NELSON MANDELA

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Business School

AN ADAPTIVE INTERNET MANAGEMENT MODEL FOR HIGHER EDUCATION INSTITUTIONS IN SOUTH AFRICA

Ryno Boshoff

Promoter: Professor A.P. Calitz

Co-Promoter: Professor M.D.M. Cullen

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<u>DECLARATION BY CANDIDATE</u>

NAME: Ryno Boshoff

STUDENT NUMBER: 20208717

QUALIFICATION: Doctorate in Business Administration (DBA)

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                                              Education Institutions in South Africa

DECLARATION

In accordance with Rule G5.6.3, I hereby declare that the above-mentioned thesis is my own work and that it has not previously been submitted for assessment to another University or for another qualification.

SIGNATURE:_____

DATE:_____<u>06 March 2018</u>_____

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ABSTRACT

It has become standard practice at Higher Education Institutions (HEIs) for their Internet management and relevant Information and Communication Technology (ICT) resources, specifically Internet resources, to be continuously investigated by HEI Management as well as by their users. The reason is that the Internet has become the foundation on which most ICT and business resources function and therefore is labelled as a distinctive competency for the HEI. HEIs, however, have limited ICT Internet resources and are expected to use these resources optimally, to ensure efficient and effective Internet connectivity on all campuses and to all users and systems.

The management of Internet resources at South African Higher Education Institutions (SA HEIs) are the focus of this thesis. The primary purpose therefore, is to provide a proposed adaptive Internet Management Model for HEIs which will assist them to achieve prime value from their Internet management resources. This was realised by firstly; identifying the current Internet Management Business Models of the SA HEI landscape; secondly, determining what the Internet users of the Nelson Mandela University, a South African Higher Education Institute situated in the Eastern and Western Cape area in South Africa, were using the Internet for; thirdly, comparing these findings to the actual Nelson Mandela University Firewall data and lastly, using the combined findings to draw conclusions and create a proposed adaptive Internet Management Model for HEIs. This can assist the HEI ICT Management team to re-align the Internet resources to match the current business and customer requirements.

This thesis is an exploratory, mixed method study which consists of literature studies, surveys and cross-sectional studies. The literature studies were conducted on secondary sources to identify the national and international governance structures that influence Internet management. The empirical study which consisted of two surveys was compiled from existing surveys as well as from literature studies and was completed by its respective respondent groups. The first survey was used to gain insight into what was considered the standard Internet Management Business Model at HEIs in South Africa. The second survey was used to gain insight how the Internet was being used at Nelson Mandela University by staff and students. Lastly, an extract of the Nelson Mandela University Firewall data were gathered and used to confirm or deny results from the previous survey.

The findings of the first survey, HEI Internet Management Survey (HEIIMS), confirmed that the Internet and its relevant resources are extremely important to all HEIs. The HEIs Internet Management Business Models are to a large extent aligned with the National Research and

Education Networks (NRENs) business models with some adjustments. The HEIs indicated that they cater for a large Internet community but do not differentiate between them. The findings do, however, specify that some differentiation does take place. The HEI Internet is provided to the Internet community at no cost and is funded by Council funds. The requirements of staff and students are mostly similar with some priority differences to key content needs. The Internet resources of the HEIs are very much aligned to support the physical infrastructure of the Internet. HEIs consider the NRENs to be key partners and suppliers with additional local suppliers used as secondary support.

The second survey, Nelson Mandela University Internet Usage Survey (NMUIUS), indicated that there was a wide gap between how the Internet was used by the staff and students. The findings indicated that staff tend to be more aware of the policies and surrounding practices while students appeared somewhat unaware. The staff and students have different needs for the Internet and these needs also change slightly according to the time of day and day of the week. Regarding content access (including Firewall data), some of the users said Internet practices were true whilst others were false. The majority of those giving a false opinion said that said Internet practices were focused on activities linked to cyberloafing content. In addition, they stated that these activities were undersold, meaning that they said that they access the Internet content rarely while the Firewall data indicated that it was frequently being accessed and by many users. It was clear that the staff received a pleasant Nelson Mandela University Internet experience while the students received a slightly degraded Internet experience.

The study concluded with the development of a proposed adaptive Internet Management Model for HEIs and recommendations and considerations on how to improve the current Nelson Mandela University Internet management strategy. This thesis makes a contribution towards the body of knowledge by identifying and discussing current national and international Internet Governance (IG) practices. It continues by identifying the current SA NRENs and their business models which overflow into the HEI landscape. This is followed by an investigation into the various HEI Internet Management Business Models, current usage of the Nelson Mandela University Internet and patterns of use and Nelson Mandela University Firewall data. The thesis will therefore assist readers to understand the effective and efficient management of their Internet usage requirements and the provision of Internet resources. This in turn, will confirm that the availability of the Internet for its users and systems becomes a productive, reliable and pleasant experience.

Keywords: Internet Governance, Internet Management, Internet Management Business Model.

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronyms & Abbreviations	Terms in full
ACL	Access Control Lists
AFRINIC	Africa Network Information Centre
APNIC	Asia Pacific Network Information Centre
ARIN	American Registry for Internet Numbers
ASAUDIT	South African University Directors of Information Technology
BMC	Business Model Canvas
BYOD	Bring Your Own Device
ccTLD	Country code Top-Level Domain
CERT	Computer Emergency Response Team
CFRG	Crypto Forum Research Group
CHPC	Centre for High Performance Computing
CIO	Chief Information Officer
CIU	Compulsive Internet Use
COBIT	Control Objectives for Information and Related Technologies
CRM	Customer Relationship Management
CSIR	Council for Scientific and Industrial Research
DANTE	Delivery of Advanced Network Technology to Europe
DBA	Doctorate in Business Administration
df	Degrees of freedom
DG	Distribution Group
DIRISA	Data Intensive Research Initiative of South Africa
DNS	Domain Name Servers
DST	Department of Science and Technology
DVC	Deputy Vice Chancellor
EAP	Employee Assistance Program
ETSI	European Telecommunications Standards Institute
FCC	Federal Communications Commission
GAIARG	Global Access to the Internet for All Research Group
GDP	Gross Domestic Product
GSM	Groupe Spéciale Mobile
gTLD	Generic Top-Level Domain
HEIIMS	Higher Education Institute Internet Management Survey
HEIs	Higher Education Institutions

Acronyms & Abbreviations	Terms in full
HRPC	Human Rights Protocol Considerations Research Group
IAB	The Internet Architecture Board
ICANN	Internet Corporation for Assigned Names and Numbers
ICCRG	Internet Congestion Control Research Group
ICNRG	Information-Centric Networking Research Group
ICT	Information and Communication Technology
IEEE	Institute of Electrical and Electronics Engineers
IESG	Internet Engineering Steering Group
IETF	Internet Engineering Task Force
IG	Internet Governance
IGF	Internet Governance Forum
IoE	Internet of Everything
IoT	Internet of Things
IRTF	Internet Research Task Force
ISO/IEC	International Organization for Standardization/Electrotechnical Commission
ISOC	The Internet Society
ISP	Internet Service Provider
IT	Information Technology
ITIL	Information Technology Infrastructure Library
ITU	International Telecommunication Union
KPI	Key Performance Indicator
LACNIC	Latin American and Caribbean Internet Address Registry
LAN	Local Area Network
MANOVA	Multivariate ANOVA
MAPRG	Measurement and Analysis for Protocols Research Group
MOOC	Massive Open Online Course
MSM	IG Multi-Stakeholder Model
MTEF	Medium-Term Expenditure Framework
NFVRG	Network Function Virtualization Research Group
NICIS	National Integrated Cyberinfrastructure System
NMRG	Network Management Research Group
NMUIUS	Nelson Mandela University Internet Usage Survey
NOC	Network Operating Centre
NREN	National Research and Education Network
NRO	Number Resource Organization

Acronyms & Abbreviations	Terms in full
NSA	National Security Agency
NWCRG	Network Coding Research Group
One-factor ANOVA	One-factor analysis of variance
OSI model	Open Systems Interconnection model
p-value	Probability value
Paired t-test	Paired-tailed test
PB	Petabytes
PII	Personal Identifiable Information
PRINCE2	PRojects IN Controlled Environments
REC-H	Research Ethics Committee - Human
RFC	Request for Comments
RIPE NCC	Reseaux IP Europeens
ROx	Research Objectives
RQx	Research Questions
RIRs	Regional Internet Registries
SA	South Africa
SA NREN	South African NREN
SANReN CA	South African National Research Network Competency Area
SANS	South African National Standards
SARUA	South African Regional Universities Association
SLA	Service Level Agreement
T2TRG	Thing-to-Thing Research Group
TB	Terabytes
TCP/IP	Transmission Control Protocol/Internet Protocol
TENET	Tertiary Education and Research Network of South Africa
TLD	Top-Level Domains
TOGAF	The Open Group Architecture Framework
VOIP	Voice over IP
W3C	The World Wide Web Consortium
WAN	Wide Area Network
WEF	World Economic Forum
WIPO	World Intellectual Property Organization
WSIS	World Summit on the Information Society
WWW	World Wide Web
XP	Internet Exchange Points

