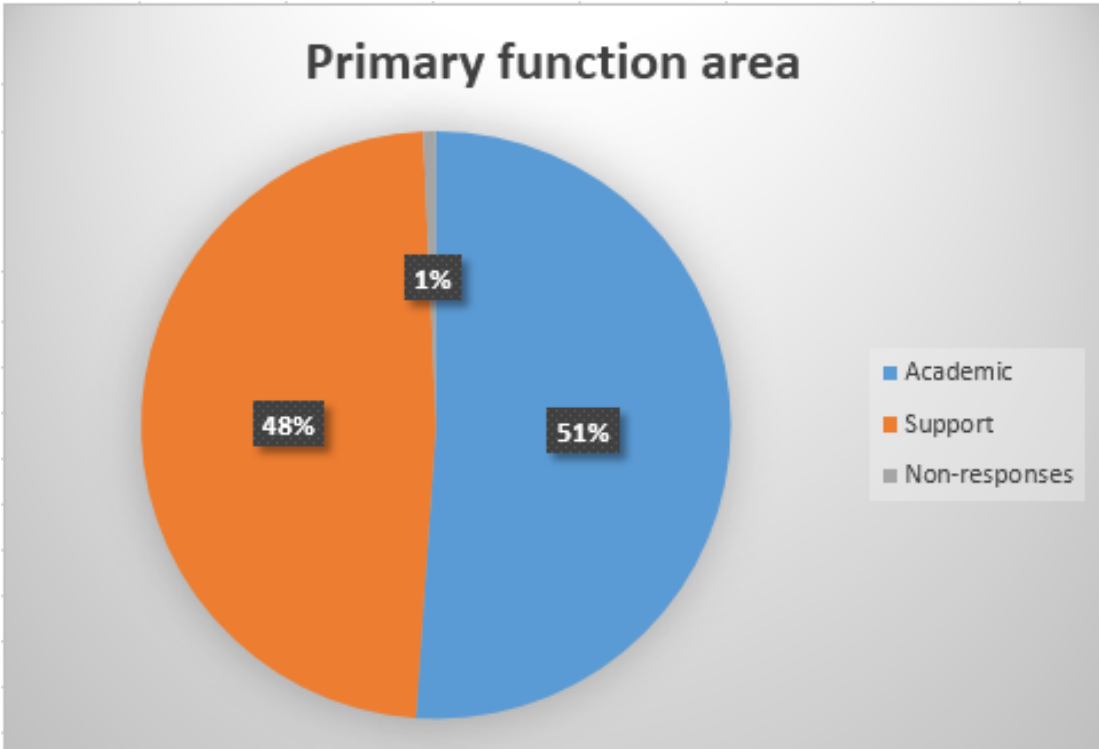


Figure 3.3: Primary function area

Comments

Both academic and support disciplines between the institutions were almost equally represented by respondents, as is clearly visible in Figure 3.3 above.

3.8.1.3 Question 4: In which business function/division do you work?

Table 3.3: Functional area within institutions

	Frequency	Percentage
Marketing and communication	9	6.5
Finance	4	2.9
Information Technology	17	12.2
Human Resources	4	2.9
Technical Services	4	2.9
Student Affairs	11	7.9
Administration	11	7.9
Operational Management	2	1.4
Faculty	61	43.9
Non responses	16	11.5
Total	139	100%

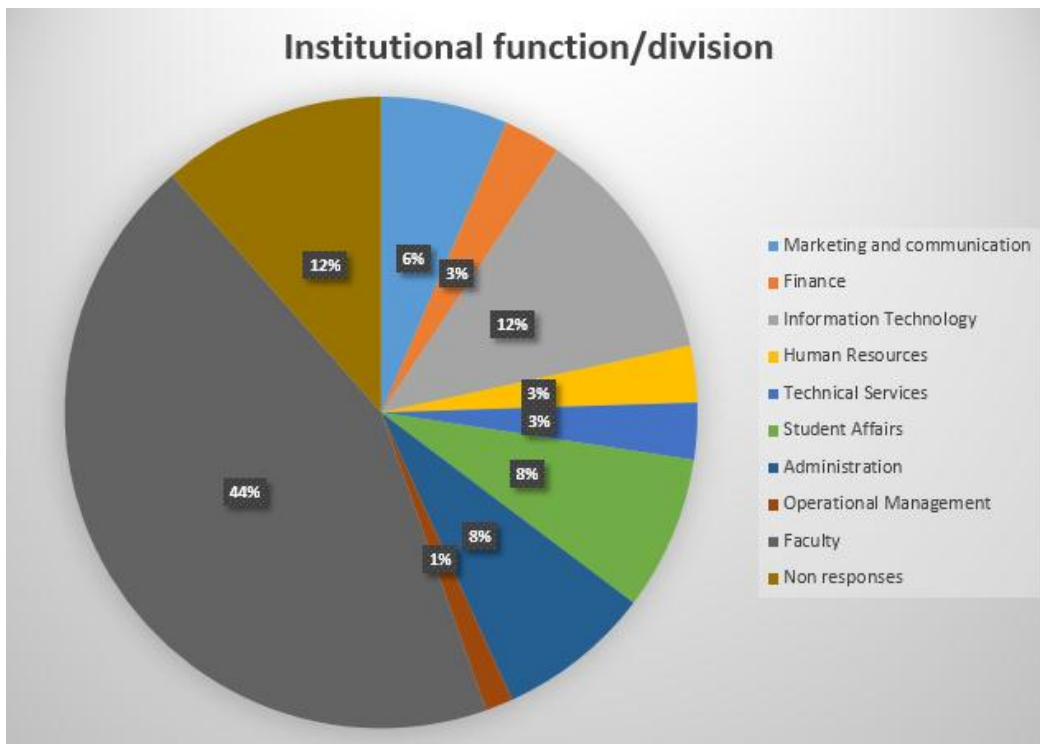


Figure 3.4: Institutional function/division.

Comments

The intended purpose of this question was to attempt user and departmental segmentation that would provide valuable information to those involved in BYOD strategy formulation. The question was successful in segmenting support departments as indicated in Figure 3.4. However, academic respondents were required to indicate their division within their respective faculty via a text box, this resulted in varying unreliable responses. Having two questionnaires for each discipline would ensure more reliable segmentation.

3.8.1.4 Question 5: What is your age group?

Table 3.4: Age groups

	Frequency	Percentage
20 to 30 Years	33	23.7%
30 to 40 Years	47	33.8%
40 to 50 Years	26	18.7%

50 to 65 Years	32	23.0%
Non responses	1	0.7%
Total	139	100%

Comments

Interestingly, the different age groups were all well represented and fairly closely distributed as indicated by Figure 3.5. The age group responsible for the most responses were from participants were between the ages of 30 and 40 years old.

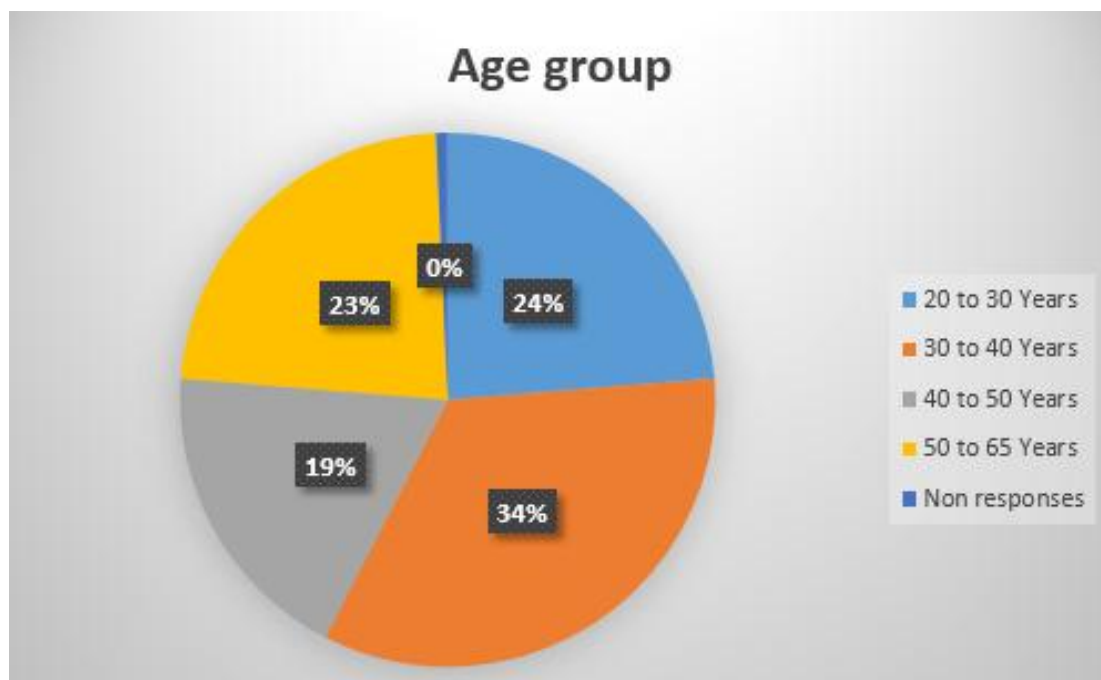


Figure 3.5: Age groups

3.8.1.5 Question 6: How do you spend most of your time at work?

Table 3.5: General work routine

	Frequency	Percentage
Between meetings	10	7.6%
Behind a desk	84	64.12
On the road	4	3.05
Lecturing	33	25.19

Non-responses	8	5.8%
Total	139	100%

Comments

The general work routine respondents indicated were expected, but it was interesting to find that some respondents are not “desk bound” and that their need for mobile technologies might be greater.

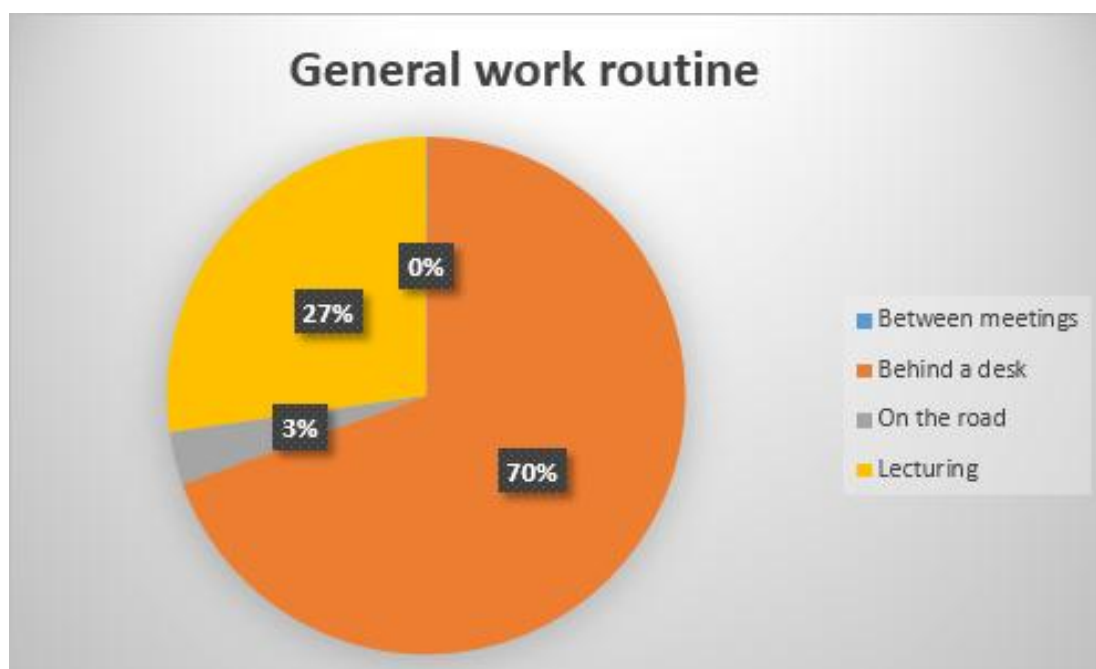


Figure 3.6: General work routine

3.8.2 Section 2: User comfort levels and ability to integrate

3.8.2.1 Question 7: What is your comfort level using Information technology?

Table 3.6: Technology comfort level

	Frequency	Percentage
Beginner	0	0%
Average	37	29.39%
Above average	71	56.34%

Expert	18	14.27%
Non-responses	13	9.4%
Total	139	100%

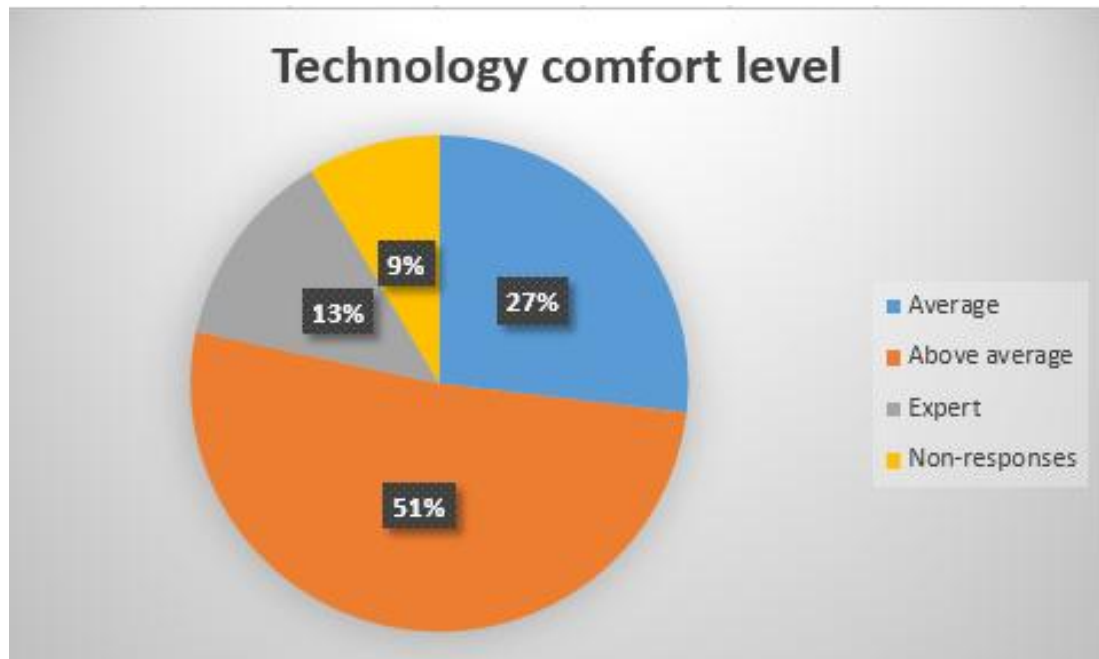


Figure 3.7: Technology comfort level

Comments

This section intended to explore end-user comfort levels and their ability to integrate technologies into the work environment. None of the respondents (0%) perceived themselves to be beginners in terms of technology use. Most respondents (56%) perceived that their abilities using technology is above average, indicating that they are comfortable with the technologies they use at work and in private.

3.8.2.2 Question 8: I use the following technologies on a daily basis for personal and/or work related use.

Table 3.7: Daily device usage

Device	Personal use			Work use		
	Total	f	%	Total	f	%
Smart Phone	139	120	86.3%	139	69	49.6%

Device	Personal use			Work use		
	f=frequency	Total	f	%	Total	f
Cellular Telephone	139	34	24.5%	139	21	15.1%
Tablet Computer	139	79	56.8%	139	52	37.4%
Smartwatches	139	5	3.6%	139	1	0.7%
eReader	139	22	15.8%	139	8	5.8%
Laptop computer	139	96	69.1%	139	94	67.6%
Netbook	139	8	5.8%	139	8	5.6%
Desktop computer	139	35	25.2%	139	60	43.2%
Desktop All-in-One computer	139	12	8.6%	139	30	21.6%
Other	139	4	2.9%	139	3	2.2%

Comments

The two most popular devices respondents use on a daily basis was smartphones and laptops, where smartphones was mostly used for personal use rather than performing work related tasks. Interestingly, laptop use was almost equally distributed between work and personal use, indicating a versatile mobile device. These two device types were followed by tablet computers and desktop computers where tablet computers saw a preference towards personal use, and desktops were obviously a preferred device to perform work related activities.