1. INTRODUCTION
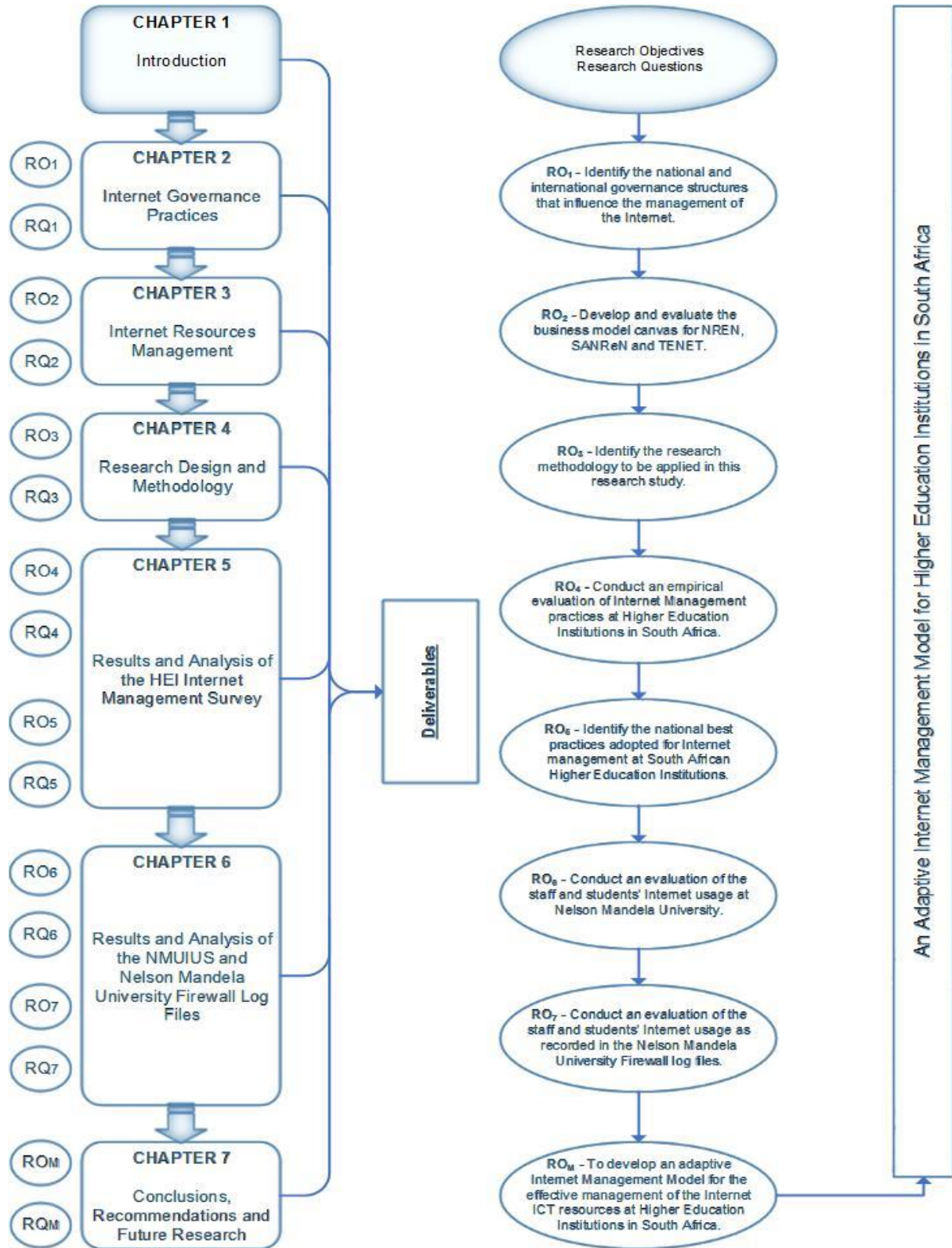
Figure 1.1: Structural Overview of Thesis.

1.1. Background

On 31 May 1961, Leonard Kleinrock published his first paper titled, 'Information Flow in Large Communication Nets' (Kleinrock, 1961). His vision of a galactic network was the seed that grew into the network that has no geographic, sectorial or technological boundaries. Today, this enormous decentralised network is known as the Internet (Computer Hope, 2016). The Internet is arguably one of the most successful, implemented technologies of all time, due to the way it has positively influenced the standards of living, the way work is conducted, the way scholars/students are taught and educated, the methods of entertainment, political participation and above all, by the way society interacts socially (Chen & Nath, 2016). The success of the Internet is based on two basic reasons: the Internet satisfies the needs of all its users and the Internet technologies were developed by solving real world problems (Weis, 2010). The Internet has been adopted into all aspects of our lives to the extent that it would be impossible for any person, government or economy to continue to function adequately without its presence (Almeida, 2014). The Internet has therefore become an indispensable pillar that support business transformation and economic modernisation on all levels (Manyika & Roxburgh, 2011).

In the year 2000, the Internet had only 414 94 957 active users globally which was about 6.8 percent of the world's population. This constitutes a massive increase in Internet usage, content sharing, etc. Currently, the Internet contributes up to 8 percent of the Gross Domestic Product (GDP) in some economies, which promotes exponential growth and assists with job creation. The Internet had 3.9 billion active users globally as at 30 June 2017 which was about 51.7 percent of global users. This increase constitutes a growth rate of 976.4 percent from 2000 - 2017. In South Africa (SA), the total number of Internet users is at 30 million people, which amounts to 54.6 percent of the population. That constitute a growth rate of 1 147.3 percent from 2000 - 2017 (Miniwatts Marketing Group, 2017). The total international Internet bandwidth for the same period was at 185'000 Gbit/s. The highest international connectivity is North America, which is the continent with the highest Internet penetration rate of 88,1 percent. Africa has the lowest international connectivity and the lowest Internet penetration rate of 28.3 percent (Miniwatts Marketing Group, 2017; Sanou, 2016). The 2016 global economic contribution of the Internet was around $4.2 trillion (Bock, Field, Zwillenberg & Rogers, 2015).

According to the World Economic Forum (2016), South Africa is ranked the 75th economy for Network Readiness or Internet Readiness (World Economic Forum, 2016). The Network Readiness Index ranking measured a total of 143 economies in terms of their capacity to

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prepare for, use and leverage ICT resources to better their economies. In a News24 online article by Van Zyl (2016), it was specified that the South African Internet contribution to the economy is well below average as compared to the average expected growth of other countries (Goldstuck, 2012; Van Zyl, 2016). Due to the overall low rating of South Africa's Internet resources, it comes as no surprise that it is regarded at Aspirants status, the lowest of the four rankings (Natives, Players, Laggards and Aspirants, in that order) (Dean, DiGrande, Field, Lundmark, O'Day, Pineda & Zwillenberg 2012).

The Internet offers many positive attributes to its community members. There are, however, some negative attributes associated with being connected to the Internet. Due to the Internet's size, decentralisation, openness and insecurity, many vulnerabilities have presented themself and as such, are being exploited for financial gain, malicious intent, idealism, security breaches and just for the challenge. These threats include cyber-attacks, global surveillance, cybercrime, commercial espionage, threats to critical national infrastructure, etc. (Savage & McConnell, 2014). It is clear that anybody who connects to the Internet is at risk and many users are still unaware of these risks (Byrne, Dvorak, Peters, Ray, Howe, & Sanchez, 2016). Effective countermeasures must therefore be created, implemented and managed to ensure that the community, systems and information are safeguarded when the Internet is being used (Bauer & Dutton, 2015). It is therefore imperative that the Internet is governed and managed according to set acts, standards, policies, procedures and guidelines. These controls, in turn, will ensure that all positive aspects are enhanced whilst ameliorating or eradicating all possible negative effects on the economic life of the community and Internet resources.

Internet Governance (IG) refers to the processes that influence how the Internet is managed in its entirety. It describes the management of Internet resources, public policy issues such as safety and security, development aspects and it also addresses issues pertaining to the proper use of the Internet as an open and trusted platform (Swinehart, 2007). The 2005 Tunis Agenda as well as the 2015 United Nations General Assembly Outcome document on IG contains the following definition for Internet Governance:

> *"A working definition of Internet governance is the development and application by Governments, the private sector and civil society, in their respective roles, of shared principles, norms, rules, decision-making procedures and programmes that shape the evolution and use of the Internet"* (WSIS, 2015, p. 12).

The definition, as presented above, was adopted by the Internet community and therefore quietened the global debate on IG that started in the early 1990s. The decentralised nature

of the Internet's layout meant that no single, centralised authority could govern the Internet whilst keeping best interests of all community members at heart. Due to these reasons, it was argued and decided that the Internet be governed in a decentralised, collective fashion that ensures all aspects are addressed closest to their origin. This method of a decentralised and community-driven, Internet-management approach was accepted and implemented and by 2005 it became known as the Multi-Stakeholder model (Internet Society, 2017; Nonnecke, 2016).

The Multi-Stakeholder model is committed to a vision of an 'Internet for everyone'. The value and principles of this model rely on the co-operation and engagement of all its stakeholders in all aspects of IG. The stakeholders encompass the sharing of global ownership, development of open standards and freely distributing processes for technology and policy development (Internet Society, 2017). The governance of the Internet is divided into policy and technical matters. The policy and technical matters are then further divided into the following core elements of IG:

- Naming and Addressing;
- Local, National, Regional and Global Policy Development;
- Education and Capacity Building;
- Users;
- Shared Global Services and Operations; and
- Open Standard Development.

Each of these core elements has various stakeholders who are ultimately responsible for the effective and efficient management of overarching matters. Mismanagement in one of these areas can cripple the open, transparent and collaborative nature of the Internet. Proper management will ensure that the vision is fulfilled and hence, guarantees that the world continues to enjoy the benefit of a properly governed Internet (WSIS, 2015). These stakeholders are entrusted with the ultimate task of keeping the Internet alive, by ensuring that all decentralised networks can communicate with each other through a system of open network standards in an efficient and effective manner (ICC's Commission on E-Business, IT and Telecoms, 2004).

The correct stakeholders who have passable knowledge and authority, are therefore a critical component that drive the success of the Multi-Stakeholder model. The effective participation, partnership and co-operation of the stakeholders are therefore a necessity. The Multi-Stakeholder model requires the participation of a balanced representation of governments,

the private sector, civil society, international organisations, the technical and academic communities and all other relevant stakeholders. It is also imperative that developing countries be involved to ensure that the full benefit of Internet access is realised in their respective countries (Internet Society, 2017; WSIS, 2005, 2015).

The IG stakeholders, with emphasis on the group users (people, businesses, nations, etc.), have realised that being connected to the Internet will ensure that the business and consequently the nation will reap major benefit from the technological revolution (Manyika & Roxburgh, 2011). The Internet allows big and small businesses to streamline internal and external business activities and communicate more efficiently with customers while helping to reduce business expenses. In addition, it helps businesses to increase their brand visibility, build a stronger and more accessible relationship with consumers, which in turn develops customer brand loyalty. Businesses, which including HEIs, are no longer bound to operate in normal business hours only, but can be open on a 24/7 basis to its customers. Businesses can extend their local footprint into national or even international markets quickly and easily, which allows them to be placed as a competitors with larger and/or multinational businesses. The Internet therefore allows for these stakeholders to improve productivity, increase their market share more quickly, enhance their public image and achieve return on investment. This in turn will help boost infrastructure and access to other markets and customers and ensure economic growth and prosperity (Apăvăloaie, 2014).

For stakeholders to fully take advantage of the immense opportunities presented by being connected to the Internet, their Internet Information and Communication Technology (ICT) resources must be set up and managed correctly. This is at a macro (national) level and micro (local and internal) level. For example, the national infrastructure must be fully functional and have the correct resources assigned to it to ensure that all distributed networks are connected. As previously mentioned, South Africa is not as advanced or on the same level standards as global competitors in this regard. Furthermore, the stakeholders must ensure internally that the overall budget allocation, hardware and software costs, maintenance costs, active and Internet Service Provider (ISP) costs and packages are carefully selected. Additional internal consideration includes what controls must be implemented and maintained to ensure proper usage and to limit misuse. These controls may include traffic prioritisation, website monitoring, usage monitoring and established policies and procedures.

All Internet ICT resources must be carefully selected to ensure that they are aligned with the internal vision of the business. If these resources are not aligned, the full benefit of being

connected will not be realised and will change this competitive advantage into a competitive disadvantage. Typical examples of the consequences of improper Internet ICT resource management include limited Internet speed, constant downtime, over- or under-spending of budgets, unauthorised access to restricted sites (security risks), constant hardware and software failure and abuse of the Internet by users which leads to a loss of productivity.

HEIs, as with all businesses, must implement and manage the Internet to meet their set business goals. In addition to the general office environment, HEIs also have a research and educational environment. The Internet for an office environment would in most cases be strictly controlled while the Internet for an educational environment would be more relaxed and open. Managing the Internet resources in such diverse environments becomes a daunting task for various reasons, amongst which are: the National Research and Education Network (NREN) has stringent requirements that HEIs must observe, guidelines, best practices, governance influences, etc. but these are not readily available to assist with decision making; the number of devices that require Internet connectivity is increasing almost on a daily basis; the content found on the Internet has become extremely resources-demanding; the Internet is no longer being used only during working hours but on a 24/7 basis; and lastly, the Internet is increasingly being abused in its use for non-work/non-academic related activities which hinder the required connection and resources requirements for those who are using the Internet for work and research purposes.

The following section identifies the research problem statement that this research study will address. This is followed by the Research Objectives (RO$_X$), Research Questions (RQ$_X$) and scope and constraints. The significance of the research study is then highlighted, followed by the research paradigm, the research design and methodology adopted for this study. The data analysis is identified, which is followed by the level of ethics clearance received. The research proposal concludes with a written and graphical structural overview of the thesis. Figure 1.1 illustrates an overview of the research objective for this chapter and Figure 1.2 for the structural overview of Chapter 1.

Chapter 1: Introduction

1.1. Background
1.2. Research Problem
1.3. Thesis Statement
1.4. Research Objectives (RO$_X$)
1.5. Research Questions (RQ$_X$)
1.6. Scope and Constraints
1.7. Significance of the Research
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1.9. Research Approaches
1.10. Research Strategy (ies)
1.11. Research Techniques and Procedures
1.12. Data Collection and Data Analysis
1.13. Data Analysis
1.14. Research Paradigms
1.15. Ethics Clearance
1.16. Outline of Chapters and Structure of Thesis
1.17. Summary

Chapter 2: Internet Governance Practices

Chapter 3: Internet Resources Management

Chapter 4: Research Design and Methodology

Chapter 5: Results and Analysis of the HEI Internet Management Survey

Chapter 6: Results and Analysis of the NMUIUS and Nelson Mandela University Firewall Log Files

Chapter 7: Conclusions, Recommendations and Future Research

Figure 1.2: Structural Overview of Chapter 1.

1.2. Research Problem

As discussed in the previous section, various stakeholders with diverse backgrounds, knowledge and skills are tasked with the control over all Internet-based technologies and policies that support it. The stakeholders must then manage their Internet ICT resources according to their predefined set of roles and responsibilities or within their vicinity according to the vision of the Internet. Furthermore, they need to do so in such a manner that fully encompasses the technological and policy advancements of the Internet in their own capacity and environment, in order to give their business itself a competitive advantage over their competitors. It is therefore clear that these stakeholders must address their individual, fundamental business Internet management requirements in such a manner that they realise the overarching IG requirements.

Universities, as they form part of Higher Education Institutions (HEIs), are one of the key stakeholders who assisted with the early development of the Internet (Trinkunas & Wallace, 2015). Today, HEIs still contribute to the development of the Internet through innovative world-class research (Manyika & Roxburgh, 2011). Additionally, HEIs are also classified as Internet users and use the Internet as an essential service for research (other than Internet research), teaching and learning and engagement in both their primary and secondary value-chain activities. HEIs are expected to deliver high speed, reliable Internet connections with the ability to support flexible and secure connectivity between online networks and systems. A well-managed Internet ICT resources infrastructure and supporting system will ensure that HEIs perform better in this competitively important operational and strategic activity and therefore turn their core Internet foundation layer into a competitively superior resource.

Unfortunately, HEIs are finding it increasingly difficult to manage their Internet ICT resources adequately, according to the agreed Service Level Agreement (SLA). This is mainly due to the fact that HEIs are experiencing exponential growth in Internet traffic which leads to an increased cost of maintenance (Broucek, Turner & Zimmerli, 2011). Furthermore, due to the #feesmustfall movement that started in October 2015, the HEI ecosystem has become extremely unstable (Venter, 2016). The zero percent increase left the South African government with a R3bn deficit in its budget, which directly influences the HEI's subsidies which are awarded annually. Most HEIs responded to the turbulent environment by only slightly increasing budgets to Departments and using the funds to increase their buffered resources, for example, their savings, to address requirements in an uncertain future. A reshuffle of the expenditures was an attempt to remedy the shortage in the academic fees and financial requirements academically worthy but previously disadvantaged students (Pilane, 2016). Due to a limited increase in the financial subsidy from the South African government, the financial resources had to be taken from other areas within the HEIs. Additionally, the economic impact that stemmed from recent national activities weakened the Rand/Dollar exchange rate and therefore increased the costs of the Internet ICT resources requirements significantly (Venter, 2016).

Over and above these macro-economic factors, additional micro-economic strains were added to the HEI Internet ICT resources. Staff and students are bringing more Internet-enabled devices into the HEI environment. These devices require an active Internet connection, which adds more Internet traffic to the already congested network and Internet bandwidth. According to Cisco Mobile VNI (2017), in 2015, the average smartphone usage was at 1 169 MB per month and grew to 1 614 MB per month. This calculates to a 38 percent increase in traffic in 2016. In 2016, 429 million mobile devices and connections were added and smartphones

account for the most growth. It is predicted that by 2021, mobile data traffic will increase sevenfold as compared to 2016. In addition, there will be 1.5 mobile devices per capita. This means that there will be 11.6 billion connected mobile devices by then. This would exceed the world's population at that time (7.8 billion) (Cisco Mobile VNI, 2017).

It is clear that there is an expected increase that will take place in the next few years. This, combined with a growing number of staff, student and contractors using the Internet, will place the HEI's Internet ICT resources under increased pressure. Furthermore, rich content is being accessed by the staff, students and contractors and this requires additional bandwidth (bandwidth-consuming content such as high definition video streaming). These devices include Bring Your Own Device (BYOD), Cloud computing, Voice over IP (VOIP) and Internet of Things (IoT) also known as Internet of Everything (IoE).

The ease of Internet availability to the staff, students and contractors throught the various devices resulted in the phenomenon, known as Compulsive Internet Use (CIU). In layman's terms, CIU is the addiction to the Internet. Meerkerk, Van den Eijnden, Franken and Garretsen, (2010) define CIU as the "pattern of Internet use characterised by loss of control, preoccupation, conflict, withdrawal symptoms and use of the Internet as a coping strategy" (Meerkerk, Van den Eijnden, Franken & Garretsen, 2010, p. 729). This addiction to the Internet can cause the personal and work lives of staff, students or contractors to be in conflict. At the one end, the person becomes a workaholic and is using his/her 24/7 Internet connection to address work matters. In this scenario, the business will benefit greatly as tasks are being completed around the clock while the person's wellness deteriorates. At the other end, a person is using his/her 24/7 Internet connection to address personal matters. In this scenario the person's work will stand still or be completed at a slower pace. This will cause the business to not meet set targets and the person's career may be in jeopardy (Quinones, Griffiths & Kakabadse, 2016). The latter is known as cyberloafing.

According to Staff Monitoring Solutions (2015), during an average business day, employees spend between 30 and 40 percent of their time browsing the Internet on non-work related matters which causes significant productivity and liability issues (Staff Monitoring Solutions, 2015). A study conducted by Prof Matthew McCarter from The University of Texas at San Antonio found that cyberloafing costs American companies millions of dollars annually in loss of productivity. The study draws its findings from the fact that social media sites such as Facebook and Twitter notify their users approximately every 10 minutes which prompts the user to investigate the notification. Thereafter, it takes the user 23 minutes to get back to their

his/her work (Corgnet, Hernán-González & McCarter, M, 2015). This unwanted behaviour directly affects the Internet ICT resources management of the businesses. It is therefore obvious that both ends of CIU are extremely destructive to the parties involved and a balance must be maintained.

HEIs are expected to acknowledge all these weaknesses and threats and turn them into strengths and opportunities without any formal guiding structure of Internet management (framework, model or best practices). The general instability of the South African environment as well in South African HEIs, makes it extremely difficult to keep the Internet ICT resources relevant. A study by Boshoff (2016) reiterated these shortcomings and presented a proposed Internet Management Model for HEIs with the emphasis on one University. From the study it was clear that no formal external framework, model or best practices document were used, due to non-availability, to govern the Internet resources of individual HEIs. Instead, the HEIs relied heavily on consultants, their selected Internet Service Provider (ISP), business processes and available Internet ICT resources to guide them. The general consensus was that the HEIs managed their Internet ICT resources on an exploratory or ad-hoc basis (Boshoff, 2016).

In summary, the current South African macro- and micro-economy is unstable and causes difficulties in managing the current HEI Internet infrastructure and policies. HEIs have restricted Internet ICT resources (physical-, organisational-, financial- and human resources) available to implement and manage the Internet ICT resources at the HEIs. Staff, students and contractors generally misuse their Internet privileges by using the Internet for personal matters within normal business hours. Therefore, the problem this thesis will address is:

> *South African Higher Education Institutions have limited expertise, knowledge and guidance at their disposal to manage the Internet resources in their educational environment. Limited and costly Internet resources are generally misused by users (staff and students) for non-academic purposes.*

These issues will be addressed by reviewing the current HEI Internet management practices and environment and thereafter creating a proposed adaptive Internet Management Model.

1.3. Thesis Statement

The thesis statement which will be addressed is:

> *An adaptive Internet Management Model will ensure the effective management of Internet ICT resources at Higher Education Institutions in South Africa.*

1.4. Research Objectives (RO$_x$)

The Main Research Objective (RO$_M$) of this study is as follows:

RO$_M$ - *To develop an adaptive Internet Management Model for the effective management of the Internet ICT resources at Higher Education Institutions in South Africa*.