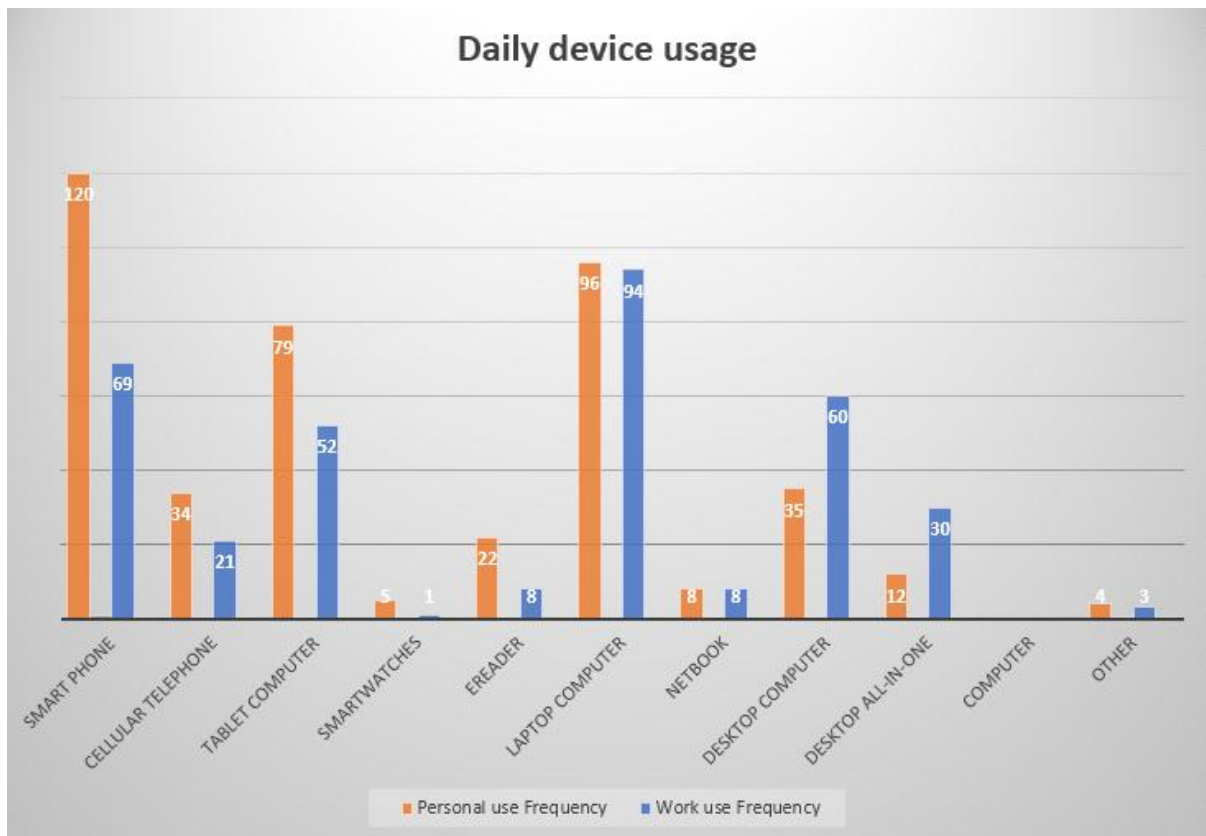


Figure 3.8: Daily device usage

3.8.2.3 Question 9: On average, I use technology for

Table 3.8: Technology use

	Daily	Weekly	Monthly	Seldom	Never	Missing
Large group collaboration	25.9%	19.4%	6.5%	19.4%	7.9%	20.9
Small group collaboration	32.4%	24.5%	5.8%	16.5%	2.2%	18.7
Individual use	82%	2.9%	0.7%	0.7%	0%	13.7%
Presentations	25.9%	25.6%	14.4%	13.7%	3.6%	15.8%
Word Processing	74.1%	7.9%	1.4%	0.7%	0.7%	15.1%
Spreadsheets	48.9%	18%	10.1%	5%	1.4%	16.5%
Social networking	55.4%	19.4%	2.9%	3.6%	4.3%	14.4%
Instant messaging	69.1%	6.5%	1.4%	4.3%	5.8%	12.9%

	Daily	Weekly	Monthly	Seldom	Never	Missing
Internet access	87.1%	2.9%	0%	0%	0%	10.1%
Email with other staff	89.2%	0.7%	0.7%	0.7%	0%	8.6%
Email with students	48.9%	15.1%	8.6%	6.5%	5%	15.8%
Private Email	66.9%	14.4%	4.3%	2.9%	0%	11.5%
Collaboration with peers	47.5%	18%	7.2%	5.8%	1.4%	20.1%
Collaboration across departments	36%	24.5%	14.4%	9.4%	1.4%	14.4%
Institutional training development	11.5%	12.9%	23.7%	23%	8.6%	20.1%
Personal development	48.9%	14.4%	15.1%	5.8%	1.4%	14.4%
Entertainment	45.3%	15.6%	6.5%	12.9%	2.9%	15.8%

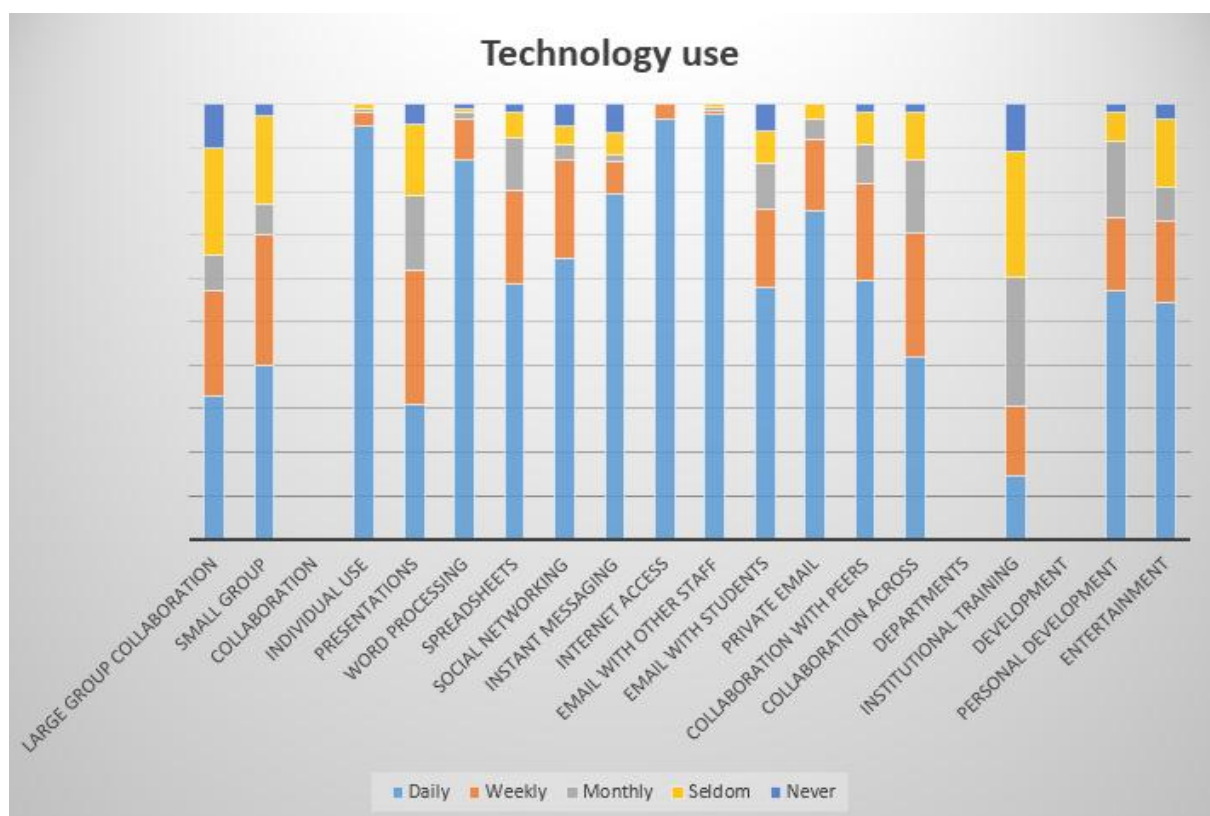


Figure 3.9: Technology use

Comments

On average respondents used technology on a daily basis to facilitate a number of tasks, the most popular being **email between staff members**, closely followed by accessing the Internet. After which word processing, instant messaging and private email featured closely. It was interesting to note that three of the five most popular tasks used on a daily bases were communication related tasks. Figure 3.9, provides a visual representation of the technology use responses.

3.8.2.4 Question 10: What is your current ability to integrate technology into your work environment?

Table 3.9: Ability to integrate

	Frequency	Percentage
Beginner	0	0%
Average	37	26.6%
Above average	70	50.4%
Expert	20	14.4%
Non-responses	12	8.6%
Total	139	100%

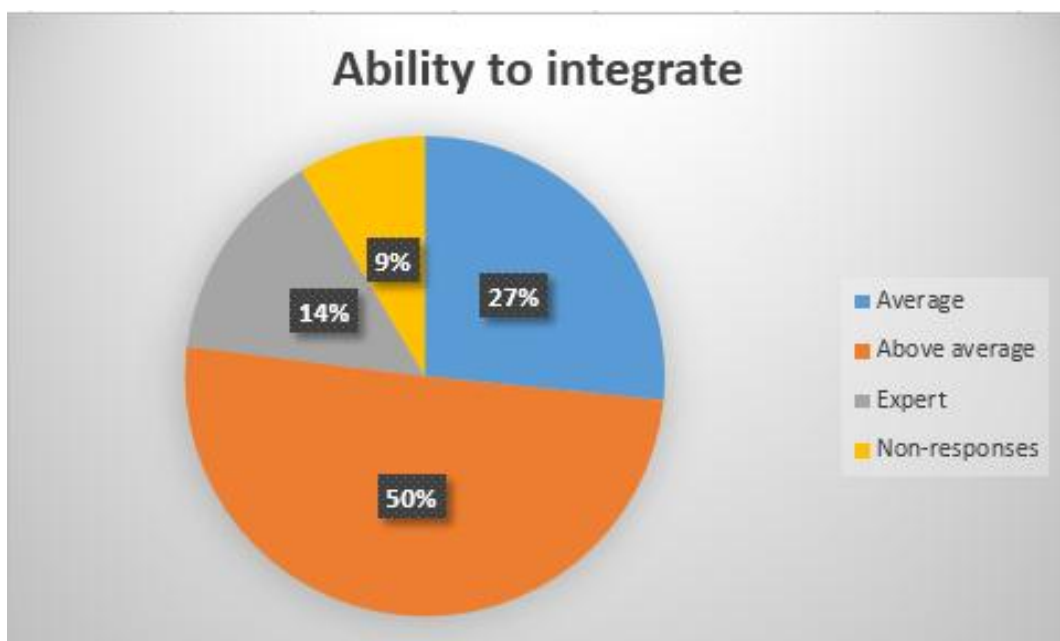


Figure 3.10: Ability to integrate

Comments:

Respondents indicated that they were comfortable integrating technology into their work environment where the majority (50%) indicated that their ability was above average and that they were very comfortable with the idea.

3.8.2.5 Question 11: For each of the following collaborative tools, rate how often you use each for work related purposes.

Table 3.10: Collaborative tools

N=139	Daily	Weekly	Monthly	Never	Tool not available	Missing
Wiki	1.4%	15.8%	16.5%	40.3%	6.5%	19.4%
Blogs	3.6%	13.7%	18%	43.2%	3.6%	18%
Twitter	10.8%	9.4%	7.9%	47.5%	5%	19.4%
Facebook	37.4%	12.2%	7.2%	28.1%	2.9%	12.2%
Online discussions Conferences	7.9%	13.7%	25.9%	34.5%	3.6%	14.4%
Instant Messaging	44.6%	18%	5%	16.5%	1.4%	14.4%
Email	89.2%	3.6%	0%	0%	0%	7.2%
Department Shared Drive	23.7%	10.8%	11.5%	27.3%	10.8%	15.8%
Video conferencing	2.2%	5.8%	32.4%	30.9%	13.7%	15.1%

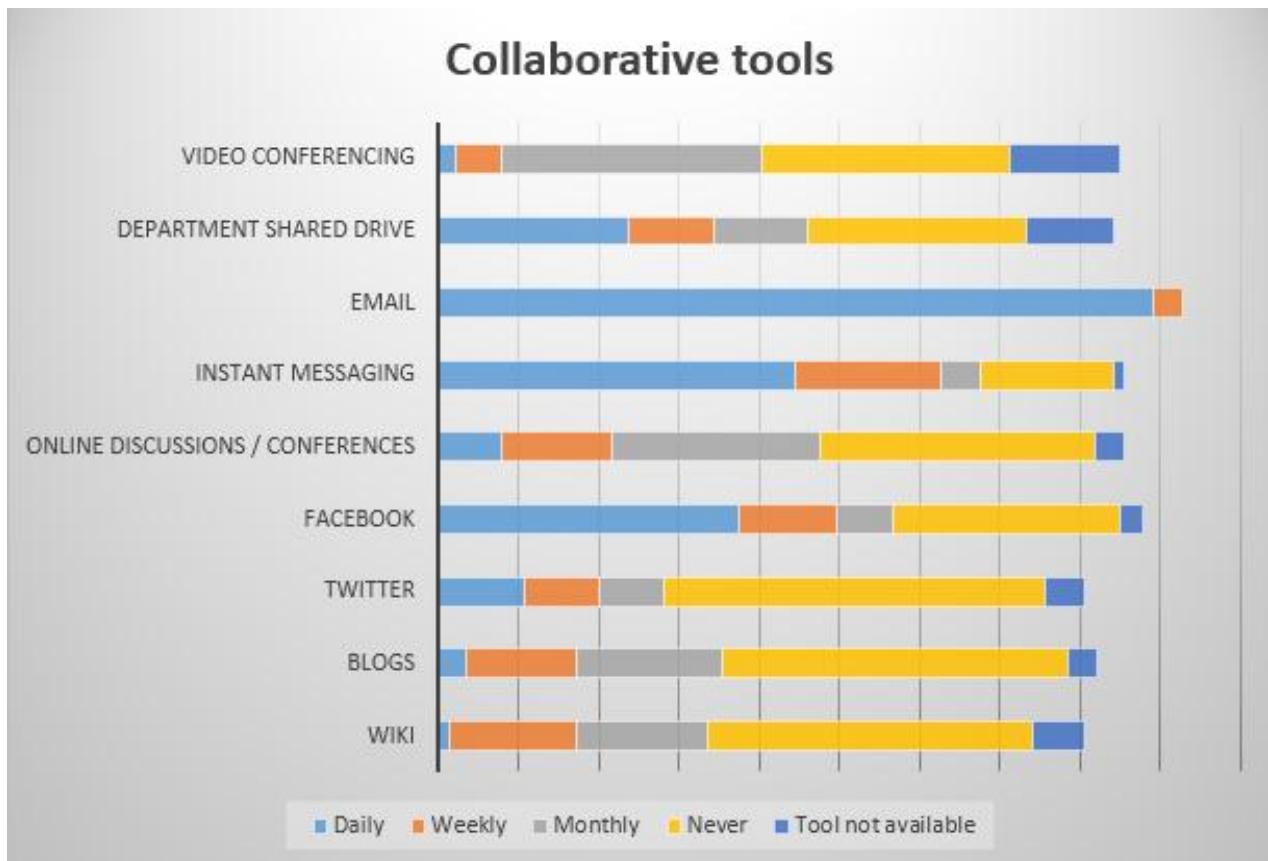


Figure 3.11: Collaborative tools.

Comments

Participants were asked how often they use certain collaborative tools in their work environment, where email again featured at the top of the list followed by, instant messaging and Facebook. The majority of the tools listed here was **never used** by the majority of respondents and could indicate that they were not aware of the available tools, although very few admitted that the tool was not available for use. It is important to note that the majority of tools listed was freely available, with the possible exception of a few, and not all the tools are typically provided by the institution. The tools respondents could select that was not typically provided by the institution, and was intended to explore if end-users already make use of tools with the intent to innovatively compliment possible IT shortcomings within their roles. The analysis proves that a considerable number of the tools are used although not daily but at least once a month.

3.8.3 Section 3 Bring Your Own Device (BYOD)

3.8.3.1 Question 12: Which of the following devices do you currently own?

Comments: On questions 12, 13 and 14

Current device ownership amongst respondents seems to be representative of findings in the literature study. Smartphone ownership was most prevalent at 72% followed by laptop computers at 68% and tablets at 48%. Respondents were then requested to indicate devices they would like to own, where the majority indicated that they would like to own a tablet followed by the smartwatch which is a new gadget available to consumers. Lastly, respondents were asked to indicate which devices were currently supplied by their institution, where laptop computers (63%) and desktop computers (40%) were identified by respondents. Some questions allowed for respondents to add comments, one of the few comments made here was that the institution should still supply the devices employees wanted. The figures and tables below attempted to visually represent the findings.