In order to achieve the Main Research Objective (RO$_M$), the following secondary objectives need to be achieved:

RO$_1$ - Identify the national and international governance structures that influence the management of the Internet;

RO$_2$ - Develop and evaluate the business model canvas for NREN, SANReN and TENET;

RO$_3$ - Identify the research methodology to be applied in this research study;

RO$_4$ - Conduct an empirical evaluation of Internet Management practices at Higher Education Institutions in South Africa;

RO$_5$ - Identify the national best practices adopted for Internet management at South African Higher Education Institutions;

RO$_6$ - Conduct an evaluation of the staff and students' Internet usage at Nelson Mandela University; and

RO$_7$ - Conduct an evaluation of the staff and students' Internet usage as recorded in the Nelson Mandela University Firewall log files.

1.5. Research Questions (RQ$_x$)

The Main Research Question (RQ$_M$) was formulated based on the Main Research Objective (RO$_M$) and is stated as follows:

RQ$_M$ - *What are the components of an adaptive Internet Management Model that will ensure the effective management of the Internet ICT resources at Higher Education Institutions in South Africa?*

In order to analyse the main research problem effectively, the following research questions based on the secondary research objectives, needs to be answered first:

RQ₁ - What national and international governance structures are available that influence the management of the Internet?

RQ₂ - What is the current business model canvas for NREN, SANReN and TENET?

RQ₃ - What research methodology can be used for this study?

RQ₄ - What are the current Internet Management practices at Higher Education Institutions in South Africa?

RQ₅ - What are the national best practices adopted for Internet management at South African Higher Education Institutions?

RQ₆ - What are the staff and students within Nelson Mandela University using the Internet for?

RQ₇ - What are the staff and students within Nelson Mandela University using the Internet for, according to the Firewall log files?

Table 1.1. displays the Research Questions (RQ_X), Research Objectives (RO_X) and Chapter Outline and how they are interconnected.

Table 1.1: Research Questions (RQ_X), Research Objectives (RO_X) and Chapter Outline.

Research Questions (RQ_X)	Research Objectives (RO_X)	Chapters
RQ₁ - *What national and international governance structures are available that influence the management of the Internet?*	**RO₁** - Identify the national and international governance structures that influence the management of the Internet.	**Chapter 2 - INTERNET GOVERNANCE PRACTICES**
RQ₂ - *What is the current business model canvas for NREN, SANReN and TENET?*	**RO₂** - Develop and evaluate the business model canvas for NREN, SANReN and TENET.	**Chapter 3 - INTERNET RESOURCES MANAGEMENT**

Research Questions (RQ$_X$)	Research Objectives (RO$_X$)	Chapters
RQ$_3$ - *What research methodology can be used for this study?*	**RO$_3$** - Identify the research methodology to be applied in this research study.	**Chapter 4 - RESEARCH DESIGN AND METHODOLOGY**
RQ$_4$ - *What are the current Internet Management practices at Higher Education Institutions in South Africa?*	**RO$_4$** - Conduct an empirical evaluation of Internet Management practices at Higher Education Institutions in South Africa.	**Chapter 5 - RESULTS AND ANALYSIS OF THE HEI INTERNET MANAGEMENT SURVEY**
RQ$_5$ - *What are the national best practices adopted for Internet management at South African Higher Education Institutions?*	**RO$_5$** - Identify the national best practices adopted for Internet management at South African Higher Education Institutions.	**Chapter 5 - RESULTS AND ANALYSIS OF THE HEI INTERNET MANAGEMENT SURVEY**
RQ$_6$ - *What are the staff and students within Nelson Mandela University using the Internet for?*	**RO$_6$** - Conduct an evaluation of the staff and students' Internet usage at Nelson Mandela University.	**Chapter 6 - RESULTS AND ANALYSIS OF THE NMUIUS AND NELSON MANDELA UNIVERSITY FIREWALL LOG FILES**
RQ$_7$ - *What are the staff and students within Nelson Mandela University using the Internet for, according to the Firewall log files?*	**RO$_7$** - Conduct an evaluation of the staff and students' Internet usage as recorded in the Nelson Mandela University Firewall log files.	**Chapter 6 - RESULTS AND ANALYSIS OF THE NMUIUS AND NELSON MANDELA UNIVERSITY FIREWALL LOG FILES**
RQ$_M$ - *What are the components of an adaptive Internet Management Model that will ensure the effective management of the Internet ICT resources at Higher Education Institutions in South Africa?*	**RO$_M$** - To develop an adaptive Internet Management Model for the effective management of the Internet ICT resources at Higher Education Institutions in South Africa.	**Chapter 7 - CONCLUSIONS, RECOMMENDATIONS AND FUTURE RESEARCH**

See Appendix A - Research Alignment Plan for the full research alignment plan for this thesis.

1.6. Scope and Constraints

The thesis will focus on the development of a proposed adaptive Internet Management Model for the effective management of the Internet ICT resources at South African Higher Education Institutions. The SA HEIs include Traditional universities, Comprehensive universities and Universities of technology. The Internet Management Model would therefore be able to be adjust to the macro- and micro-driving forces experienced in the HEI environment. The focus will be on HEIs and their currently implemented Internet resources and Nelson Mandela University will be used as a case study.

The case study for the application of the proposed adaptive Internet Management Model will be on the Internet usage in Nelson Mandela University, a HEI with six campuses, five in Port Elizabeth, Eastern Cape and one in George, Western Cape. The scope of the case study will focus on the Internet traffic activities of the Nelson Mandela University users, being staff and students, which will be sourced through an Internet usage survey answered by staff and students. Furthermore, the Internet usage traffic of the Nelson Mandela University users as captured by the Fortigate 1000C boundary firewall, the main tool used for Internet Management at Nelson Mandela University, will be analysed. The log data will be for the period of 01 January 2014 to 26 February 2016. In addition, all captured Internet traffic data will be analysed which includes the Internet only. Internal communication such as the intranet and extranet traffic are excluded. Unfortunately, due to the Edward Snowdon saga, some Internet traffic is encrypted by default and therefore logged into the category titled 'empty'. This category cannot be analysed by the researcher as this is way it was captured during that period.

1.7. Significance of the Research

The purpose of the thesis is to provide insight by proposing an adaptive Internet Management Model, consisting of what is considered best practice regarding effective management of Internet resources in the ever-changing South African HEI environment.

Furthermore, this thesis will assist with:
- Understanding the evolution of the Internet and the factors that led to its constant change;
- Understanding the governance structures that are implemented to manage the Internet;
- Understanding the sources that are available to guide the management processes of the Internet;
- Understanding the global and South African NREN business models;

- Understanding the business models of the Management of the Internet in South African HEIs;

- Understanding by means of an Internet usage survey what the staff and students indicate they use the Nelson Mandela University's Internet for;

- Understanding by means of the firewall log review process what the staff and students are actually using the Nelson Mandela University's Internet for; and

- Gap analysis between Internet usage patterns indicated by the staff and students and their actual Internet usage patterns.

1.8. Research Philosophy

A research philosophy is the philosophical framework that guides researchers on how their scientific research should be conducted. There are three main philosophies, namely: positivism, interpretivism and realism (Collis & Hussey, 2014; Saunders, Lewis & Thornhill, 2012). For this thesis, positivism will be adopted. Positivism provides a framework for research to be completed in the natural sciences. The paradigm stems from the belief that researchers are independent from reality whilst theories are discovered through empirical research. The paradigm allows the act of investigating social reality to have no effect on the environment being examined (Creswell, 2014). The knowledge derived from this act can be scientifically verified by means of mathematical equations (Collis & Hussey, 2014).

1.9. Research Approaches

The research approach refers to the two broad methods of reasoning. The two broad approaches to research are deductive and inductive reasoning. The deductive approach is aimed at testing theories and in most cases starts with a hypothesis. The inductive approach is concerned with the construction of new theories that emerge from the collection of data and usually start with a research question (Trochim, 2006). For the purpose of this research study, deductive reasoning will be adopted as the study progresses from theorising to practice.

1.10. Research Strategy (ies)

Surveys are one of the most common methods of collecting primary or secondary data from samples through the direct interrogation of respondents by using questionnaires to structure the collection of data (Wegner, 2012). The results from a survey are recorded, analysed and generalised to the sample population (Collis & Hussey, 2014). For this thesis, electronic surveys, which included the use of questionnaires, will be used as a form of structured interviewing, which will guide all respondents to answer the same questions in the same layout and format (Krippendorff, 2012).

A Case Study is the research strategy that is adopted to explore a single phenomenon or case in its natural setting using a variety of methods to obtain in-depth knowledge (Collis & Hussey, 2014). For this thesis, Nelson Mandela University will be used as a case study to determine the validity and reliability of the proposed adaptive Internet Management Model.

1.11. Research Techniques and Procedures

The research techniques and procedures refer to cross-sectional studies or longitudinal studies. Cross-sectional studies are the study of a population at approximately the same time period or over a short period of time. It provides a snapshot of a particular situation, which allows for a comparison to be made of the vast number of variables captured within that timeframe (Bailey, 1994; Hair, Celsi, Money, Samouel & Page, 2015; Monsen & Van Horn, 2008). A cross-sectional study will be used to compare the two different population groups identified in the NMUIUS.

1.12. Data Collection and Data Analysis

The literature will be produced in three stages. Firstly, a literature review will be completed to highlight the evolution of the Internet since its inception with emphasis on areas of change. The current Internet status is described and its impact on life, businesses and the global economy. Secondly, a literature review will be conducted to determine what factors constitute the Internet Governance (IG) structures, nationally and internationally. Finally, a literature review will be undertaken on current sources and management practices regarding Internet management. This will conclude the literature review chapters (Chapters 1 - 3) as found in this thesis. All literature reviews will be accomplished by collecting secondary research data. The data will be collected from internal and external sources and in a variety of formats. Sources will include publications in general, databases or records (Wegner, 2012). The review will be finalised by means of a thorough analysis of current literature studies on the relevant topics.

An HEI Internet Management Survey (HEIIMS) questionnaire will be drafted and distributed to all HEIs in South Africa (SA). The respondent to the HEIIMS will be either the Director of the ICT Department or the Internet Directors of the 26 HEIs in SA. The questionnaire will include a demographic section as well as sections covering the business model building blocks. Information obtained from the literature reviews will be used to strengthen the foundation of the questions to ensure the overarching research goals of the research are achieved.

The purpose of the questionnaire will be to collect the current implemented HEI Internet Management Business Model building blocks. This will allow the researcher to gain insight

into the HEI Internet's value proposition, infrastructure, customers and finance and from these combined findings. A general practice SA HEI's Internet Management Business Model will be created. It should be acknowledged that, in the context of this thesis, the term best practices refers to the most general practice across the SA HEI Internet Management Business Model.

The Nelson Mandela University Internet Usage Survey (NMUIUS) questionnaire will be drafted on the Nelson Mandela University survey management platform and distributed to all Nelson Mandela University administrative and academic staff, as well as to the Nelson Mandela University student population. The questionnaire will include a demographic section as well as sections covering probing questions on their Internet usage patterns at the Nelson Mandela University. Information obtained from the literature studies will be used to strengthen the foundation of the questions used in this questionnaire.

The purpose of the NMUIUS questionnaire is to collect the Internet usage data usage patterns of the Nelson Mandela University's users, being academic staff, administrative staff and students. This will allow the researcher to gain insight into the Internet usage requirements and usage patterns of the users from the users' perspective.

The Nelson Mandela University Firewall Logs, as captured on the Fortigate (FortiGuard) 1000C boundary firewall hardware, will be imported into the Nelson Mandela University Sawmill universal log analysis software for analysis. The imported data will focus on the Internet traffic only and no Personal Identifiable Information (PII) will be processed. The imported firewall logs will be analysed on a monthly basis as analysing data over a longer period will result in larger file sizes and will result in the analysing software reaching its maximum processing capacity and consequently crashing. The data will be categorised into the 79 Fortigate web filtering classifications. The results will be statistical data on the type of Internet information being accessed in the Nelson Mandela University environment.

The purpose of analysing the Nelson Mandela University Firewall Log Files is to determine what the users are specifically using the Nelson Mandela University's Internet ICT resources for, as well as the frequency of the usage. Full ethical clearance for both surveys and the Nelson Mandela University Firewall Log analysis will be covered in more detail in Section 1.15.

1.12.1. Sample

A sample is a subset of data value derived from the population. A sample is used when it is not possible to record every data value from the entire population, mainly due to cost, time and possible destruction of the object being measured, counted or observed (Wegner, 2012).

RQ_5 refers to the population of all HEIs' Internet Directors. Therefore, the population of this HEI Internet Management Survey (HEIIMS) refers to the population of HEIs' ICT Directors or Internet Directors. RQ_6 refers to the population of all Nelson Mandela University users. Therefore, the population of the NMUIUS and the Nelson Mandela University Firewall Log Files are constructed from the sample group, namely Nelson Mandela University staff and students. The following sub-sections will elaborate on each group respectively.

1.12.1.1. HEIs' Internet Directors

The HEIs' Internet Directors sample group consists of 26 ICT Directors or Internet Directors in various HEIs across South Africa. These ICT Directors or Internet Directors combined, constitute the entire population of South African HEIs' Internet Directors. These are the individuals who are ultimately responsible for HEI Internet's value proposition, infrastructure, customers and finances.

The sampling method used for the HEIs' Internet Directors will be judgement sampling as the researcher used his judgement alone to select the best sampling units to include in the sample (Wegner, 2012). In this study, the researcher sought the most qualified individual within the HEI that are responsible for the management of the HEI's Internet ICT resources.

1.12.1.2. Nelson Mandela University Users

The Nelson Mandela University users' sample group consists of groups of 1 611 Nelson Mandela University staff, being administrative and academic staff, and 26 119 Nelson Mandela University students. These groups combined, constitute the entire Nelson Mandela University population. It is therefore clear that all Nelson Mandela University Internet users in these categories qualify for this research study and would consequently be invited to participate.

The sampling method used for Nelson Mandela University users would be cluster random sampling as the targeted population can be naturally divided into clusters with similar profiles (Wegner, 2012). These profiles are academic staff, administrative staff and students.

1.12.1.3. Nelson Mandela University Firewall Logs

The Nelson Mandela University Firewall Log Files consist of all Internet traffic captured and logged by the Nelson Mandela University Fortigate 1000C boundary firewall database in the identified research study period (see Section 1.6. Scope and Constraints for the study period). Therefore, the population of the entire Nelson Mandela University Firewall Log Files was used.

1.13. Data Analysis

The HEIIMS questionnaire will be forwarded to the selected HEI ICT Director or Internet Directors with an invitation to participate. All qualified respondents willing to participate will then be requested to complete and submit the questionnaire. When returned, the HEIIMS will be manually tabulated into the required Microsoft Excel format by the researcher.

The NMUIUS questionnaire will be forwarded to the Nelson Mandela University user population and they will be invited to participate. All respondents willing to participate will then be requested to complete and submit the questionnaire. Once completed, the NMUIUS will be automatically tabulated in the required format by the Nelson Mandela University online survey tool. The Nelson Mandela University online survey tool will then allow the researcher to export the data into the required Microsoft Excel format which will simplify the analysis process.

All data for both surveys will then be checked for reliability and validity and all corrupt or incomplete data will be removed from the datasheet. Descriptive and Inferential Statistical methods will then be used to analyse the collected data.

The Nelson Mandela University Firewall Logs will be extracted at stipulated intervals and exported into Microsoft Excel format which would ease the analysis process. All data will then be checked for reliability and validity and all corrupt or incomplete data will be removed from the datasheet.

1.14. Research Paradigms

A research paradigm is the philosophical framework that guides researchers on how their scientific research should be conducted. The two paradigms are quantitative and qualitative. There are two main approaches within the two paradigms, these are quantitative research and qualitative research (Collis & Hussey, 2014; Morgan & Smircich, 1980; Yilmaz, 2013).

A mixed method research approach will be used for this thesis. This incorporates elements at both ends of the paradigm continuum, which are quantitative and qualitative approaches. The collection of data will therefore involve both quantitative and qualitative data, integrating these approaches with one another and then using distinct designs that may involve philosophical assumptions and theoretical frameworks. A complete understanding of the research problem will therefore be comprehended, which is not possible when using each approach in isolation (Creswell, 2008).

1.15. Ethics Clearance

Full ethics clearance was obtained from the Nelson Mandela University Business School through the Research Ethics Committee - Human (REC-H). The accepted ethical clearance form with Resolution Number [H16-BES-BUS-015/Approval] is attached as an Appendix B and the approval letter from the Nelson Mandela University Deputy Vice Chancellor (DVC): Research and Engagement will be attached as an Appendix C.

1.16. Outline of Chapters and Structure of Thesis

The preliminary layout of this thesis is clearly depicted in Figure 1.3. The flow of the thesis is as follows:

1.16.1. Chapter 1: Introduction

Chapter 1 commences by emphasising the significance and importance of the Internet in all aspects of life. The chapter then continues by stressing how difficult it is to govern and manage the Internet ICT resources, which is especially true for HEIs. Various examples of these issues are highlighted to support the main argument towards the value that this thesis will give the research community and HEIs. It will then be argued that a proposed adaptive Internet Management Model would aid HEIs to manage the Internet ICT resources effectively and efficiently. In doing so, the main research objective and secondary research objectives, as well as the related research questions were formulated. Following this process, the purpose of this chapter serves its purpose by creating a holistic view of what is to be expected from this thesis.

1.16.2. Chapter 2: Internet Governance Practices

Chapter 2 introduces the key IT governance frameworks that govern and manage IT. The chapter then identifies and discusses the national and international governance structures that influence the management of the Internet. Therefore, the purpose of this chapter aims to answer RQ_1, which questions "*What national and international governance structures are*

available that influence the management of the Internet?". This is realised by reviewing current literature studies concerning this specific research area.

1.16.3. Chapter 3: Internet Resources Management

Chapter 3 developed and evaluated the business model canvas for NREN, SANReN and TENET. The combined findings constitute the global NREN and SA NRENs general business practices. Therefore, the purpose of this chapter aims to answer RQ_2, which questions "*What is the current business model canvas for NREN, SANReN and TENET?*".

1.16.4. Chapter 4: Research Design and Methodology

Chapter 4 provides a comprehensive explanation of the research methodology followed in this thesis, which aids reproduction in future studies. This chapter specifically elaborates on the research methodology used, with specific reference to the research paradigm, sampling design and measuring instruments. Therefore, the purpose of this chapter aims to answer RQ_3, which questions "*What research methodology can be used for this study?*".

1.16.5. Chapter 5: Results and Analysis of the HEI Internet Management Survey

Chapter 5 identifies and analyses existing HEI Internet management practices and thereafter, provides a complete analysis of the collected empirical data for the HEIIMS. Therefore, the purpose of this chapter aims to answer RQ_4, which questions "*What are the current Internet Management practices at Higher Education Institutions in South Africa?*" and RQ_5, which questions "*What are the national best practices adopted for Internet management at South African Higher Education Institutions?*". This chapter concludes by offering a general SA HEI Internet Management Business Model.

1.16.6. Chapter 6: Results and Analysis of the NMUIUS and Nelson Mandela University Firewall Log Files

Chapter 6 provides a complete analysis of the collected empirical data for the NMUIUS and Nelson Mandela University Firewall Log Files. The NMUIUS analysis is compiled by analysing each research question and presenting these findings in a clear and logical manner. The Nelson Mandela University Firewall Log Files are compiled by analysing each entry and presenting these findings in a clear and logical manner. Therefore, the purpose of this chapter aims to answer RQ_6, which questions "*What are the staff and students within Nelson Mandela University using the Internet for?*" and RQ_7, which questions "*What are the staff and students within Nelson Mandela University using the Internet for, according to the Firewall log files?*".

1.16.7. Chapter 7: Conclusions, Recommendations and Future Research

Chapter 7 presents the proposed adaptive Internet Management Models. Furthermore, it concludes the thesis and offer recommendations on how to improve the HEI ICT Internet management strategy. Therefore, the purpose of this chapter aims to answer RQ_M, which questions "*What are the components of an adaptive Internet Management Model that will ensure the effective management of the Internet ICT resources at Higher Education Institutions in South Africa?*". This chapter concludes by discussing possibilities for future research and lists the limitations of this thesis.

1.17. Summary

This chapter provided a background to the use of the Internet in general and its importance in our daily lives. Internet Governance (IG) and Internet management are then briefly discussed in general, followed by how difficult it has become to manage the ICT Internet resources, especially from an HEI perspective. Various examples of these difficulties were highlighted to support the importance and need for this research study. The research paradigm, research design and methodology and data analysis used in this research study were then discussed. This chapter therefore laid the foundation for what is to be expected in this thesis.