Table 3.11: Device ownership

N=139	Frequency	Percentage
Smart Phone	101	72.7%
Cellular Telephone	22	15.8%
Tablet Computer	67	48.2%
EReader	20	14.4%
Laptop computer	95	68.3%
Netbook	7	5%
Desktop computer	47	33.8%
Desktop All-in-One computer	14	10.1%

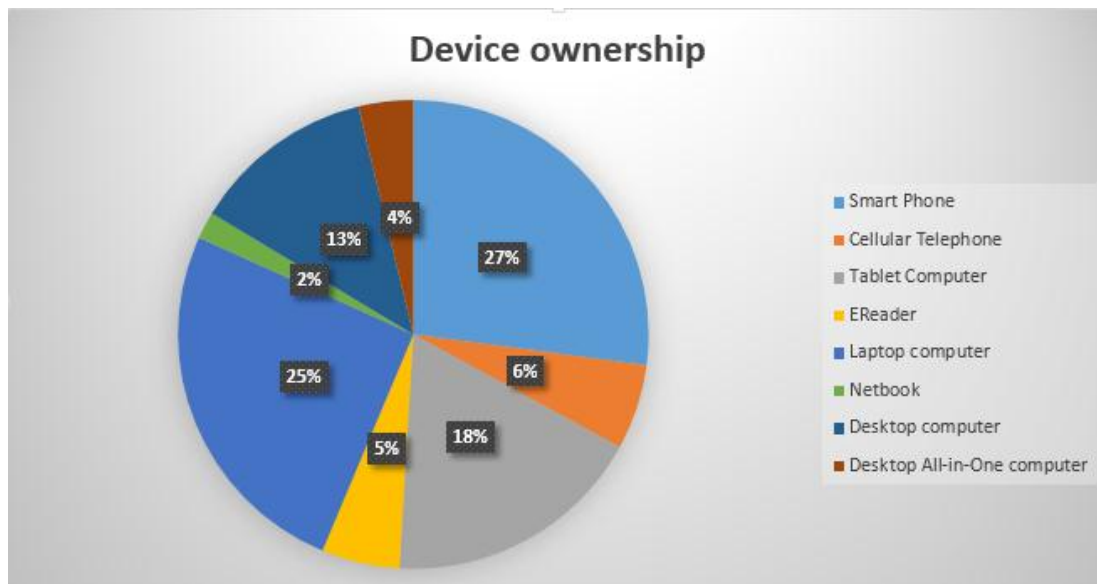


Figure 3.12: Device ownership

3.8.3.2 Question 13: Which of the following devices would you like to own?

Table 3.12: Choose your device

N=139	Frequency	Percentage
Smart Phone	19	13.7%
Cellular Telephone	4	2.9%
Tablet Computer	43	30.9%
Smartwatch	42	30.2%
EReader	24	17.3%
Laptop computer	23	16.5%
Netbook	22	15.8%
Desktop computer	6	4.3%

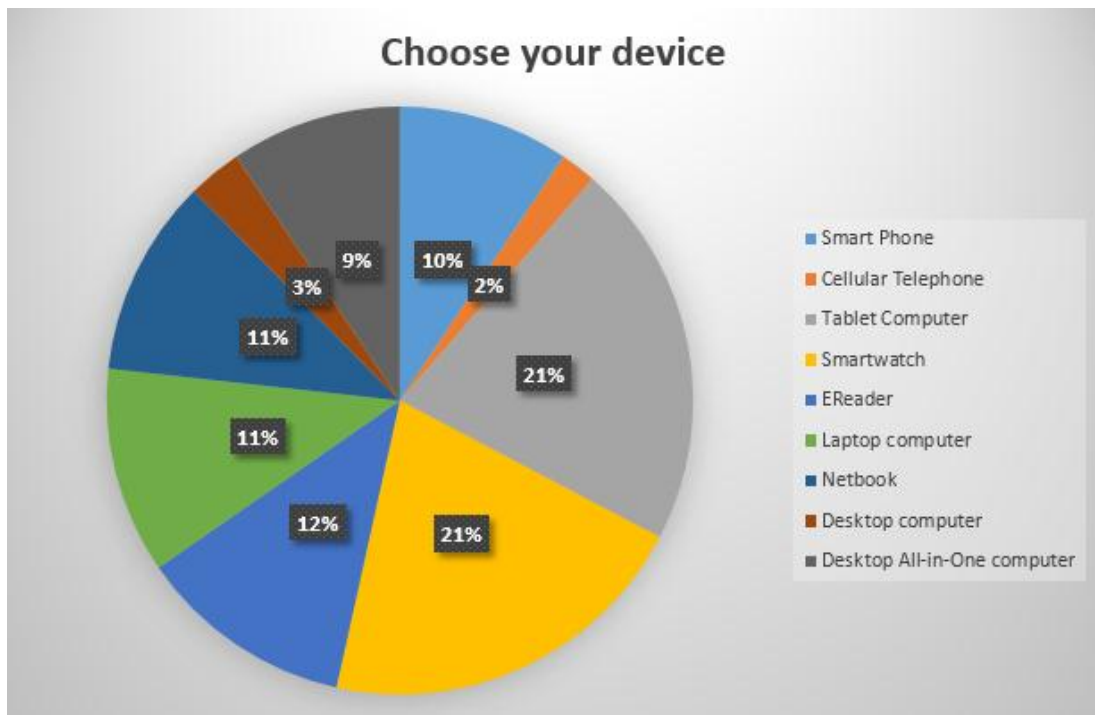


Figure 3.13: Choose your device.

3.8.3.3 Question 14: Which of the following devices is supplied by your department?

Table 3.13: Supplied devices

N=139	Frequency	Percentage
Smart Phone	8	5.8%
Cellular Telephone	2	1.4%
Tablet Computer	22	15.8%
Laptop computer	70	50.4%
Netbook	5	3.6%
Desktop computer	45	32.4%
Desktop All-in-One computer	30	21.6%
Smart Phone	8	5.8%

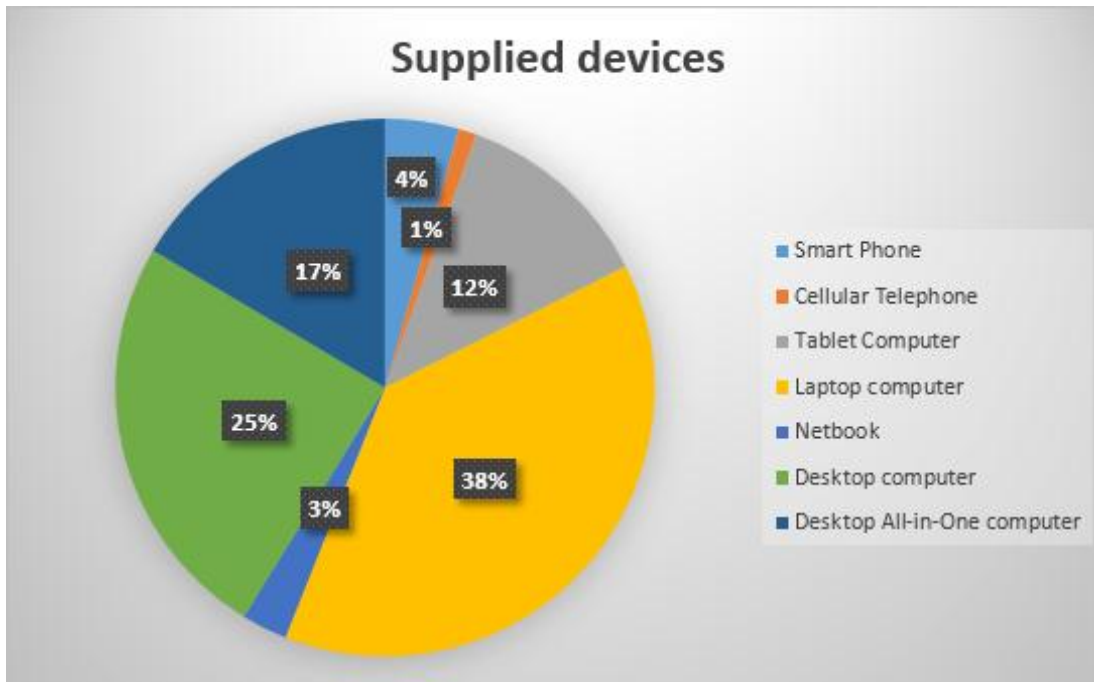


Figure 3.14: Supplied devices.

3.8.3.4 Question 15: Would you like to bring your personal computer or other mobile device (Tablet smartphone, laptop etc.) and connect it to the institutional network?

Table 3.14: BYOD

N=139	Frequency	Percentage
Yes, I already do	61	43.9%
Yes, I would like to but have not done so yet	22	15.8%
No	29	20.9%
Non-responses	27	19.4%
Total	139	100%

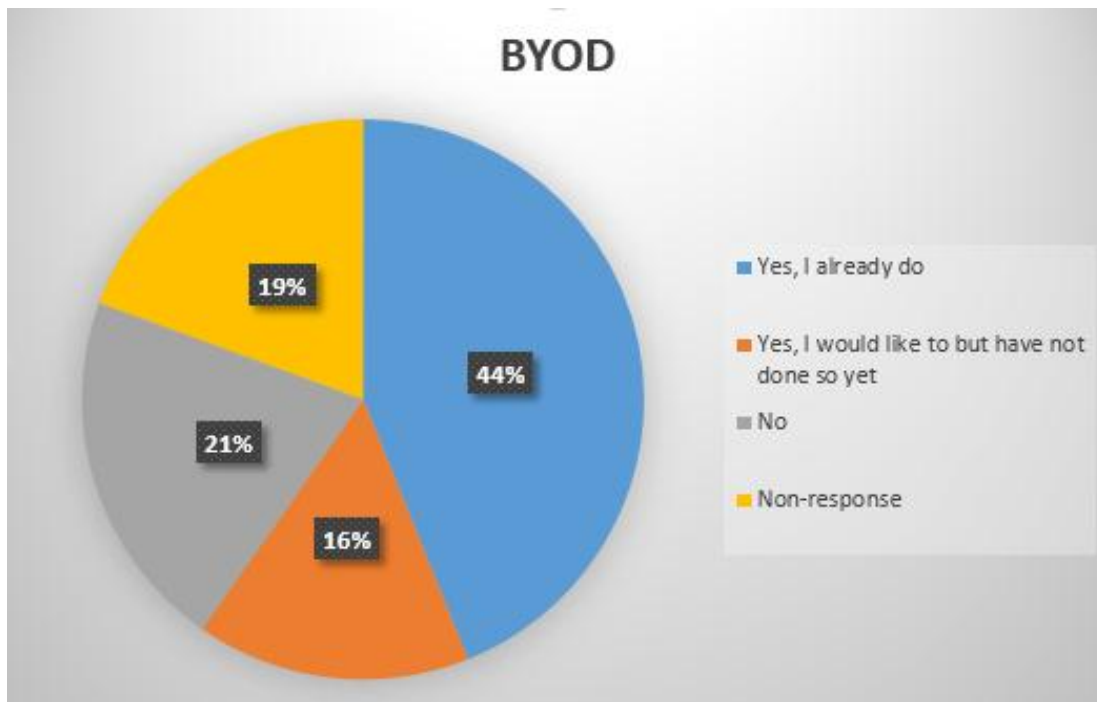


Figure 3.15: BYOD

Comments

Possibly the most important question with regards to the research objectives were asked, whether respondents would like to bring their own devices to work. The majority responses indicated that they already do at 44% followed by responses that they would like to at 16%, thus indicating that 60% of respondents were in favour of bringing their own devices to work. Noticeably, there was a significant portion of respondents (21%) indicating that they do not want to connect their personal devices to the institutional network, this might indicate privacy concerns.

Please note: It became apparent that responses from participants withered in question 16 and 18 possibly due to the question design, these questions were designed to identify possible concerns respondents might have bringing their own devices to work. More than 70 percent of respondents did not complete these questions. The questions were designed to allow for factor analysis, but that was not possible due to the low response rate.

3.8.3.5 Question 16: If you answered 'No' to question 15, choose the concerns below that best describe why you have not connected your device to the institutions network (choose as many as you would like).

3.8.3.6 Question 18: For the devices that you indicated, in the previous question, that you would not bring to work or would like to but you do not, which of the following best describes your reason?

3.8.3.7 Question 17: For each of the devices listed, please select the statement that most accurately describes how you feel.

Table 3.15: BYOD or NOT

	Laptop computer	Tablet Computer	Smartwatch	Netbook	Smart phone
I would not want to bring this to work	22.3%	9.4%	5%	4.3%	7.2%
I would like to bring it to work but I don't	2.9%	5%	0%	0.7%	0%
I do bring it to work but the institution limits how and where I can use it	5%	5.8%	0.7%	0%	9.4%
I do bring it to work and I can use it for work purposes whenever I want	35.3%	29.5%	0.7%	3.6%	49.6%
I do not own this device	10.8%	23%	51.8%	48.9%	7.9%
Non-responses	23.7%	27.3%	41.7%	42.4%	25.9%

Comments

Responses started picking up again in this question where respondents again confirmed that they do bring their devices to work and use it for work purposes. Findings represented in the table above and figure below confirms that smartphone, tablet and laptop devices were the preferred devices for end-users that wants to integrate their devices into their work environment.

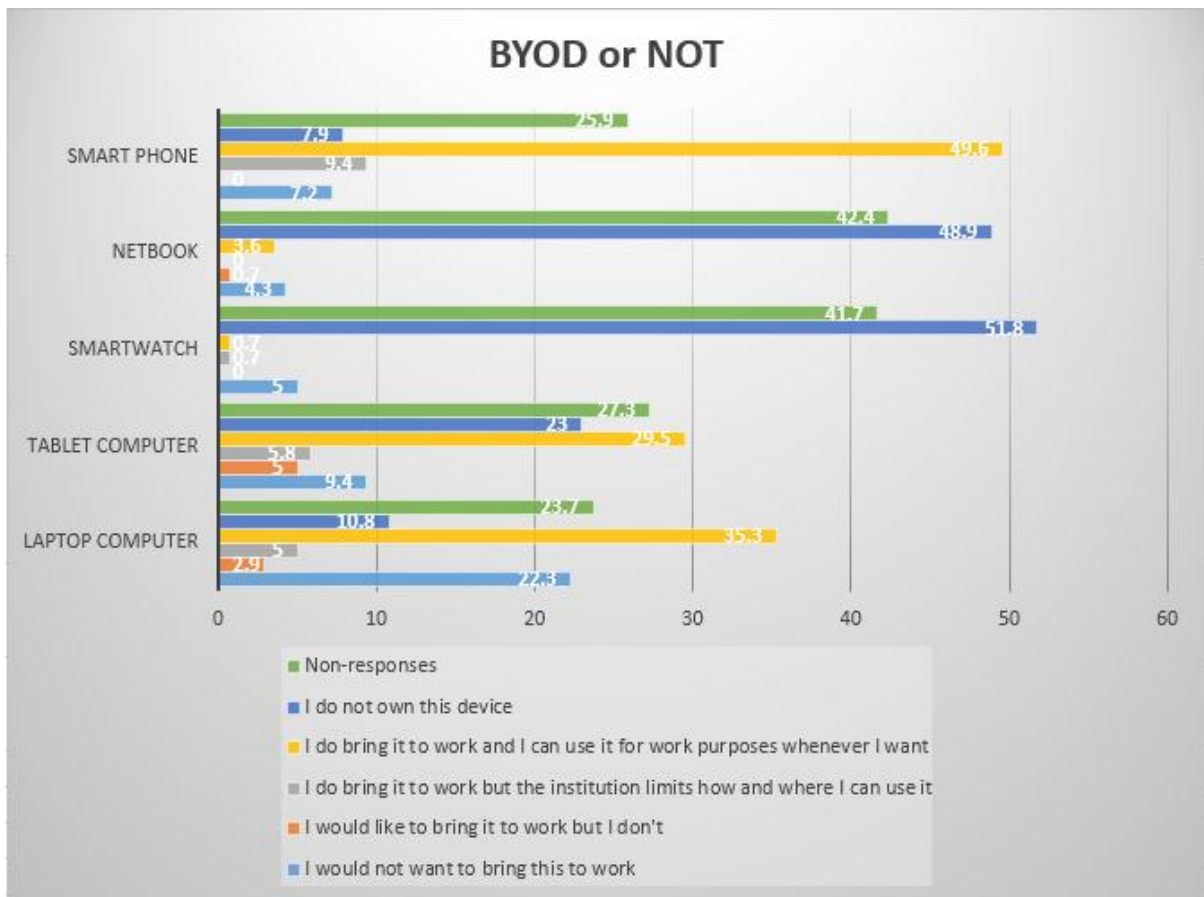


Figure 3.16: BYOD or NOT

3.8.3.8 Question 19: If you could bring your own device to work, which of the following work-related activities would you want to use it for? (Select all that apply).