Chapter 2 identifies and discusses the national and international governance structures that influence the management of the Internet. Therefore, the research objective of this chapter will be focused on RO_1, which is to identify the national and international governance structures that influence the management of the Internet. This will be achieved by asking RQ_1, which questions "*What national and international governance structures are available that influence the management of the Internet?*".
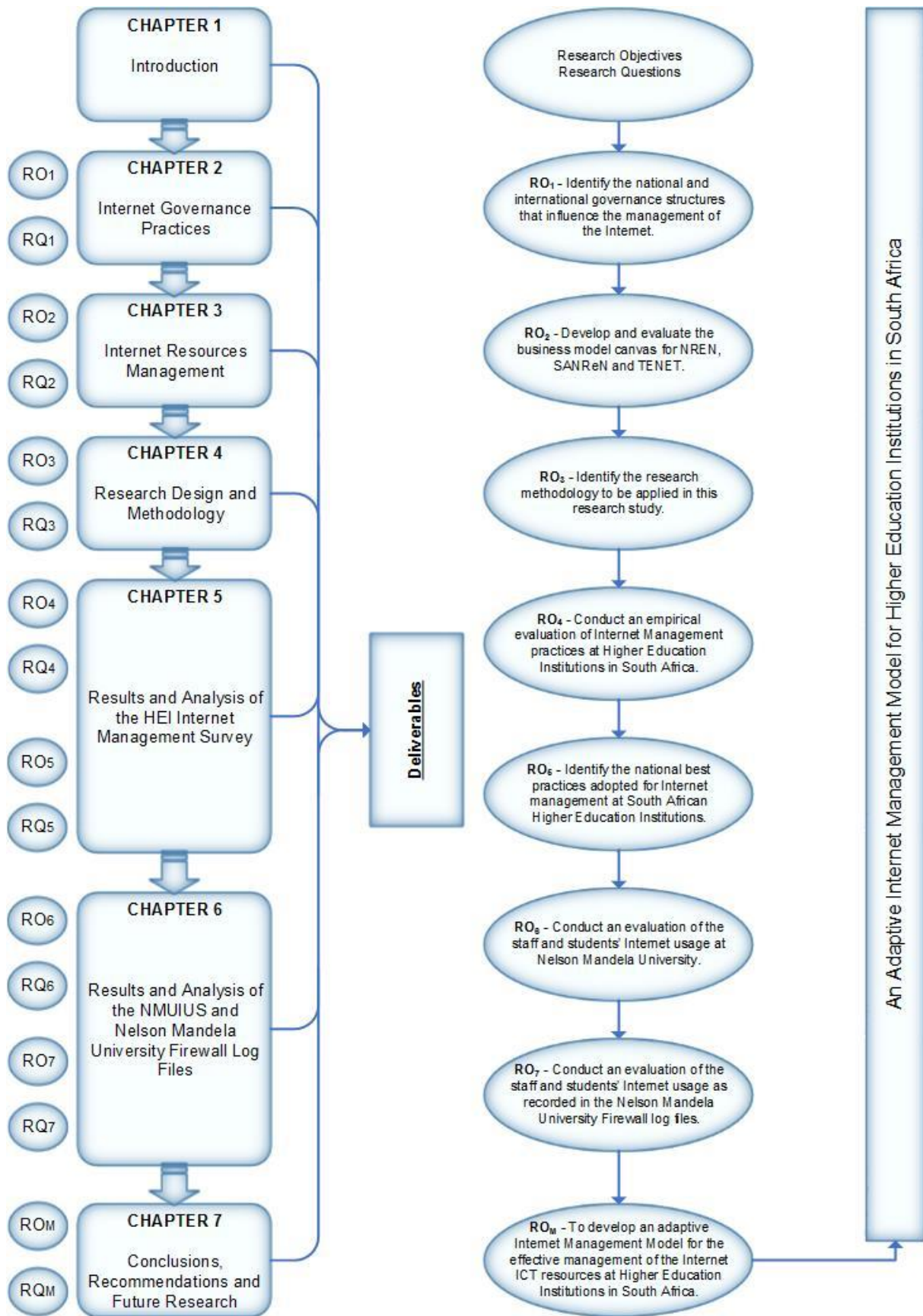
Figure 1.3: Preliminary Layout of the Thesis.

2. INTERNET GOVERNANCE PRACTICES

2.1. Introduction

Chapter 1 presented the outline of the thesis by discussing the background to this research study and explaining the research problem. The problem statement was then identified and linked to the research questions and research objectives, which must be explored to ensure that the problem is adequately addressed. Chapter 1 concluded by briefly discussing the research methodology that will be used in this thesis to ensure it is deemed reliable and valid in the research community.

Chapter 2 reviews the current literature which assists the researcher to critically summarise current knowledge in the respective field of study. The literature review provides a contextual view within which the research study is placed.

This chapter addresses RQ_1 which states, "*What national and international governance structures are available that influence the management of the Internet?*". The purpose of the chapter is to identify the national and international governance structures and the Internet governance ecosystem that influence the management of the Internet. Current literature studies are reviewed and documented to find a suitable answer for the identified research question. Figure 2.1 illustrates an overview of the research objective for this chapter.

Chapter 2 commences by introducing the key IT governance frameworks that govern and manage IT and consequently, the Internet. The chapter continues to review what Internet Governance (IG) models are available to govern the Internet-related resources. After this review, the currently implemented IG structures will be discussed. The different IG actors or role players (Governments, Private Sector, Civil Society and International and regional institutions or their representatives) and their respective roles in maintaining the Internet's global interoperability are presented. The IG ecosystem sphere, which is a roadmap or framework used to address any new IG issues which arise is then presented. The Internet as a public good is discussed and the chapter concludes with a review of the current Internet ecosystem. See Figure 2.2 for a Structural Overview of Chapter 2.
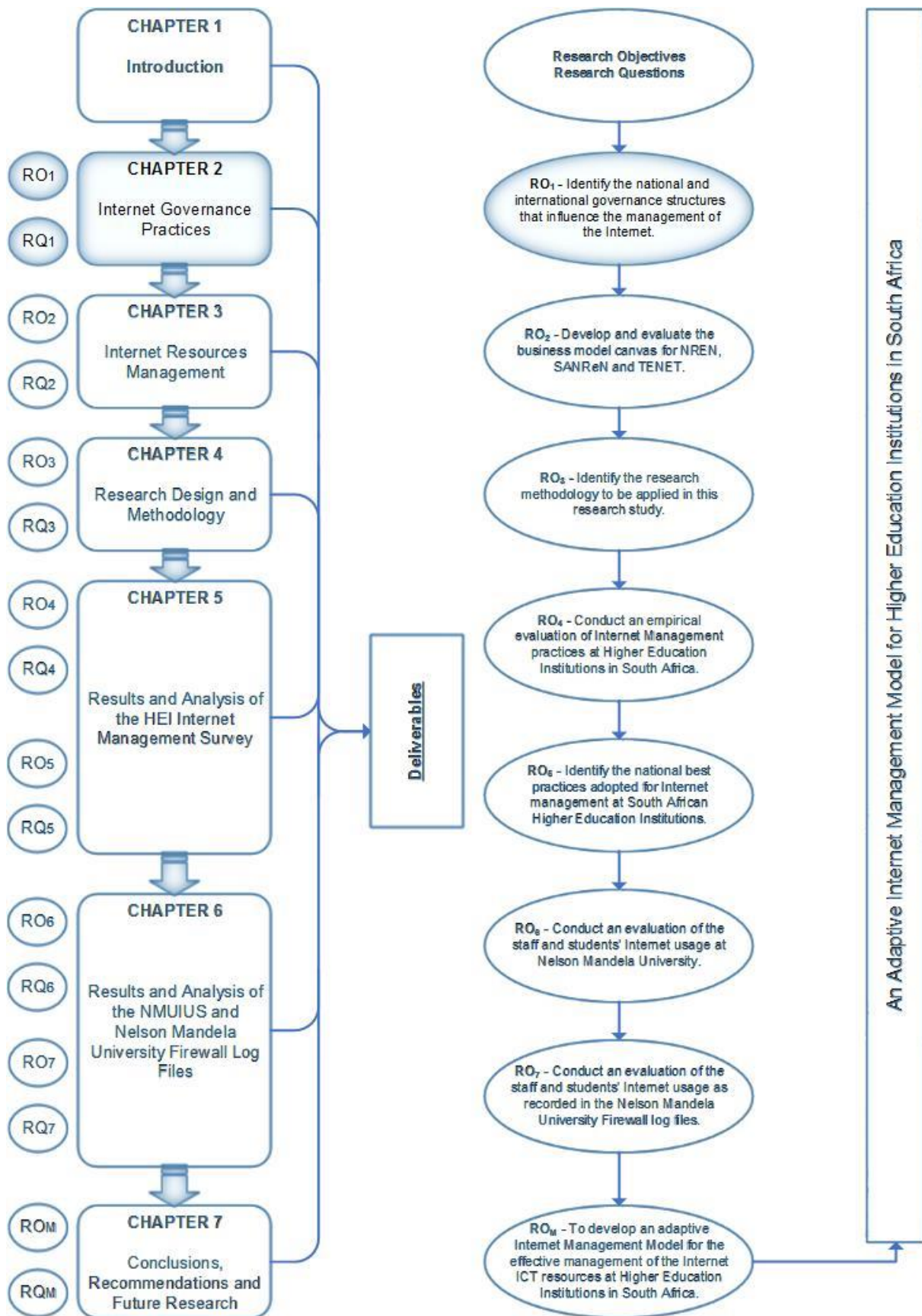
Figure 2.1: Chapter 2 Overview of the Research Objectives.

Chapter 1: Introduction

Chapter 2: Internet Governance Practices

2.1. Introduction
2.2. IT Governance
2.3. Internet Governance
2.4. Internet Governance Models
2.5. Multi-Stakeholder Model
2.6. Internet Governance Stakeholders
2.7. Internet Governance Committees and Groups
2.8. Internet Governance Ecosystem
2.9. Net Neutrality
2.10. Summary

Chapter 3: Internet Resources Management

Chapter 4: Research Design and Methodology

Chapter 5: Results and Analysis of the HEI Internet Management Survey

Chapter 6: Results and Analysis of the NMUIUS and Nelson Mandela University Firewall Log Files

Chapter 7: Conclusions, Recommendations and Future Research

Figure 2.2: Structural Overview of Chapter 2.