Table 3.16: Intended use

N=139	Frequency	Missing	Percentage
Administrative tasks.	64	75	46%
Work related information source.	64	75	46%
Organising work related tasks.	63	76	45.3%
Planning work related tasks	58	81	41.7%
As a communication tool with peers	63	76	45.3%
As a collaboration tool with my peers	46	93	33.1%

N=139	Frequency	Missing	Percentage
As a collaboration tool between departments.	42	97	30.2%
As a communication tool across the institution	41	98	29.5%

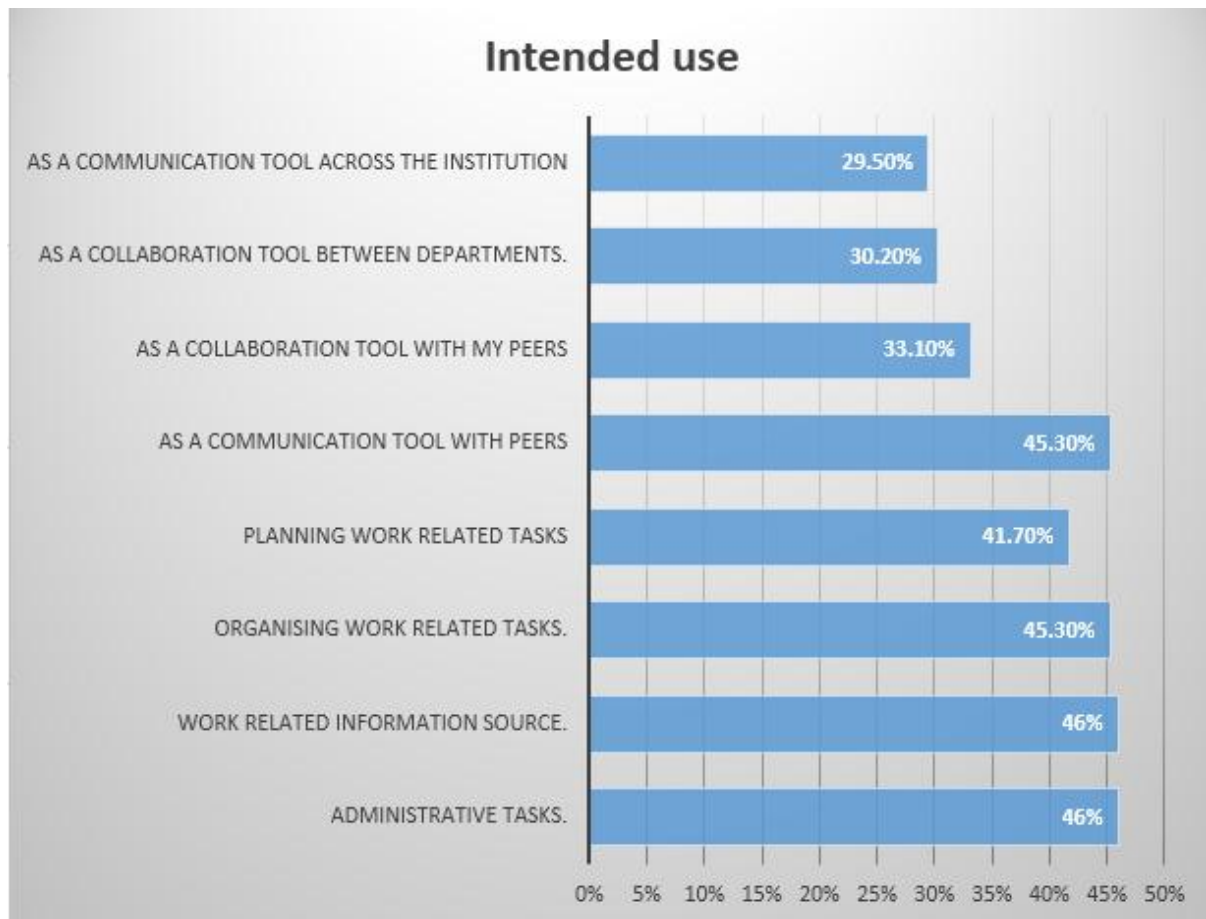


Figure 3.17: Intended use

Comments

The visual representation of the data collected for question 19 indicates fairly evenly distributed intended usage expectations. Interestingly, a rather large group of respondents expect to perform administrative tasks that included access to business systems as one of the prominent intended uses. This should be a concern for IT departments in the sense that, IT departments will need to secure institutional information. The other prominent choices do not seem to pose the same risks and should be facilitated by allowing basic institutional network access.

3.8.3.9 Question 20: If you already bring personal mobile devices to work, please select all of the applicable uses from the list below.

Table 3.17: Current use

N=139	Frequency	Missing	Percentage
Administrative tasks.	43	96	30.9%
Work related information source.	54	85	38.8%
Organising work related tasks.	51	88	36.7%
Planning work related tasks	51	88	36.7%
As a communication tool with peers	68	71	48.9%
As a collaboration tool with my peers	39	100	28.1%
As a collaboration tool between departments.	27	112	19.4%
As a communication tool across the institution	32	107	23%

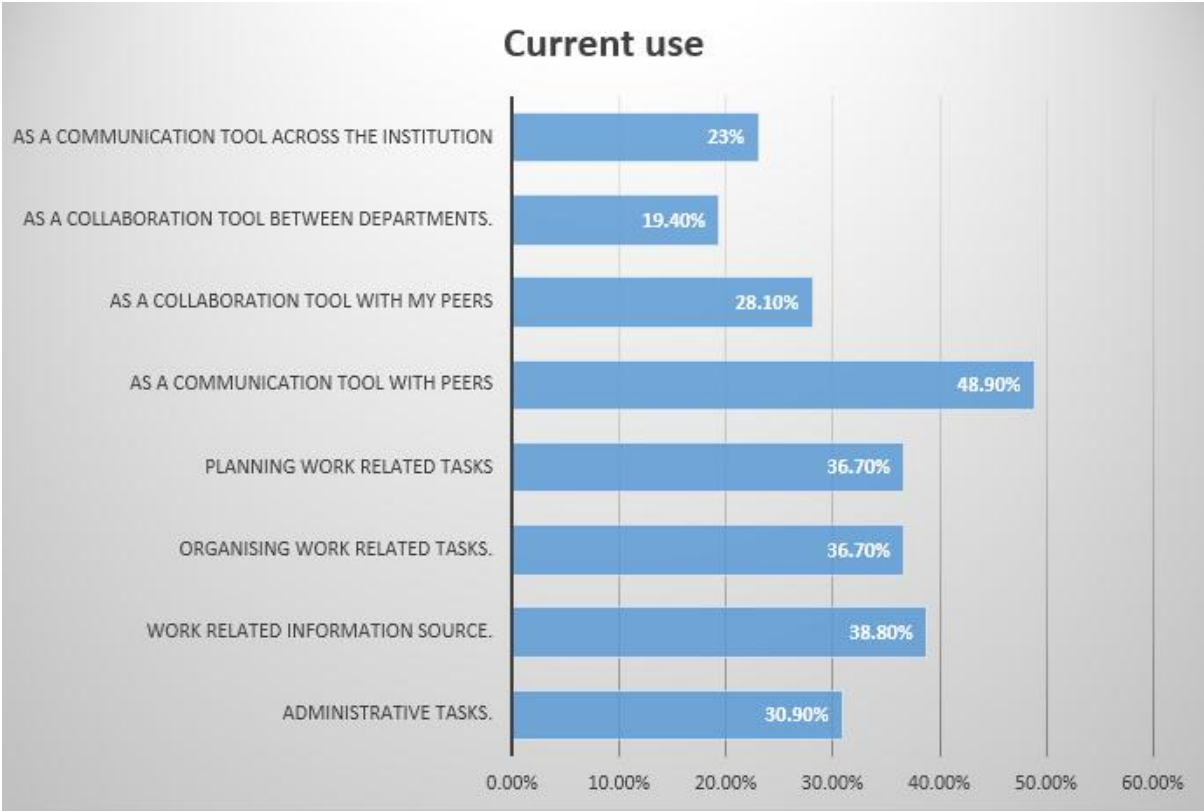


Figure 3.18: Current use

Comments:

The visual representation of the data collected for question 20 indicates fairly evenly distributed current usage patterns. Interestingly, a rather large group of respondents currently use their personal mobile devices to perform administrative tasks. Again, this should be a concern for IT departments in the sense that, IT departments will need to secure institutional information. The other prominent current usage trends seem to lean towards devices currently used to communicate in the work environment, and to facilitate planning and organising tasks.

3.8.3.10 Question 21: I would like to (or already do) use my personal mobile device(s) to access: (choose all that apply)

Table 3.18: Current usage and expectations

N=139	Frequency	Missing	Percentage
My email	87	52	62.6%
Notes	57	82	41%
Information resource	50	89	36%
Online resources/tools	60	79	43.2%
Calendaring and scheduling	77	62	55.4%
Web 2.0 tools (Facebook, twitter etc.)	49	90	35.3%
Online videos for information	50	89	36%
Digital documentation	48	91	34.5%
Project organising, planning and monitoring	50	89	36%
Professional training opportunities	42	97	30.2%
Tools to collaborate with my peers	46	93	33.1%
Tools to collaborate institutionally	36	103	25.9%
Other	4	135	2.8%

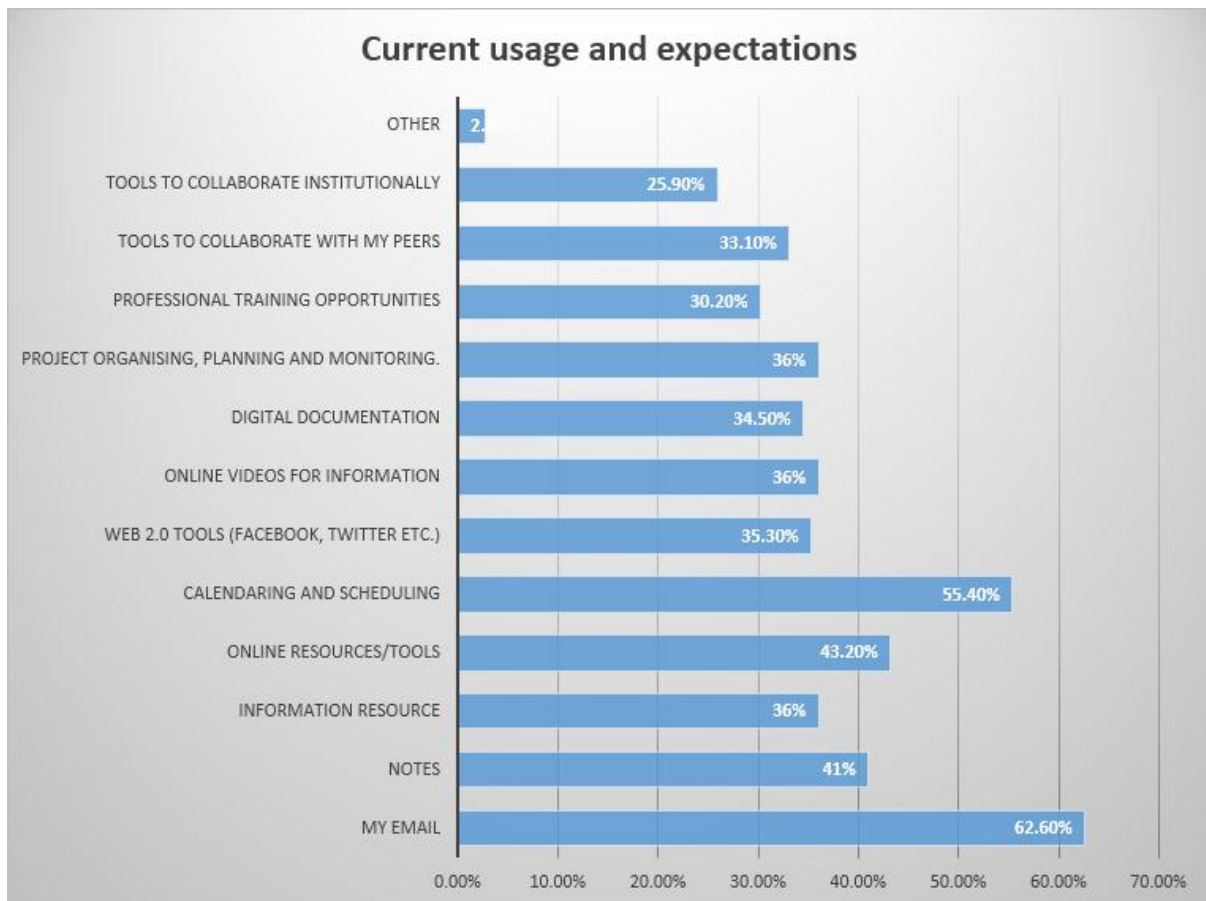


Figure 3.19: Current usage and expectations

Comments

This question just elaborated on questions 19 and 20 adding more possible uses and features that can be used by end-users. The visual representations of responses again reiterated that current device usage and expectations reside largely with being able to use devices as communication, collaboration, organising and scheduling tools. Social media and digital documentation also featured strongly as new additions to the list, where social media can be perceived to be either a distraction or collaboration tool.

3.8.3.11 Question 22: I am comfortable with my peers bringing their own personal devices for work purposes.

Table: 3.19: Comfort level with peers, work use

N=139	Frequency	Percentage
Always	72	51.8
Mostly	28	20.1
Somewhat	6	4.3
Never	2	1.4
Non-response	31	22.3

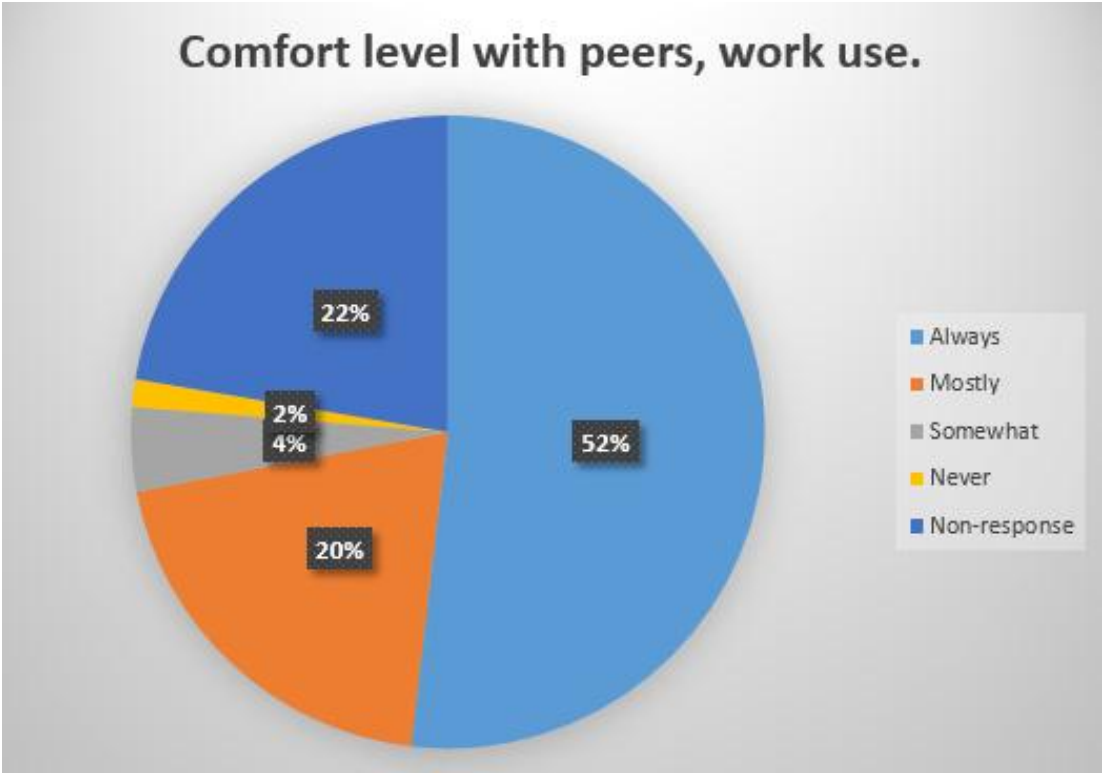


Figure 3.20: Comfort level with peers, work use

3.8.3.12 Question 23: I am comfortable with my peers bringing their own personal devices for personal use.

Table 3.20: Comfort level with peers, personal use

N=139	Frequency	Percentage
Always	55	39.6
Mostly	28	20.1
Somewhat	18	12.9
Never	4	2.9
Non-response	34	24.5

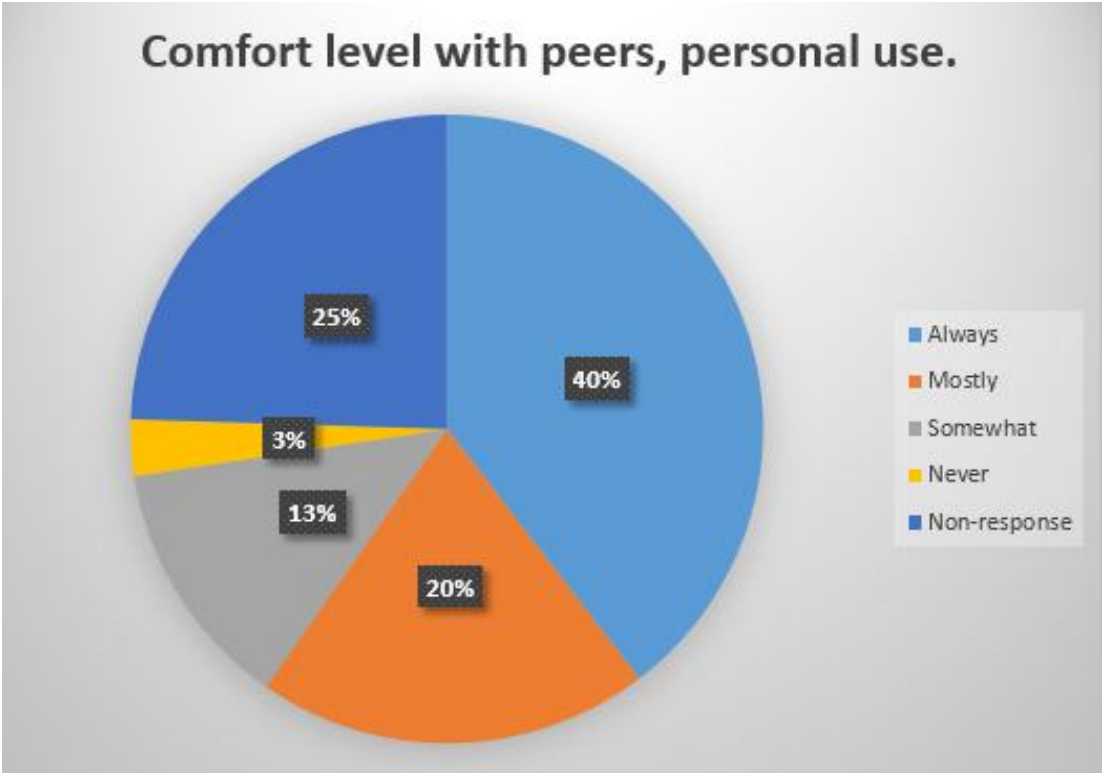


Figure 3.21: Comfort level with peers, personal use.