2.2. IT Governance

IT (Information Technology) governance is the process that ensures the effective and efficient use of IT by enabling an organisation to achieve its goals. According to Gerrard (2010), IT governance covers three major sets of collective decisions and guidance. These are:

1) How IT should be used in business, which is focused on guiding policies and principles.

2) Who makes what decisions and how they are made, which defines clear accountabilities.

3) Business cases and investments, which describe ownership, priorities, realisation, benefits, funding and chargeback processes (Gartner, 2017; Gerrard, 2010).

These three major sets of collective decisions and guidance, taken together, constitute IT governance which aims to ensure that IT investments support business objectives. It should be acknowledged that IT governance, Internet governance and management are a product and service that currently stem from IT. Consequently, IT governance and the relevant frameworks will be elaborated on briefly. The following sub-sections will introduce the key IT governance frameworks currently available.

2.2.1. COBIT

COBIT (Control Objectives for Information and Related Technologies) is a comprehensive business framework for the governance and management of enterprise IT. It recognised that IT currently plays a significant part in doing business. COBIT 5 can aid enterprises to create optimal value from IT by maintaining a balance between optimising risk levels and resource use and by realising benefits. It allows for IT to be comprehensively governed and managed for the entire enterprise. COBIT 5 is generic and useful for all enterprises, irrespective of sizes, composition, function, purpose etc. (COBIT 5, 2012).

2.2.2. King IV

King IV is a benchmark report for corporate governance in South Africa which applies to all organisations, regardless of their form of incorporation. King IV is a set of voluntary principles and leading practices, which are linked to desired outcomes, subsequently expressing the benefits of good corporate governance. The practices under Principle 12 are focused on the governance of Technology and Information (Information Technology). King IV reiterates that the advancement in technology is transforming product, services and business models and consequently revolutionising societies and businesses. Technology and Information should therefore be governed accordingly to ensure that they provide value to the organisation by being aligned with the organisational governance aims and results (Giles, 2016; King IV, 2016; KPMG, 2016; PwC, 2017).

2.2.3. ITIL

ITILv3 (Information Technology Infrastructure Library) is an IT governance framework of best practices for delivering IT services. ITIL comprises of five books, each one covering various processes and stages of the IT service lifecycle. ITIL offers a methodical approach to IT service management which aims to strengthen customer relations, manage risk, build a stable IT environment and establish cost-effective practices that allow for scale, growth and change (White & Greiner, 2017).

2.2.4. ISO 27001/27002

The International Organization for Standardization/Electrotechnical Commission IEC (ISO/IEC) 27000, a collection of standards, assists organisations to keep information assets secure. In essence, it helps to manage the security of assets such as intellectual property, financial information, employee details or third party information entrusted to the organisation (ISO/IEC, 2017). ISO/IEC 27001 is the best-known standard in the 27000 collection and provides a model for establishing, maintaining, implementing, monitoring, operating, reviewing,

and improving an information security management system (ISO/IEC 27001, 2015). ISO/IEC 27002 helps to protect the confidentiality, integrity and availability of the information by providing guidance on designing, implementing and auditing information security management systems (Aegify, 2017; ISO/IEC 27002, 2005).

2.2.5. PRINCE2

PRINCE2 (PRojects IN Controlled Environments) is a process-based method that provide a common language, systems and procedures for the effective and efficient management of projects. PRINCE2 allows for the proper control for all project resources to obviate possible risks, which leads to fewer mistakes during the project management process. The key characteristics of PRINCE2 include focus on business justification, a product-based planning approach, a defined organisation structure for the project management team, which divide the project into manageable and controllable stages and allows flexibility that can be applied at a level appropriate to the project (PRINCE2, 2017).

2.2.6. TOGAF

The Open Group Architecture Framework (TOGAF) is an enterprise architecture methodology and framework to improve business efficiency. It is not a model, but rather serves as a guiding document when creating an architecture. TOGAF is considered as the most prominent and reliable enterprise architecture standard, which ensures that consistent methods, standards, and communication among enterprise architectures are adhered to (Brocker, 2006; Weisman, 2012). The following section will elaborate on Internet Governance.

2.3. Internet Governance

The Internet is a global network of computers (or hosts), servers and routers that are interconnected through wire, optic fibre and wireless technologies. The network provides for an almost instantaneous electronic exchange and transmission of information between these devices by means of communication protocols, currently, the Transmission Control Protocol/Internet Protocol (TCP/IP) (Dorogovtsev & Mendes, 2013). At its core, the Internet is a fusion of hardware and software technical infrastructure, which allows applications to function. These applications then communicate and generate content, which is shared over these networks (Solum, 2008).

Since the first documented series of memoranda written by J.C.R Licklider of Massachusetts Institute of Technology in August 1963 titled 'The Intergalactic Computer Network', the adoption rate of the Internet has increased significantly (Licklider, 2010). J.C.R Licklider's

vision of a global, interconnected set of devices through which any connected user can quickly access data and programs from any site was met. The journey of achieving the vision went through various phases. In the beginning, the Internet was known as the '*Internet of Links*', which meant that computers and the information stored on them was searchable through links. As the Internet of Links expanded and the amount of searchable data increased, the term '*Internet of Data*' was adopted. The '*Internet of Data*' referred to volumes of data of wide variety and velocity being open to all on the networks. The next phase was named '*Internet of People*'. The '*Internet of People*', also known as Web 2.0, focused on connecting users through the use of social and collaborative software for quick and easy social engagement. This gave users the power to find other users with similar interests, regardless of geographical location. The last and most current Internet phase is known as the '*Internet of Things*'. The '*Internet of Things*' refers to the use of everyday connected devices which include watches, microwaves, refrigerators, heart monitors, etc. that generate enormous quantities of rich and revealing data (Leiner, Cerf, Clark, Kahn, Kleinrock, Lynch, Postel, Roberts, & Wolff, 2012). The direction that the Internet environment moves towards, is a direct result of how the Internet is governed on a local, national and global sphere.

Today, the Internet spans all continents and has mostly a positive, disruptive impact on everyone and everything. The Internet is known as a general-purpose technology that has become one of the most important global communication systems in the 21st century. It has introduced surges of economic growth and productivity, thus paving ways for new industries to enter the market place and has established new rules for the remaining industries. The Internet brought about a disruptive path of innovation, which introduced pricing transparency, which unsettled commercial relationships, increased customer expectations and superseded old business models (McKinsey Global Institute, 2013).

It is clear that the Internet is an extremely large and powerful technology spanning the globe, affecting a major portion of our lives. It must be realised that Internet is made up of millions of devices, running countless applications, which are generating, manipulating and sharing a vast array of data and information over an open medium, continuously. This raises the following questions,

- *Who is entitled to regulate the Internet in its entirety?,*
- *What do these role players do to ensure it is regulated adequately for the benefit of all?*,
- *Why are they needed and in what capacity?*,
- *How do they govern the Internet?*,
- *How do they keep the IG practices current in an ever-changing environment?* and

- *How has this IG ecosystem influenced the current Internet environment and what is its status*?

These actors or role players, comprising Governments, Private Sector, Civil Society and International and regional institutions or their representatives, must have sufficient knowledge to address *policy issues,* as well as address the technical issues related to the Internet, two very diverse skills sets. Due to the immense size, scatter impact and continuous growth of the Internet, it must, in some manner, be regulated.

IG is ultimately responsible for the regulation of the Internet as it develops and changes over time. As the Internet is a shared and open medium of communication, the main aim of IG must be to create shared, evolving policies, standards and mechanisms to guide the development and use of the Internet for the benefit of the wider Internet community. The Internet should therefore be transparent, multifaceted and democratic and available to all, with equal delivery of resources, simplified access for all users and with a stable, safe and secure Internet environment (Kowack, 1997).

The IG environment, also known as the Internet Governance Ecosystem, is divided by the research community into two types of simple scope definitions. The first scope is known as the narrow definition. The narrow definition is the IG components that are focused on the governance of the technical infrastructure and architecture of the Internet. The narrow definition refer to the bottom layer and parts of the middle layer of the Internet Governance Ecosystem, which will be discussed in Section 2.7. The second scope definition is known as the broad definition, which argues that IG is not only responsible for regulating the technical infrastructure and architecture such as Domain Name Servers (DNS), IP numbers, routing protocols, etc., but it is also ultimately responsible for policy and political issues such as child pornography, freedom of speech, privacy, security, international organisation, etc. (King IV, 2016; Solum, 2008).

The broad definition refer to all three layers of the Internet Governance Ecosystem, which will be discussed in Section 2.7. It is, however, apparent that all three layers or both scope definitions cannot be isolated from one other. The entire Internet Governance Ecosystem is dependent on the seamless synergy of all components or focus areas. A common strategy is needed between the underlining components and actors to ensure that the shared vision of the Internet is achieved. Without this common strategy, the Internet would not be globally interoperable and would have diminished functionality (Raymond & Gordon, 2013).

2.4. Internet Governance Models

Historically, IG was labelled as an arcane and even marginal topic, which only held the attention of a handful of computer geeks and government officials. All that, however, changed when Edward Snowden, a former contractor for the United States government, blew the whistle on various global surveillance programs that were run by the National Security Agency (NSA) and the Five Eyes Intelligence Alliance (Epstein, 2017). The disclosure of classified US National Security Agency documents made the world realise how connected and vulnerable all connected Internet users are. Key IG topics such as privacy and security quickly became important and became central to the IG discussions (Almeida, Getschko & Afonso, 2015). Furthermore, a spike in the adoption rate of the Internet by other non-traditionally connected sectors such as education, health care, manufacturing and even governments focused additional attention on IG. These areas combined re-emphasised the importance of the need for a properly governed Internet on a local, national and global sphere (Raymond & Gordon, 2013).

A properly governed Internet requires adequately aligned structures to be in place where all Internet resources, whether the physical, logical, economic and societal layers, are adequately sustained. A study conducted by Solum (2008) found that there are currently five IG models which are centred around two thought-processes associated with IG. The two thought processes are:

1) *What or who determines where the responsibilities must lie?*

2) *What level of operation is associated with these responsible parties?*

Each model, as presented in the study, is developed around these questions and is therefore focused on a contextual environment and line of throught. Another study by Collins (2007), reinforces these IG models. The models, however, are referred to as myths and are divided into three models. The three models are Network Organisations, Horizontal vs Vertical and Hierarchy and Markets. Furthermore, Pavan, Senges and Komaitis (2009) incorporate elements of the model into four areas known as commons. The four models are Social commons, Infrastructure commons, Service commons and Access commons. These commons are, however, not in line with the thought processes and would therefore not be included in their entirety in the chapter. For the purpose of this thesis, the focus is on the model at its most simple level, therefore the five models as covered by Solum (2008) will be discussed and will be aligned with Collins's (2007) myths. The following sub-sections will elaborate on each of the five models of IG.