Comments

Lastly participants were asked how comfortable they are with regards to their peers bringing their own devices to the institution for work or personal use. The majority of respondents, a combined 72% were comfortable with their peers bringing their own

devices for work purposes, where slightly less was comfortable with peers bringing their devices for personal use at 60%. An overall positive attitude towards BYOD was observed, with respondents claiming to be comfortable using their own devices for work purposes. The majority of the respondents tended to shy away from questions concerning BYOD concerns, security matters and institutional barriers.

3.8.4 Section 4: Personal development

3.8.4.1 Question 24: Indicate to what extent training and support is provided to enable me to be comfortable with.

Table 3.21: Provision of training and support

N=139	More than enough	Enough	Somewhat less than needed	Very little	Missing
How to use the standard hardware devices at work.	16.5%	31.7%	10.1%	14.4%	27%
How to use the general software that is available at work	18.7%	30.9%	10.1%	12.9%	27.3%
How to use the institutional business software that supports my role	11.5%	32.4%	10.8%	15.8%	29.5%
How to promote responsible use of technology and digital citizenship	8.6%	23.7%	20.1%	18%	29.5%
How to manage personal devices that employees might bring into the work environment.	5.8%	17.3%	23.7%	23.7%	29.5%
How to take advantage of the device that I prefer to bring to work in terms of the environment or area I work in.	7.2%	18.7%	19.4%	25.2%	29.5%
What it means to be a responsible digital citizen	5.8%	18%	23.7%	22.3%	30.2%
Institutional IT policies and procedures related to own device usage for work related purposes.	6.5%	18%	16.5%	28.1%	30.9%

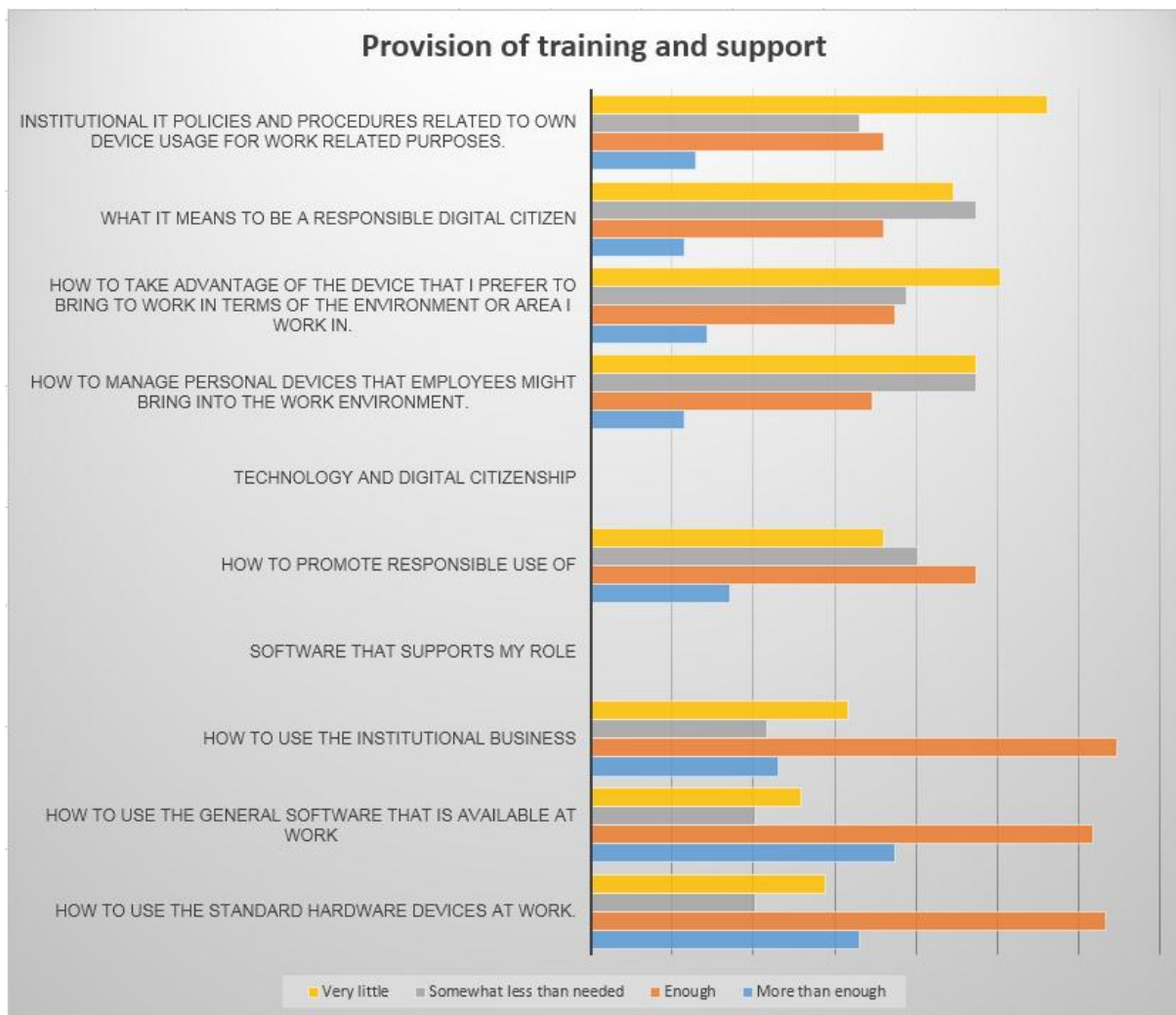


Figure 3.22: Provision of training and support

Comments

This section intended to explore how respondents perceived the institution or more specifically the institutional IT department in providing empowerment initiatives related to BYOD. The visual representation presented in Figure 3.21 indicate clearly that although not perfect, the institution does provide a fair amount of support and training in terms of standard institutional technologies (legacy) or rather the systems and equipment that has been deemed as standard. However, regarding current mobile trends such as BYOD, respondents perceived the opposite effect and indicated that not enough or inadequate support and training was provided. This indicates that there was most likely no formal strategy developed to prepare for and accommodate the trend. This question was one designed with the intent to investigate relationships and patterns from participant responses.

Reliability and validity

Reliability

Table 3.22: Reliability: Training

Cronbach's Alpha	Inter-item correlations
.951	.709

The alpha coefficient for the 8 items is .951, suggesting that the items have high internal consistency and the scale is therefore reliable.

Validity

Figure 3.23 and Tables 3.23A and B below were generated by using the statistical software IBM SPSS (Version 22).

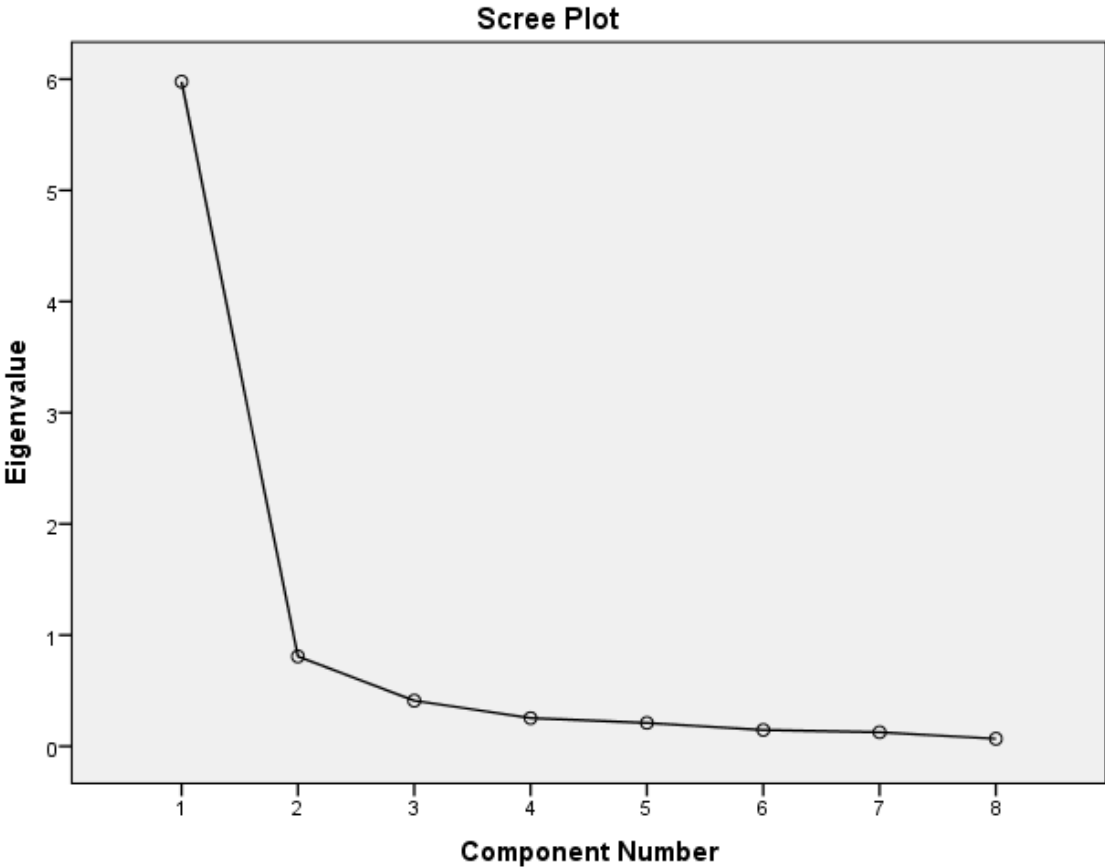


Figure 3.23: Scree plot: Training

Table 3.23A: Total variance explained

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	5.978	74.719	74.719
2	.808	10.102	84.821
3	.410	5.127	89.948
4	.254	3.173	93.121
5	.210	2.624	95.746
6	.147	1.834	97.580
7	.126	1.573	99.154
8	.068	.846	100.000

Table 3.23B: Rotated component Matrix: Training

Item	Component	
	1	2
Training1	.332	.880
Training2	.320	.899
Training3	.554	.653
Training4	.728	.494
Training5	.853	.422
Training6	.864	.330
Training7	.881	.330
Training8	.861	.307

A single factor was extracted and this one factor accounts for 74.72% of the total variance. The scree plot visually indicates that from the second factor onwards the line flattens meaning that each successive factor accounts for increasingly smaller amounts

of total variance. This indicates that the eight items all load on the same factor, named Training.

3.8.4.2 Question 25: To what extent do you encounter the following barriers to the successful integration of mobile technology into your role? Select all that apply.

Table 3.24: Barriers to successful integration

	Almost always	Very often	Sometimes	Rarely	Almost never	Missing
Not enough Professional Development	5%	10.1%	25.2%	12.2%	10.1%	37.4%
Institution not allowing personal mobile devices.	5.8%	3.6%	6.5%	22.3%	24.5%	37.4%
IT infrastructure does not allow for the use of personal mobile devices	7.2%	7.2%	18.7%	16.5%	15.8%	34.5%
Institutional policies does not allow for the use of personal mobile devices	5%	2.2%	13.7%	19.4%	23%	36.7%
Not understanding how to integrate technology into my area/department.	5%	6.5%	14.4%	18.7%	18.7%	36.7%
Not enough time to become comfortable with the technology	6.5%	10.8%	10.8%	20.1%	15.8%	36%
Not enough time to become comfortable with the software / resources	5.8%	12.2%	12.2%	20.9%	13.7%	35.3%
Inability to separate work related tasks from personal tasks using mobile technologies.	1.4%	7.9%	11.5%	17.3%	25.2%	36.7%
Can't find appropriate resources for my area of expertise.	2.9%	5%	15.1%	20.9%	15.8%	40.3%
Do not know what resources are appropriate for use within my area	3.6%	11.5%	8.8%	20.1%	17.3%	38.8%

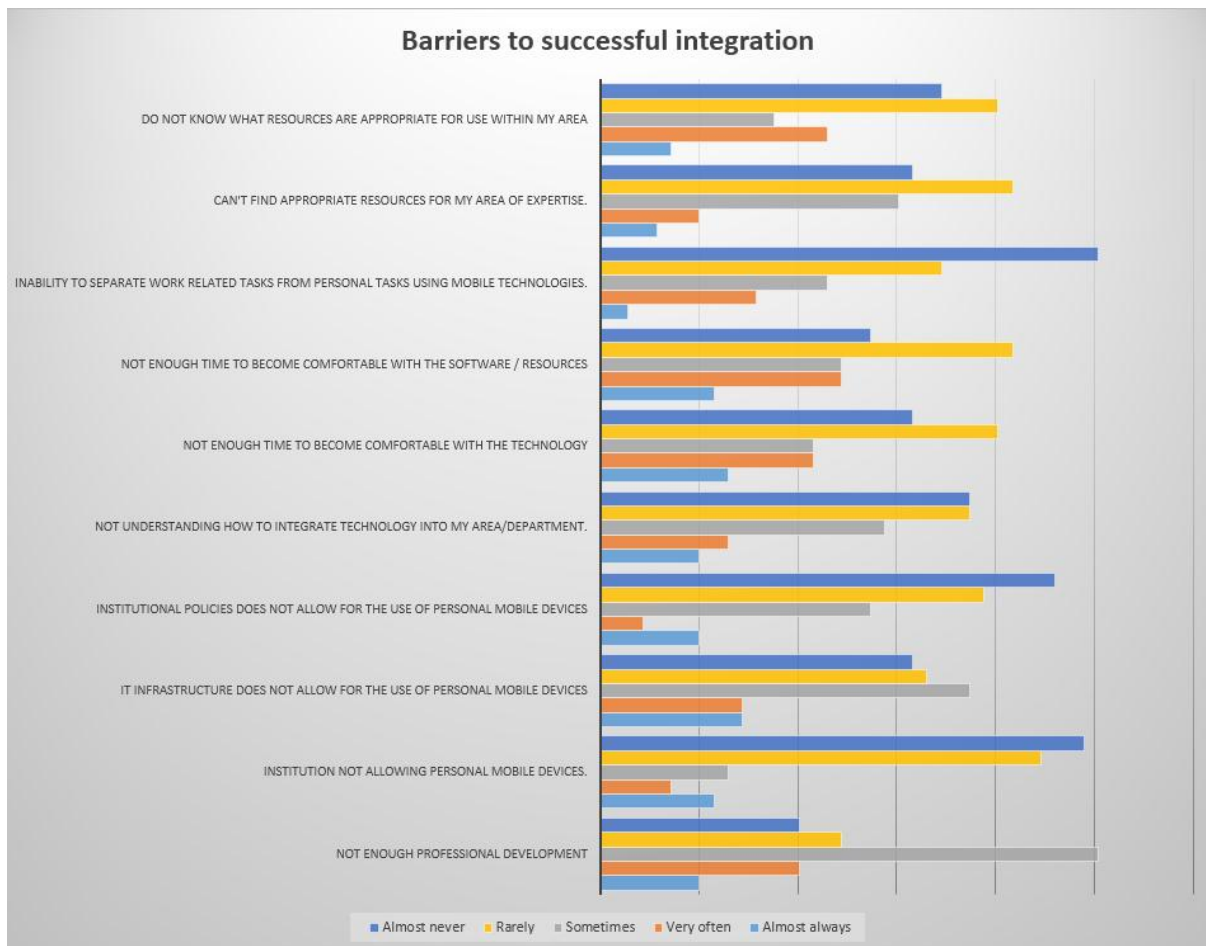


Figure 3.24: Barriers to successful integration

Comments

The general perceptions towards barriers experienced with the integration of mobile technology seem to be in favour of the institutions analysed, most respondents indicated that they rarely or almost never experienced barriers. However personal development and IT infrastructure were perceived as a barrier that was sometimes encountered, this finding corresponds with the findings of Question 24.

Reliability

Table 3.25: Reliability: Barriers

Cronbach's Alpha	Inter-item correlations
.855	.372

The alpha coefficient for the 10 items is .855, suggesting that the items have relatively high internal consistency and the measuring instrument is therefore regarded as reliable.

Validity

The results generated by SPSS indicate that three factors accounts for 73.7% of the total variance. The scree plot visually indicates that from the forth factor onwards the line flattens meaning that each successive factor accounts for increasingly smaller amounts of total variance. This indicates that the 10 tests and subtests all load on three distinct factors; these factors were identified as the following;

- Tests 5, 6 and 7 were identified as factor 1 and named **Personal Barriers**, as they are all related to perceived personal barriers respondents might or might not experience.
- Tests 1 to 4 were identified as factor 2 and named **Policy Barriers**, as they relate to perceived institutional IT policy barriers respondents might or might not experience.
- Tests 8 to 10 were identified as factor 3 and named **Lack of training** as they relate to perceived institutional training barriers respondents might or might not experience.

Figure 3.34 and Tables 3.26A and B below were generated by SPSS and visually represents the above findings.

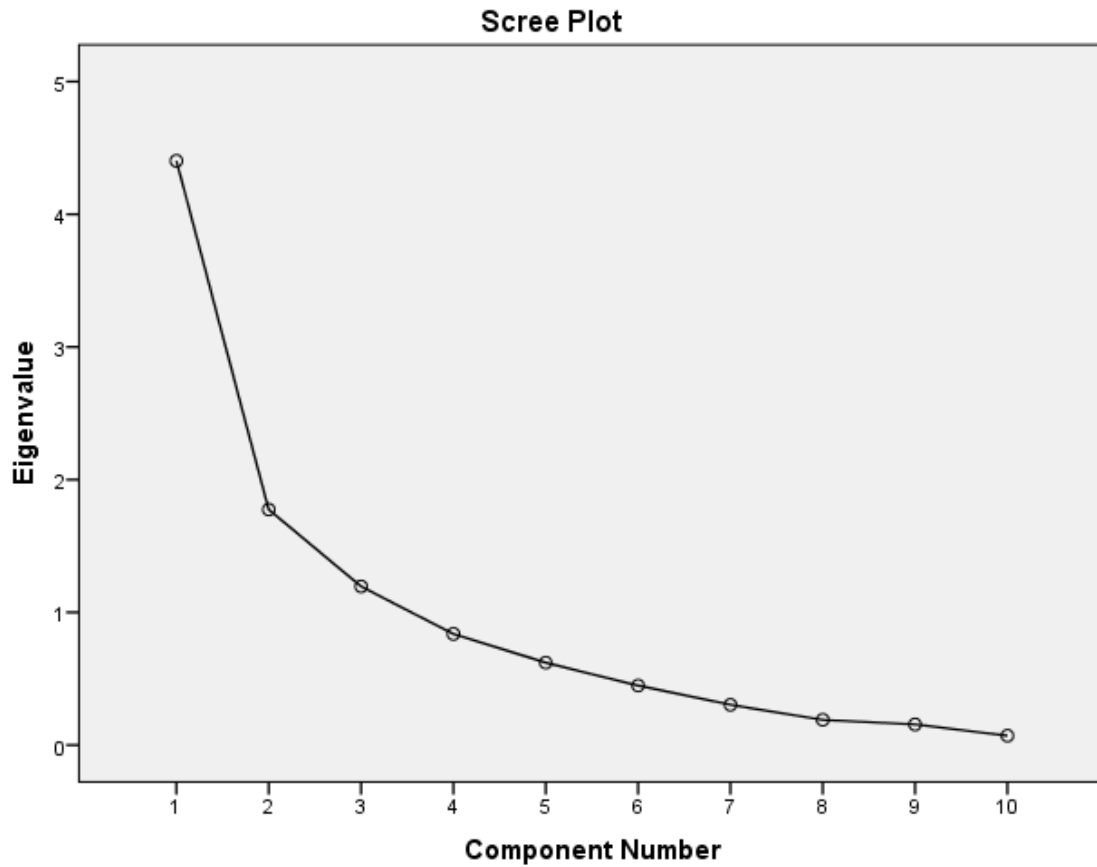


Figure 3.25: Scree Plot: Barriers

Table 3.26A: Explained variance: Barriers

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings	
	Total	% of Variance	Cumulative %	Total	% of Variance
1	4.403	44.028	44.028	2.591	25.906
2	1.774	17.744	61.773	2.508	25.081
3	1.196	11.958	73.731	2.274	22.743
4	.838	8.375	82.106		
5	.621	6.211	88.317		
6	.448	4.484	92.801		
7	.304	3.038	95.839		
8	.190	1.900	97.739		
9	.156	1.555	99.294		
10	.071	.706	100.000		

Table 3.26B: Rotated Component Matrix: Barriers

	Component		
	1	2	3
Barrier1		.512	
Barrier2		.811	
Barrier3		.789	
Barrier4		.854	
Barrier5	.745		
Barrier6	.925		
Barrier7	.926		
Barrier8			.744
Barrier9			.866
Barrier10			.830

Descriptive statistics for the three factors

The descriptive statistics for the three factors are depicted in Table 3.24.

Factor	N	Mean	Standard deviation	Skewness	Kurtosis
Personal barriers	90	3.474	1.150	-0.419	-0.728
Policy barriers	92	3.559	.979	-0.806	-0.728
Lack of training	87	3.745	1.021	-0.540	-0.449

From the table above it is evident that there is no reason to suspect that the normality assumptions are violated as the skewness as well as the kurtosis of all three factors are very small.

Reliability

Table 3.27: Reliability: Barriers

Construct/Factor	Cronbach's Alpha	Inter-item correlations
Total scale	.855	.372
Personal barriers	.899	.745
Policy barriers	.753	.427
Lack of training	.839	.638

The alpha coefficient for the 10 items is .855, suggesting that the items have relatively high internal consistency and the measuring instrument is therefore regarded as reliable. Furthermore, the three factors are also consistent as the Cronbach alpha is larger than 0.7 (Malhotra, 2010:319).

3.8.5 Section 5: Academic

3.8.5.1 Question 27: Please indicate to what extent you agree/disagree with each of the following statements

Table 3.28: Perceptions of BYOD in lecture rooms

	Strongly agree	Agree	Agree somewhat	Disagree somewhat	Disagree	Strongly Disagree	Missing
increase student engagement in learning	17.3%	10.8%	8.6%	0.7%	1.4%	0%	61.2%
allow me to differentiate your instruction	10.8%	12.2%	10.8%	1.4%	1.4%	0%	63.3%
help me utilize high yield strategies?	8.6%	12.2%	14.4%	0.7%	0.7%	0.7%	62.6%
improve student achievement	11.5%	10.1%	12.2%	2.9%	1.4%	0%	61.9%
increase attendance	8.6%	7.9%	12.2%	3.6%	3.6%	1.4%	62.6%
create opportunities for creativity	12.9%	17.3%	7.2%	0.7%	0.7%	0%	61.2%

	Strongly agree	Agree	Agree somewhat	Disagree somewhat	Disagree	Strongly Disagree	Missing
create opportunities for critical thinking	12.9%	15.1%	7.9%	2.2%	0%	0.7%	61.2%
creating opportunities for communication	17.3%	12.9%	5.8%	1.4%	1.4%	0%	61.2%
creating opportunities for collaboration	15.1%	15.1%	7.9%	0%	0.7%	0%	61.2%

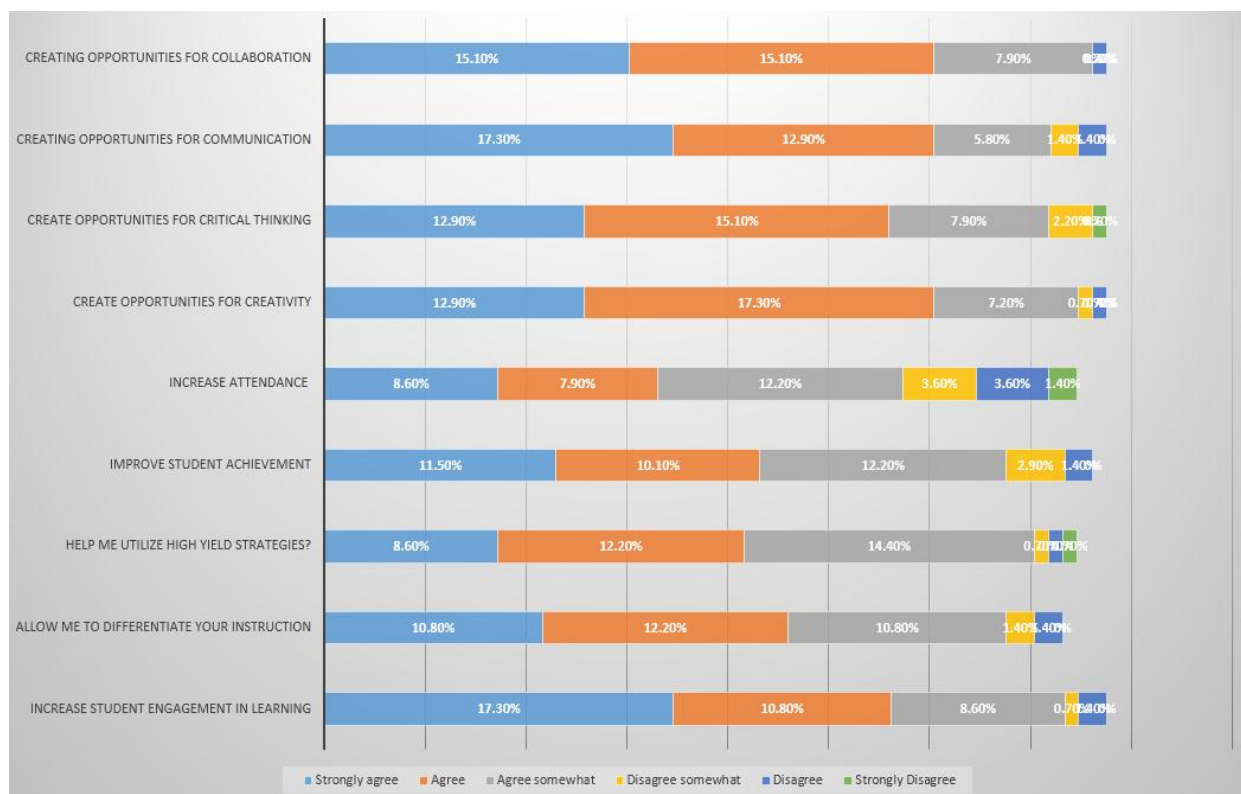


Figure 3.26: Perceptions of BYOD in lecture rooms

Comments

It is clear from the visual representation of data in Figure 3.23, that academic staff members strongly agree that BYOD in the classroom has a positive affect and a purposeful use. Findings indicate an overall positive attitude from academic respondents towards the use of BYOD in the classroom, very few academic respondents indicated that BYOD in the classroom would have a negative effect on class activities as is visible in the data analysis and figures.

3.8.5.2 Question 28: Currently some students are using their own personal devices to

Table 3.29: Current student BYOD class use

Currently some students are using their own personal devices to	Yes	No	No, but I would like them to	Missing
facilitate research	27.3%	2.9%	7.9%	61.9%
create projects	28.8%	6.5%	2.9%	61.9%
take notes	23.7%	5.8%	9.4%	61.2%
capture group notes	25.2%	4.3%	9.4%	61.2%
update calendar/agenda	21.6%	7.2%	8.6%	62.6%
manage content	20.9%	6.5%	10.1%	62.6%
submit work to me digitally	27.3%	4.3%	7.2%	61.2%
collaboratively take notes to share with class members	19.4%	7.2%	10.8%	62.6%
contribute to discussions/ share class information via web 2.0 tools such as Twitter or other back channel programs	12.2%	9.4%	14.4%	64%
use online tools for research i.e. surveys, Skype, advanced search engines, social networking	23%	5%	8.6%	53.3%
access a growing selection of digital resources (such a digital textbooks)	21.6%	3.6%	11.5%	63.3%
choose from a wider array of options for demonstration of knowledge including use of Web 2.0 tools.	14.4%	9.4%	11.5%	64.7%
collaborate with students and worldwide experts	10.8%	8.6%	17.3%	63.3%
utilize opportunities for eLearning/blended learning	14.4%	6.5%	15.8%	63.3%

Comments

Current student usage patterns observed by academic respondents were also indicative of current student device ownership, indicating a much larger institutional stakeholder group who was not intended to be covered by this study. However it is important not to forget about students as they are **the** customers that participate in core institutional activities. Students were not considered to form part of this study as they do not need

access to sensitive institutional areas and information, students do need Internet access which can be provided as part of a basic BYOD plan.

Overall academic respondents indicated that they observe various usage patterns and tools used by students to facilitate their studies, and found it to have positive effects. There are also strong indicators that academic staff would like to see students utilising their devices for academic purposes especially E-Learning or Blended learning.

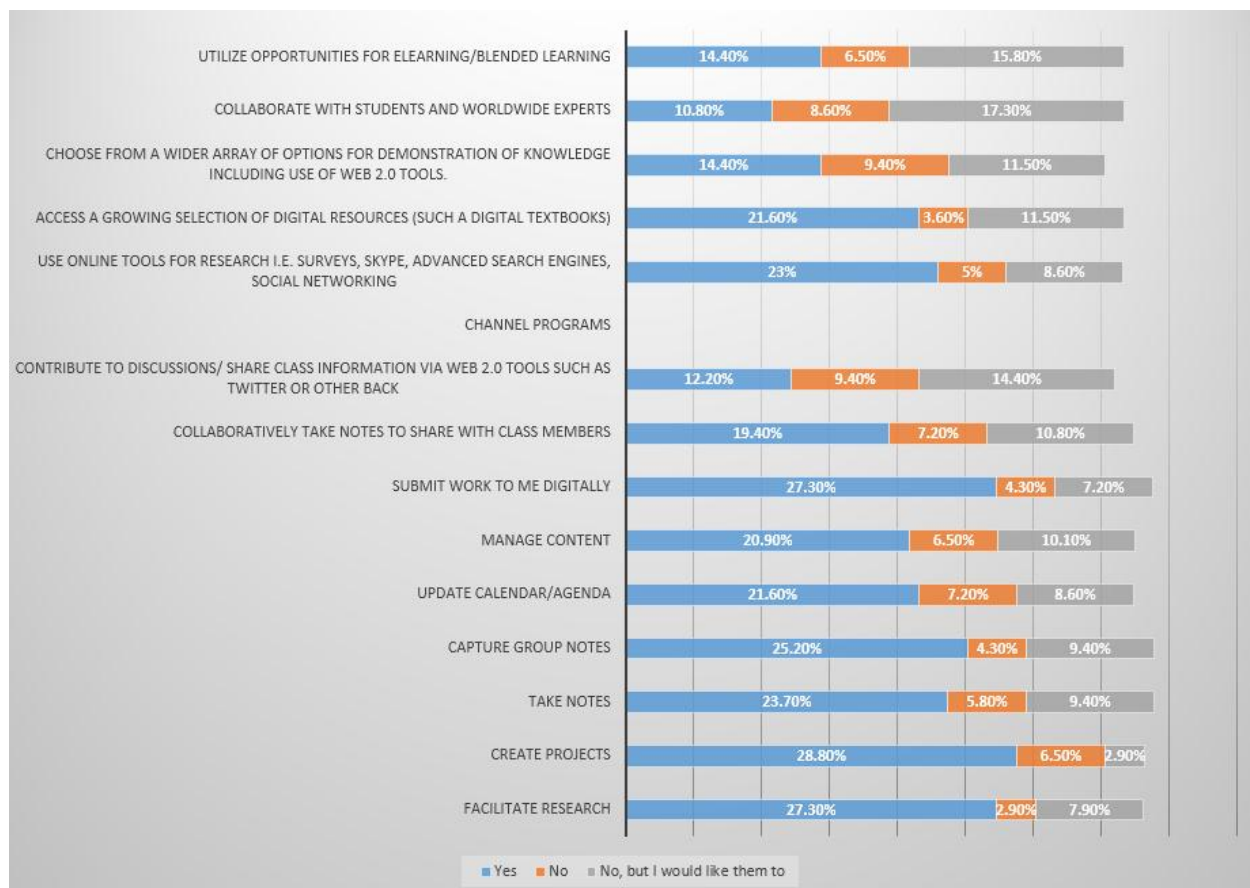


Figure 3.27: Current student BYOD class use.

3.9 ETHICAL CONSIDERATIONS

Ethical precautions were made by requesting ethical clearance and obtaining the necessary clearance numbers. All participants were required to complete and sign an informed consent form for semi-structured interviews. All participants had the option to opt out or refuse participation.

With regards to the online questionnaire, ethical precautions were taken by a synopsis of the study introducing participants to the details and project staff members of the

study. Participants were then given the option “Do you want to participate in the questionnaire?” where after they could either select Yes or No as a means to accept or decline participation. Should a participant have selected the No option, declining to participate he/she was directed towards a “Thank you” screen, where after they could close their browser window.

As proof of ethical clearance, the following ethics numbers was obtained;

- EMS15/02/26-1/09
- 201510.21.5.4

As a matter of interest, for the purposes of qualitative data collection the researcher was required to make contact with the chosen participants. However, personal information will not form any part in the analysis of the interview questions, and this was clearly communicated to participants.

3.10 CONCLUSION

In this chapter the results of the empirical research study were presented and analysed. The objective of this chapter was to discuss the research approach and methods used to gather sample data in support of the objectives presented in Chapter 1 of this study.

A mixed methodology method was chosen, as it consisted of quantitative and qualitative research methods. The reasoning behind using both methods was to approach this study as would be suggested from the literature to simulate real-world scenarios. The intent was to first approach institutional leadership and influential senior staff members who had prior knowledge of the topics and concepts covered throughout this study. IT leaders would typically do the same to secure initial executive buy-in. Thereafter, an attempt was made to gather data from the broader institutional community to prove the need for strategic intervention. The intent was also to simulate real world scenarios that could be used in practice and to make recommendations in the final chapter. The quantitative research instrument was designed to be simple and understandable without containing too much IT jargon that could discourage participation. As a result mostly frequencies could be analysed although attempts were made to analyse factors.

Analysis of the qualitative semi-structured interviews indicated early on that BYOD is currently managed and not formally implemented at both institutions. Various opinions and perceptions surrounding IT related factors were discussed that generated valuable insight into expectations concerns and opportunities BYOD presents. An overall positive attitude towards BYOD was observed, as a solution to current IT shortcomings.

Analysis of the survey questionnaire indicated that personal device usage existed at both institutions. Respondents provided evidence that they already use, or wants to use their devices at work. End-users also indicated that they would like to be able to access institutional systems via their personal mobile devices. Further, respondents highlighted their expectations and needs regarding access, training and academic use. The overall analysis indicated a positive attitude towards BYOD initiatives, and that these institutions should consider strategic implementation sooner rather than later.

3.11 CHAPTER SUMMARY

This chapter focused on the research methodology and findings of the empirical study. The research approach was defined to present the direction of the study aims to follow from findings in the literature. The research procedures and scope was discussed as well as the measuring instruments used. The population was discussed along with innovative ideas used in an attempt to maximise participation.

Qualitative data was analysed separately from each individual institution to explore specific institutional needs, expectations, perceptions and opinions, and also to indicate that each institution has unique characteristics. Quantitative data was mostly analysed via analysing frequency distributions, and this basic method was deemed suitable to realise the secondary objectives. This simple method could be highly effective in practice where factor analysis could aid the initial strategy formulation and development phases in practice.

Lastly, ethical considerations were discussed and ethical clearance numbers from both institutions were presented to the reader.

CHAPTER 4

RECOMMENDATIONS AND CONCLUSION

4.1 INTRODUCTION

The primary objective for this study was to investigate whether strategic intervention was required in the wake of the BYOD phenomenon, specifically within higher education institutions. The secondary objectives of this study had to be realised to prove the necessity for the primary objective.

The secondary objectives intended to provide proof of, to what extent mobile device usage for work related purposes existed within the institutions amongst employees. Secondly, attempts were made through the study to determine how the institutions currently manage the trend, and if expectations were being met. Thirdly attempts were made to establish segments of users and departments which have or would likely adopt and excel with a sound BYOD strategy. The last secondary objective was to investigate whether popular alternatives to BYOD could be feasible for the institutions in question.

The two higher education institutions used in this study served as a platform to explore the problem statement and facilitate the research in answering the objectives first stated in Chapter 1. It is noteworthy to mention that this study does not intend for its findings to be generalised as a model or solution for higher education institutions facing disruptions caused in the wake of the BYOD phenomenon and IT consumerism. The findings are specific to the institutions in question, and other institutions may vary in culture, diversity, leadership and other factors. The intent was to prove that the BYOD phenomenon existed in general in higher education institutions, and that dependant on the institution, if strategic intervention would be required.

In Chapter 1 it was stated that this chapter, Chapter 4 would focus on drawing conclusions supported by the literature in Chapter 2 and the empirical study analysed in Chapter 3. Subsequently recommendations will be put forward for higher education institutions to help identify employee and institutional needs to accomplish alignment between IT strategy and institutional strategic objectives.

4.2 CONCLUSIONS REGARDING SECONDARY OBJECTIVE 1

Determine how advanced the consumerisation of IT and BYOD is within the institution, including how BYOD is currently managed without having a formal BYOD strategy in place. This information will highlight the need or urgency for strategic intervention.

The empirical research proved that end-user personal devices are already widely used within the two institutions selected to facilitate this research.

Results from the empirical study provided the following compacted information;

- End-user device ownership and the use of personal consumer devices for work related purposes were confirmed.
- IT departments provide some support and infrastructure to facilitate own device usage; however continuous monitoring and improvement will be required.
- The institutions in this study have not implemented a BYOD strategy and are currently haphazardly managing the trend, and providing basic device connectivity to meet basic expectations.

4.2.1 Comments

The first secondary objective was realised as findings in the literature study as well as the empirical study indicated that end-user owned personal devices are in fact widely used by employees across most industries including within higher education institutions on a global scale. Findings from the literature study indicated that BYOD has disruptive qualities that affect how IT departments provide services and support to their respective organisations or institutions. The empirical results supported the findings from the literature study providing evidence that although users seem to be excited about the possibilities BYOD presents, IT departments struggle to meet current expectations. Furthermore the trend cannot just be managed indefinitely as important leadership and legal factors surrounding the trend exist such as, IT Governance, policy development, security etc. This reiterated the fact that strategic intervention is required in cases where no strategy has been developed to accommodate the trend.

4.3 CONCLUSIONS REGARDING SECONDARY OBJECTIVE 2

Establish user expectations along with business areas within the institution which are likely to excel and benefit from BYOD. Effectively segmenting business areas and user needs in order to compliment strategy formulation and areas of interest.

Secondary objective number two was realised as a result of the empirical studies conducted, successfully identifying user expectations and, user and business segments, although improvements can be made in terms of instrument design to increase participation and accuracy.

In short, the empirical research proved the following;

- Current user expectations and future user expectations were identified.
- Basic user segmentation in terms of the main institutional functions were achieved.
- Departmental segmentation was achieved with regards to the institutional support functions.
- Departmental segmentation with regards to institutional academic functions proved to be a challenge, however improvements towards the research approach and instrument could improve results.

4.3.1 Comments

Data analysed during the empirical study confirmed that employees of both institutions were in favour of the idea of personal mobile device usage, BYOD and/or similar alternatives. To prove this statement, possibly the most important question with regards to the research objectives were asked in question 15 of the questionnaire which asked respondents, whether they would like to bring their own devices to work. The majority of the participants (59.7%) responded that they already bring their own devices to work or would like to do so. Furthermore, respondents were asked how comfortable they were with regards to their peers bringing their own devices to the institution for work or personal use. The majority of respondents, indicated they were comfortable with their peers bringing their own devices for work purposes, and slightly less was comfortable with their peers bringing their devices for personal use.

Respondents were first segmented into the two main functions usually found in higher education institutions namely academic and support staff members where both were fairly represented by questionnaire respondents. Thereafter, further attempts were made to segment respondents by department or faculty, this approach proved to be effective in segmenting support departments but not academic schools and departments within each faculty. Therefore it will be mentioned as a limitation to improve upon in practical situation or future studies.

It became apparent that employees had certain expectations with regards to using their own devices within their work environment. Respondents reacted strongly towards being able to use their devices for accessing business systems such as for example, institutional administrative systems and not just for improved communications related activities. Therefore it was assumed that users expect further integration of personal mobile devices within their institutional roles.

Academic respondents who represented roughly half of the sample were content with current student device usage patterns in and around campus, and would like to see further initiatives that integrate these new technology trends within teaching and learning environments. Academics reacted positively towards options that were available to them in the questionnaire indicating that BYOD was perceived as an opportunity in improving both the student experience and in facilitating certain tasks that is expected of lecturing staff members.

The majority of the respondents tended to shy away from questions seeking their opinion regarding BYOD concerns, security matters and institutional barriers. Overall a positive attitude towards BYOD was observed, with respondents claiming to be comfortable using their own devices for work purposes.

4.4 PRIMARY OBJECTIVE

To reach the primary objective it was necessary to determine whether strategic intervention was required, where after the intent was to propose a strategic framework IT leaders could use in formulating a Bring Your Own device strategy for higher education institutions.

4.4.1 Comments

The literature study in Chapter 2, specifically the sections that placed emphasis on BYOD in higher education, recommended mobility or BYOD strategic implementation in the teaching and learning environments as a necessity. Studies conducted by reputable associations such as Educause actively promote the intelligent use of IT technologies to advance higher education initiatives globally which include trends such as BYOD. Furthermore, the vast footprint consumer grade mobile technologies have on a global scale is in itself proof that institutional leaders in higher education and industry in general should take note of the trends and, strategically adapt.

The empirical study conducted aligned with findings presented in the literature study, proving that the BYOD phenomena exists within local institutions. The secondary objectives provided information in support of the primary objective, in that strategic intervention is a requirement to address current needs and expectations amongst support and academic staff members within the teaching and learning environment.

4.4.2 Proposed framework to facilitate strategy formulation

The following framework was derived largely from best practices as discussed in the literature study for BYOD implementation and slightly adapted to align with the research objectives. It is important to note that any internal strategy should be approached **with the intention to align** with the overarching institutional strategy, goals and objectives.

a) Develop the ability to identify possible new trends and developments

IT leaders should constantly be aware of technology trends and new industry developments. The researcher considers this to be a very important skill and recommends the following. If an IT leader is not particularly sensitive towards new technology developments and trends, a team from various stakeholders that shows interest can be formed to report on perceived trends and developments. The IT leader can then analyse these trends for potential business impacts.

b) Define specific objectives and ensure executive support

Ideally some executive partnerships should exist amongst leadership within an institution. It is critical to secure leadership buy-in to ensure overall success in

strategy formulation and implementation. Ensure that the specific objectives, current and possible future value if the strategy can be presented. It is recommended to use similar measuring instruments such as the instruments used in this study to determine current and expected business and user requirements. Involving as many institutional stakeholders as possible will provide proof to ensure executive buy-in and, the establishment of specific objectives.

c) End-user segmentation

Define which departments and end-users are presently utilising personal devices to integrate with and compliment work related tasks within their roles. Knowing where BYOD initiatives will be beneficial as a business and innovation driver is recommended. Any end-user should be considered to be a stakeholder as key insights can be used and measured. The approach and research instruments used in this study could serve as a basic framework institutions could utilise and improve upon to suit their needs, in sourcing the required information.

d) Define your policy

In order to develop a new IT policy that would address BYOD and all its challenges and opportunities, working partnerships and continuous stakeholder engagement is necessary. To ensure purposeful policy development, involve cross functional teams of IT, leadership and end-user stakeholders, legal, security, and human resources in the creation of your BYOD policy. Privacy and security is an increasingly valid concern for end-users and institutions alike. Therefore policy should be developed with the input from multiple stakeholders, leveraging overall participation as a means of creating awareness in the first place. Thereafter, it is recommended to continuously analyse, update and communicate IT policies.

e) Run a pilot programme

Even though it is believed that certain aspects of BYOD was already prevalent within the institution and was currently managed to meet some user expectations, it will be wise to test a pilot roll-out programme. Executive stakeholders and committees can identify pilot groups and departments that could provide valuable

insights to potential barriers, training and IT readiness factors before decisions are made to implement an institutional strategy.

f) Technology alignment

Decide what to allow and what not to allow, which is why alternatives to BYOD strategies have been developed such as CYOD and COPE. Depending on certain policy factors, an institution can decide how to handle any and all devices and applications or allow approved devices and applications. It is recommended to procure popular consumer devices that stakeholders or IT employees could use to test functionality, compatibility and manufacturer support/warranty levels.

g) Define an end-user support

Since BYOD refers to the fact that many devices could be user owned, IT no longer carries the burden of owning the device, and the responsibility of maintaining such device. Best practices tend to lean towards the implementation of a self-service model and offering IT support on all institutionally approved apps for institutional users. In many cases, devices could still be institutionally owned such as in a CYOD or COPE strategy, where IT support efforts will be increased. A clear policy derived from cross functional stakeholders will facilitate the development of a support model. The combination of BYOD, CYOD, and COPE strategies should be considered. Furthermore, it is recommended to test end-user expectations through research to develop a support model that is practical for end-users and IT support departments.

h) Continuous Monitoring

Defining the success metrics of a BYOD strategy in the strategy formulation and development stages by the relevant leadership and stakeholder's alignment can be achieved with institutional strategy and goals. The success or failure of the strategy can be measured. Monitoring should begin as early as the pilot roll-out stage, continue throughout implementation and after implementation. It is recommended that monitoring should be continuous in order for the IT department and the institution to be agile, and adaptive towards current and new trends. Continuous

monitoring would also aid in ensuring policy and support factors being current and up to date.

To conclude, the proposed framework for BYOD strategy formulation clearly draws one's attention towards the fact that executive partnerships and purposeful stakeholder engagement features constantly throughout the framework. Secondly, as mentioned occasionally throughout the study, each institution has unique characteristics that will impact various factors involving strategy formulation.

Therefore, have clear institutionally aligned goals from the beginning in developing a BYOD IT strategy, since the goal will impact the implementation strategy, governance, policies and other factors. Ensure thorough planning and assessment of factors related to BYOD, as it will have multiple implementation phases and impacts multiple stakeholders. Decide on one, or a combination of known mobility programmes and technologies. Constantly monitor with the intent to improve strategy, goals, user expectations and engagement.

4.5 CONCLUSIONS REGARDING SECONDARY OBJECTIVE 3

Consider which mobility program would best suit an academic institution (BYOD, CYOD, or COPE)

Secondary objective 3 was intended to explore which mobility programme would best suit either of the higher education institutions used to facilitate this research. Findings from both the literature study and empirical study indicated that end-users currently expect freedom of choice and flexibility to integrate and connect their consumer grade devices to enterprise networks and systems. This tendency is rightfully perceived as a major disruption by IT departments trying to improve their image and perceived value within institutions. Therefore to find a balance between business and end-user needs, it is recommended to follow an approach similar to this research to first establish key factors to consider that is specific to the institution in question. After which decisions can be made on formulating strategy that aligns with institutional strategy, goals and objectives.

From the observations made through the empirical study at both higher education institutions the following recommendation can be proposed. It is suggested that a

combination of BYOD, CYOD, and COPE programmes be used, due to the fact that current academic institutions accommodate a host of diverse mobile devices, largely due to the student population. Through purposeful research and analysis the institution can decide on the appropriate programmes by segmenting departments and users. For example IT departments can agree on a CYOD or COPE approach to ensure enterprise IT security in areas where sensitive information is a concern, which only allow access to institutionally approved devices for instance. BYOD with its unrestricted ideals can be implemented or made available in areas where only internet connectivity is needed, for example a separate network segment with internet capabilities for “casual” use by students and staff.

The intent of this study was not to cover all the technical aspects of BYOD and its alternatives, but to view the trend from the perspective that institutional leadership should to guide strategy formulation and identify options and alternatives.

4.6 LIMITATIONS

The limitations of this study will be listed below;

- **Time constraints**

It became evident during the empirical study that time was a major factor in order to gather enough data, to provide purposeful, reliable analysis and statistics.

- **Ethics**

Ethical clearance at both institutions were a timely process, the researcher perceived the process to be complicated and time consuming even though early attempts were made to convince ethical committees that the study posed a low risk.

- **Research instruments**

The research instruments used can be improved upon significantly to produce higher quality data that can be analysed through more complex statistical methods.

4.7 RECOMMENDED FUTURE STUDIES

Similar studies could be conducted at other higher education institutions within the South African context. This study only included two higher education institutions which

were situated in the same geographic region. Secondly with more time, a repeat of the current study could be conducted improving upon some sections of the measuring instruments used in this study.

4.8 CONCLUSION

The aim of this study was to investigate the effect IT consumerism and BYOD has on higher education IT departments, and whether IT and institutional leadership should join forces in formulating a BYOD IT strategy that aligns with institutional strategic goals and objectives. This chapter aimed to provide conclusions derived from the literature study and the empirical study, to provide recommendations towards formulating a Bring Your Own Device strategy in higher education institutions

Exploratory research was conducted firstly to investigate the existence of informal BYOD usage at the institutions identified for this study. Firstly attempts were made to investigate the overall perceptions and opinions of influential institutional staff members regarding IT issues, and factors they believed to be important. Secondly an attempt was made to engage with the broader population of institutional stakeholders, to investigate device ownership, expectations and requirements. It is important to note that the approach towards the empirical research was intended to **simulate real-world scenarios** that could possibly be used in practice to gather simple understandable information that IT and non-IT stakeholders can utilise.

The secondary objectives were met through the literature study and empirical research in that strategic intervention was required at both institutions. Recommendations towards the formulation of a BYOD strategy was then presented by suggesting a strategic framework as a best practice guide to assist IT and institutional leaders. The framework was adapted from best practice methods derived from literature and adapted to suit findings from this study, it can further be concluded that the research objectives as indicated in Chapter 1 were satisfactorily met.

4.9 CHAPTER SUMMARY

In this chapter, findings from both the literature study and empirical research were summarised, conclusions were drawn and recommendations were made towards the

need for strategic intervention in the wake of the BYOD phenomenon, in higher education institutions in Gauteng.

Empirical research findings in support of the secondary objectives were discussed in short and further comments were made regarding the impact of the findings in supporting the primary objective that included observations made from the literature review.

The suggested strategic framework was presented and each section of the framework was discussed in short with recommendations. After which a separate secondary objective with regards to which mobile device programme could be considered by higher education institutions in Gauteng was discussed in short. Recommendations were made, suggesting a combination of mobility programmes to address business and IT security concerns, including end-user privacy concerns.

4.10 A FINAL THOUGHT

This study's intended focus was based on the BYOD phenomenon experienced in higher education institutions and the formulation of an institutionally aligned IT strategy. The researcher would like to place emphasis on the word "alignment" because in the current context of business, "getting things done" in an efficient and effective manner seems to be a widespread challenge, as observed through personal experience. This study exhibits the importance of soft issues in business and the significance of developing sound business relationships and partnerships between high profile stakeholders which includes stakeholder engagement downwards through the ranks. The researcher believes that sustainable relationships and partnerships are key initiatives to fast-track and successfully implement **any** project or strategy to meet organisational or institutional goals and objectives.

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APPENDIX A

SEMI-STRUCTURED QUESTIONNAIRE

INFORMED CONSENT

General Project information

Project Title:

Formulating a bring-your-own-device strategy for higher education institutions in Gauteng.

Institution / School / Subject group:

NWU Potchefstroom Business School / MBA.

Project staff:

Researcher: Mr. J.H. Erasmus

Supervisor: Mr. J.C. Coetzee

Purpose of this project:

Bring Your Own Device (BYOD) brings with it certain factors for IT managers and institutional leaders to consider. The impact, risks, opportunities and challenges institutions and organisations face in preparing, planning and adopting BYOD. Developing a framework in formulating a BYOD strategy could prove to be beneficial for these institution/s. The assumption is that higher education institutions tend to have a favourable disposition towards the acceptance of new innovative technologies, especially technologies that can facilitate teaching and learning.

Why should I participate?

IT professionals, academic and support staff members with a knack for technology, in the teaching and learning environment are encouraged to participate. Thus ensuring the inclusion of the perspectives and opinions from all business, technical and academic viewpoints with regards to the BYOD trend.

What is expected of you?

You will be expected to answer questions regarding your understanding and opinion of the BYOD phenomenon within your professional environment. Whether it in your opinion is already managed at your institution and if it should be part of your institutional strategy.

Will you be protected as participant?

Information will be strictly confidential. The questions are not designed to identify individuals in any way. Semi-structured interview data (voice and text) will be stored in a password protected file. Data will be kept for as long as is needed by the NWU Potchefstroom Business School to process the project.

Duration of the project.

Participants involved in semi-structured interviews will only be interviewed once. An appointment will be made before hand which will be scheduled for one hour.

Potential benefits which may arise from the project.

A potential referable document that lays out a suggested strategic framework for BYOD strategy and implementation in higher education institutions.

Consent:

Title:

Formulating a bring-your-own-device strategy for higher education institutions in Gauteng.

I, the undersigned

Have read the preceding premises in connection with the project, and of this informed consent form. I declare that I understand it and I hereby declare that I am takin part in this project voluntarily.

.....
Signature of participant

.....
Date

Semi-structured Interviews: Non IT management staff

Interviewer:

Interviewee:

Date and Time:

WARM UP QUESTIONS	
1.1	Briefly explain the role of your division / section / department within the institution?
1.2	What is your role within your division / section / department?
1.3	What is your comfort level using computer or communication technology?
1.4	What technologies do you use on a daily basis for personal and/or work related use?
RESEARCH QUESTIONS	
2.1	What is your perception of your IT department, do you consider it to be a Cost centre or partner amongst other business divisions?
2.4	What is your understanding of consumerisation of IT and BYOD?

2.5	In your opinion, do you think that IT has a current strategy in place for BYOD or that it is managed haphazardly?
2.6	Does BYOD and/or consumerisation of IT have a noticeable influence or impact within your division?
2.7	Do you find your cellular network coverage adequate on campus?
2.8	Do you find that IT facilities with regards to network connections are adequate?
2.9	Do you find your campus Wi-Fi coverage to be adequate in terms of location and availability? (limited to hotspots or campus wide.)?
Factors concerning BYOD strategic implementation.	
3.1	The following are factors that influence BYOD strategy formulation. As a non IT staff member, would you rate the following factors to be important or not and why?
3.1.1	IT Infrastructure

3.1.2	Security
3.1.3	Support
3.1.4	Policies / Governance
3.1.5	Cost
3.1.6	Innovation
Closing questions	
4.1	Do you think current user expectations are being met in terms of BYOD
4.3	Any further remarks or comments?

APPENDIX B

ONLINE SURVEY QUESTIONNAIRE

General Project information

Title of project: Formulating a bring-your-own-device strategy for higher education institutions in Gauteng.

Institution / School / Subject group: NWU Potchefstroom Business School / MBA.

Project staff:

Researcher: Mr. J.H. Erasmus

Supervisor: Mr. J.C. Coetzee

Purpose of this project:

Bring Your Own Device (BYOD) brings with it certain factors for IT managers and institutional leaders to consider. The impact, risks, opportunities and challenges institutions and organisations face in preparing, planning and adopting BYOD. Developing a framework in formulating a BYOD strategy could prove to be beneficial for these institution/s. The assumption is that higher education institutions tend to have a favourable disposition towards the acceptance of new innovative technologies, especially technologies that can facilitate teaching and learning.

Why should I participate?

IT professionals, academic and support staff members with a knack for technology, in the teaching and learning environment are encouraged to participate. Thus ensuring the inclusion of the perspectives and opinions from all business, technical and academic viewpoints with regards to the BYOD trend.

What is expected of you?

You will be expected to answer questions regarding your understanding and opinion of the BYOD phenomenon within your professional environment. Whether it in your opinion is already managed at your institution and if it should be part of your institutional strategy.

Will you be protected as participant?

Information will be strictly confidential. The questions are not designed to identify individuals in any way. Questionnaire data will be stored online and will be password protected.

Potential benefits which may arise from the project.

A potential referable document that lays out a suggested strategic framework for BYOD strategy and implementation in higher education institutions.

1. Do you want to continue answering the questionnaire?

Yes

No

Background information

2. Please indicate your institution

- North-West University
- University of Johannesburg
- Vaal University of Technology

Other (please specify)

3. Are you an academic or support staff member? (The questionnaire will be setup to direct academic and support staff in different directions)

- Academic
- Support

4. In which business function, division do you work?

- Marketing and communication
- Finance
- Information technology
- Human Resources
- Facility management (Technical services)
- Student affairs
- Administration
- Operational management
- Faculty

Faculty (please specify)

5. What is your age group?

- 20 to 30 years
- 30 to 40 years
- 40 to 50 years
- 50 to 65 years

6. How do you spend most of your time at work?

Between meetings

Behind a desk

On the road

Lecturing

Other (please specify)

Technology Comfort

7. What is your comfort level using Information technology?

- Beginning User, uncomfortable, need a lot of assistance
 Average User, comfortable, need a little assistance
 Above Average User, very comfortable, provide some assistance to others
 Expert User, extremely comfortable, coach and mentor others

8. I use the following technologies on a daily basis for personal and/or work related use: (Select all appropriate boxes)

	Personal use	Work use
Smart Phone (e.g. Blackberry, iPhone, other)	<input type="checkbox"/>	<input type="checkbox"/>
Cellular Telephone (e.g. limited display, lacks full QWERTY keyboard)	<input type="checkbox"/>	<input type="checkbox"/>
Tablet Computer (e.g. iPad, galaxy tab, etc.)	<input type="checkbox"/>	<input type="checkbox"/>
Smartwatches (e.g. Apple watch, Samsung gear)	<input type="checkbox"/>	<input type="checkbox"/>
eReader (e.g. Sony Reader, Kindle Reader)	<input type="checkbox"/>	<input type="checkbox"/>
Laptop computer	<input type="checkbox"/>	<input type="checkbox"/>
Netbook (Compact laptop)	<input type="checkbox"/>	<input type="checkbox"/>
Desktop computer	<input type="checkbox"/>	<input type="checkbox"/>
Desktop All-in-One computer	<input type="checkbox"/>	<input type="checkbox"/>
Other	<input type="checkbox"/>	<input type="checkbox"/>

Other (please specify)

9. On average, I use technology for

	Daily	Weekly	Monthly	Seldom	Never
Large group collaboration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Small group collaboration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Individual use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Presentations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Word Processing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Spreadsheets	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social networking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Instant messaging	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Internet access	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Email with other staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Email with students	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Private Email	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Collaboration with peers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Collaboration across departments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Institutional training development	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Personal development	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Entertainment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

10. What is your current ability to integrate technology into your work environment?

- Beginning, uncomfortable, need a lot of assistance
- Average, comfortable, need a little assistance
- Above Average, very comfortable, provide some assistance to others
- Expert, extremely comfortable, coach and mentor others

11. For each of the following collaborative tools, rate how often you use each for work related purposes

	Daily	Weekly	Monthly	Never	Tool not available
Wiki	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Blogs / Discussion pages	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Twitter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Facebook	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Online discussions / Conferences	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Instant Messaging	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Email	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Department Shared Drive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Video conferencing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other (please specify)

Bring Your Own Device (BYOD)

12. Which of the following devices do you currently own?

- Smart Phone (e.g. Blackberry, iPhone, other)
- Cellular Telephone (e.g. limited display, lacks full QWERTY keyboard)
- Tablet Computer (e.g. iPad, galaxy tab, etc.)
- Smartwatch (e.g. Apple watch, Samsung gear)
- EReader (e.g. Sony Reader, Kindle Reader)
- Laptop computer
- Netbook (Compact laptop)
- Desktop computer
- Desktop All-in-One computer

Other (please specify)

13. Which of the following devices would you like to own?

- Smart Phone (e.g. Blackberry, iPhone, other)
- Cellular Telephone (e.g. limited display, lacks full QWERTY keyboard)
- Tablet Computer (e.g. iPad, galaxy tab, etc.)
- Smartwatch (e.g. Apple watch, Samsung gear)
- EReader (e.g. Sony Reader, Kindle Reader)
- Laptop computer
- Netbook (Compact laptop)
- Desktop computer
- Desktop All-in-One computer

Other (please specify)

14. Which of the following devices is supplied by your department?

- Smart Phone (e.g. Blackberry, iPhone, other)
- Cellular Telephone (e.g. limited display, lacks full QWERTY keyboard)
- Tablet Computer (e.g. iPad, galaxy tab, etc.)
- Smartwatch (e.g. Apple watch, Samsung gear)
- EReader (e.g. Sony Reader, Kindle Reader)
- Laptop computer
- Netbook (Compact laptop)
- Desktop computer
- Desktop All-in-One computer

Other (please specify)

15. Would you like to bring your personal computer or other mobile device (Tablet smartphone, laptop etc.) and connect it to the institutional network?

- Yes, I already do
- Yes, I would like to but have not done so yet
- No

Any comment?

16. If you answered 'No' to question 15, choose the concerns below that best describe why you have not connected your device to the institutions network (choose as many as you would like)

- I don't have an appropriate device available.
- I did not know I could bring it.
- I don't know how to connect it to the networking facilities.
- I don't know how to use my device for work purposes.
- I don't think there is a place for technology in my area or department.
- I already have full time access to technology in my work environment.
- Poor performance (i.e. speed or reliability of the network).
- Data security/confidentiality.
- Loss or damage.

Other (please specify)

17. For each of the devices listed, please select the statement that most accurately describes how you feel

	I would not want to bring this to work	I would like to bring it to work but I don't	I do bring it to work but the institution limits how and where I can use it	I do bring it to work and I can use it for work purposes whenever I want	I do not own this device
Laptop computer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tablet Computer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Smartwatch	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Netbook	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Smart phone	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

18. For the devices that you indicated, in the previous question, that you would not bring to work or would like to but you do not, which of the following best describes your reason?

	Laptop computer	Tablet Computer	Smartwatch	Netbook	Smart phone
I am afraid it will get lost or damaged	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am afraid it will get stolen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I don't know how I would use this device for work purposes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I don't think there is a place for this technology in my area of work / profession	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I already have full time access to this technology at work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am worried about the data security and confidentiality on the device	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I believe the department should supply me with this device	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am worried about carrying it around and finding space to store it when not in use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The device is too old to be useful at work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I don't know how to connect to the network facilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The institution's network is too slow and unreliable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other (please specify)

19. If you could bring your own device to work, which of the following work-related activities would you want to use it for? (select all that apply)

- Administrative tasks (e.g. Access to business systems, institutional administrative systems etc.)
- Work related information source. (e.g. Using popular search engines to solve problems.)
- Organising work related tasks.
- Planning work related tasks
- As a communication tool with peers
- As a collaboration tool with my peers
- As a collaboration tool between departments.
- As a communication tool across the institution

Other (please specify)

20. If you already bring personal mobile devices to work, please select all of the applicable uses from the list below.

- Administrative tasks (e.g. Access to business systems, institutional administrative systems etc.)
- Work related information source. (e.g. Using popular search engines to solve problems.)
- Organising work related tasks.
- Planning work related tasks
- As a communication tool with peers
- As a collaboration tool with my peers
- As a collaboration tool between departments.
- As a communication tool across the institution

Other (please specify)

21. I would like to (or already do) use my personal mobile device(s) to access: (choose all that apply)

- My email
- Notes
- Information resource (e.g. Market and financial information)
- Online resources/tools (e.g. Collaboration tools, Forums etc.)
- Calendaring and scheduling.
- Web 2.0 tools (e.g. twitter, facebook, etc)
- Online videos for information ("How to's")
- Digital documentation (Procedures, training material etc.)
- Project organising, planning and monitoring.
- Professional training opportunities
- Tools to collaborate with my peers
- Tools to collaborate institutionally (i.e. across departments).

Other (please specify)

22. I am comfortable with my peers bringing their own personal devices for work purposes.

- Always
- Mostly
- Somewhat
- Never

23. I am comfortable with my peers bringing their own personal devices for personal use.

- Always
- Mostly
- Somewhat
- Never

Professional Development

24. Indicate to what extent training and support is provided to enable me to be comfortable with:

	More than enough	Enough	Somewhat less than needed	Very little
How to use the standard hardware devices at work.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How to use the general software that is available at work (i.e. MS Office, Mail client etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How to use the institutional business software that supports my role (i.e. Financial systems, Administrative systems)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How to promote responsible use of technology and digital citizenship	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How to manage personal devices that employees might bring into the work environment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How to take advantage of the device that I prefer to bring to work in terms of the environment or area I work in.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
What it means to be a responsible digital citizen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Institutional IT policies and procedures related to own device usage for work related purposes.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

25. To what extent do you encounter the following barriers to the successful integration of mobile technology into your role? Select all that apply.

	Almost always	Very often	Sometimes	Rarely	Almost never
Not enough Professional Development.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Institution not allowing personal mobile devices.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IT infrastructure does not allow for the use of personal mobile devices.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Institutional policies does not allow for the use of personal mobile devices.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Not understanding how to integrate technology into my area/department.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Not enough time to become comfortable with the technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Not enough time to become comfortable with the software / resources	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Inability to separate work related tasks from personal tasks using mobile technologies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Can't find appropriate resources for my area of expertise.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do not know what resources are appropriate for use within my area	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

26. Tell me again, are you an academic or support staff member?

- Academic
- Support

27. Please indicate to what extent do you agree/disagree with each of the following statements:

Allowing students to bring their own device into the class would

	Strongly agree	Agree	Agree somewhat	Disagree somewhat	Disagree	Strongly disagree
increase student engagement in learning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
allow me to differentiate your instruction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
help me utilize high yield strategies?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
improve student achievement	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
increase attendance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
create opportunities for creativity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
create opportunities for critical thinking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
creating opportunities for communication	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
creating opportunities for collaboration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

28. Currently some students are using their own personal devices to

	Yes	No	No, but I would like them to
facilitate research	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
create projects	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
take notes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
capture group notes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
update calendar/agenda	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
manage content	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
submit work to me digitally	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
collaboratively take notes to share with class members	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
contribute to discussions/ share class information via web 2.0 tools such as Twitter or other back channel programs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
use online tools for research i.e. surveys, Skype, advanced search engines, social networking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
access a growing selection of digital resources (such a digital textbooks)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
choose from a wider array of options for demonstration of knowledge including use of Web 2.0 tools.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
collaborate with students and world-wide experts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
utilize opportunities for eLearning/blended learning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>