2.4.1. Cyberspace and Spontaneous Ordering Model

The Cyberspace and Spontaneous Ordering model is built on the traditional thinking that the Internet is an environment not related to the real world in any way. The Internet is seen as a self-governing and separate realm of individual rights (Solum, 2008). The Internet is classified as a distinct place with no associated geographical boundaries. Areas such as legal rights and responsibilities cannot be determined by geographical borders as the law space or law map does not apply as it does in the real world where law and legal institutions are enclosed within existing borders and controlled by the respective governments (Solum, 2008). The core difference between the two realms is that the real world governance practices cannot be imprinted onto those of the Internet, as one may assume (Collins, 2007; Johnson & Post, 1996; Solum, 2008). The regulatory requirements for physical businesses and online business differ vastly. Factors such as market forces, economic forces and government regulations would therefore not apply to online businesses in the same way as with physical businesses.

In this model, it is contended that governments should not be encouraged to enforce their respective rule on the Internet. The impact of imposing rules set by an individual government which functions within its geographical border will influence the experience, of the global Internet community using the Internet. Freedom of using the Internet would be severely curtailed if, for example, North Korea, Cuba, China, Turkmenistan, Vietnam, Tunisia, Syria, Iran, Saudi Arabia etc. enforced their extremely restrictive Internet rules and regulations onto the global Internet community (USA Today, 2014). The Internet experience would be a very limited and a controlled one. Beyond this, it would be extremely costly for any government to attempt to monitor and regulate all three layers of the Internet Governance Ecosystem, because the offending source could be from any physical location, anywhere in the world. Furthermore, the technical and architectural nature of packet switching and routing associated with traffic communication will also impose some difficulties as packets seem to follow the route of least resistance, meaning that the conversation would not follow the same route every time the Internet is used (Johnson & Post, 1996; Solum, 2008).

The separate and independent nature of this realm does not mean that the Internet is a lawless space. There is an increase in law-making institutions within Cyberspace that support this argument. An example is the Cybercrimes and Cybersecurity Bill is being gazetted for the South Africa environment on 09 December 2016 (Crawford, 2017). There is, however, a fine line that needs to be understood, especially when attempting to identify with great precision cyber activity to a physical jurisdiction. Johnson and Post (1996) claim that the structures

covered in this model are better suited to address the Internet legal issues (Johnson & Post, 1996; Solum, 2008).

2.4.2. Transnational Institutions and International Organisations Model

The Transnational Institutions and International Organisations model includes the characteristic of being a self-governing, separate realm of individual rights, not related to the real world in any way discussed in the Cyberspace and Spontaneous Ordering model. The model identifies transnational institutions and international organisations as the most qualified entities to address IG concerns (Solum, 2008). The nature of these institutions must be structured as a business, should not be bound by a geographical border, must answer to the Internet community or community of network engineers and it should be founded on contractual arrangements. The respective institutions use their expertise to focus on a specific function or resource of the Internet and impose regulations upon it to best serve individuals or the Internet community at large.

Transnational institutions are entities that are outside the control of governments and report directly to the Internet community or community of network engineers. Two current examples are the Internet Corporation for Assigned Names and Numbers (ICANN) and the Internet Engineering Task Force (IETF). International organisations, on the other hand, are within the control of governments and report to their respective governments. Two current examples are the World Intellectual Property Organization (WIPO) and the International Telecommunication Union (ITU). Both Transnational Institutions and International Organisations are active entities in the current IG model (Collins, 2007; Solum, 2008). Historically, transnational institutions have been better received and accepted, while international organisations have failed to gain the high level of authority of transnational institutions.

Collins (2007) combines the first two models, Cyberspace and Spontaneous Ordering and Transnational Institutions and International Organisations, into one model which he titled the Network Organisation. The characteristics of the models discussed above remain the same.

2.4.3. Code and Internet Architecture Model

The Code and Internet Architecture model is build on the IG historical thinking that the Internet is built on code and architecture and decisions regarding it must be made by the computer geeks, in this case the technical specialists and on a technical level (Solum, 2008). After all, the nature of the Internet is first and foremost made up of software and hardware which are integrated by various levels of code. The model therefore argues that in order to regulate the

Internet, the governance must be in line with the nature of the implemented code. The rules stipulated in the code will subsequently permit some activities while denying others, in the same sense as the layout of a city (born from the city's architecture) guides users in specific directions. Anything outside the scope of the code and architecture will be irrelevant as it does not comply with the source. This logic makes code and architecture the prime regulators of the Internet (Solum, 2008).

The basis of the Code and Internet Architecture model can best be described through the standard communication functions of computer systems, best known as the Open Systems Interconnection model (OSI model). The OSI model logically divides the underlying Internet structure and technology of the network architecture into seven logical layers (Collins, 2007; DeCusatis, 2014). These seven layers are the central architecture that rationally define the communication process of the Internet. The layers are 7 – Application, 6 – Presentation, 5 – Session, 4 – Transport, 3 – Network, 2 – Data Link, 1 – Physical, each built onto each other in sequence. Each layer has a specific purpose and must be completed before the next layer can be executed.

For example, 1 – The Physical layer transmits and receives the raw bit streams over a physical medium and 2 – The Data link layer guarantees the reliable transmission of data frames between two devices connected by means of the physical layer. The relationship between each connected layer (either above or below, depending on the traveling direction of the data) is critical to the successful communication between connected devices. If any of the layers is not executed successfully or is not transferred in the correct format to the next layer, then the communication will be broken and the data will be lost (DeCusatis, 2014; Fall & Stevens, 2012). Each layer of the OSI model, therefore, represents a crucial function of the code and Internet architecture.

Figure 2.3 depicts a typical communication process between two users or systems. Starting at the top left corner where the data originate, the user sends the data from the top layer, the Application layer, which is then processed and communicated downwards towards the Physical layer. The data then travels thought the Presentation layer, Session layer, Transport layer, Network layer, Data Link layer and ends at the Physical layer. The data then leaves the source device and travels over the Internet to the destination device. The Internet is represented by the Network layer, Data Link Layer and Physical layer; the number of layers depends on the route the data travels. Each time the data packet enters a switch or router device on the Internet, the packet is opened to detect the destination address and is then

sealed and sent in the direction of the destination device according to the path of least resistance. This process is repeated every time data enters a new network segment on the Internet. When the data arrive at their destination device, the data enter the Physical layer of the device and are communicated up the layers in reverse order. The data are finally received in the Application layer where it is displayed to the user in its original form. This is the basis of a typical communication process between devices according to the logic of the code and Internet architecture (DeCusatis, 2014).

As previously mentioned, the TCP/IP is the current preferred standard protocol for network communication which makes the connection between networks materialise. TCP/IP was created to address the growing desires of the Internet architecture. It was created as a software-only protocol, which was free from any physical hardware resources. It is in essence pure code that governs the architecture of the Internet. The Code and Internet Architecture model are consequently the governance of TCP/IP (Solum, 2008).

Collins (2007) refers to this model as Horizontal v Vertical whilst Pavan, Senges and Komaitis (2009) refer to it as Infrastructure commons. The characteristics of the model, as discussed above, remain the same.
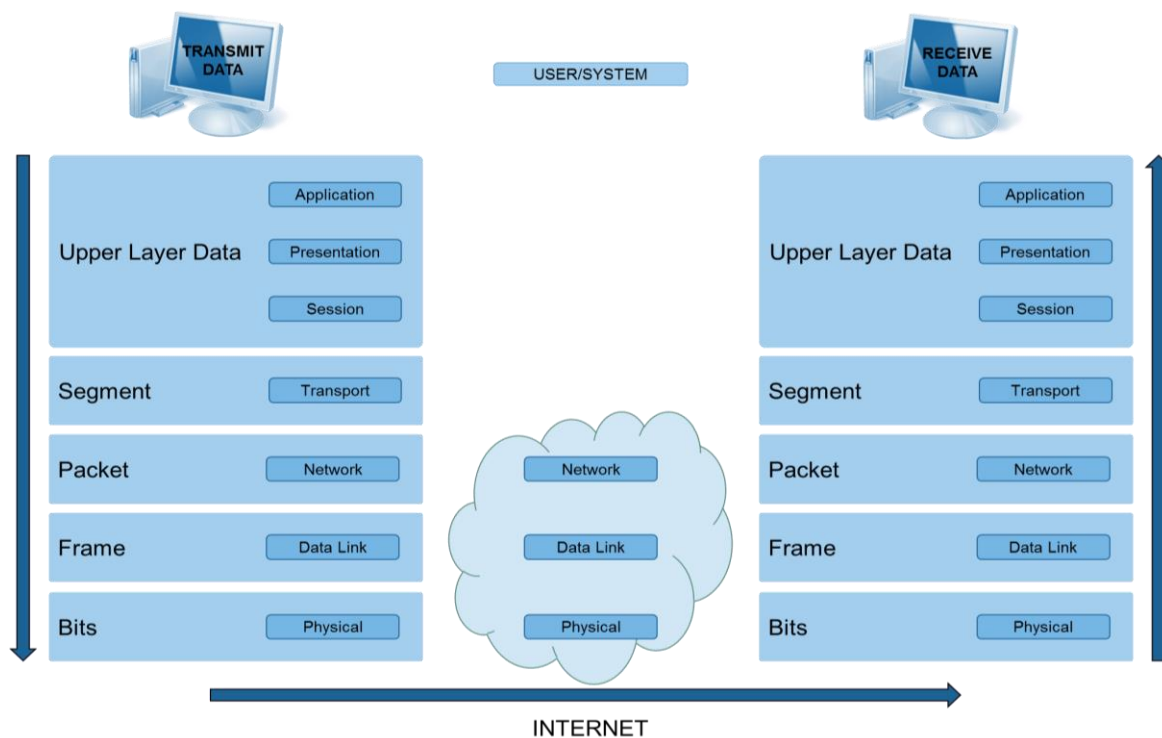
Figure 2.3: ISO 7 Layer Model of Communication.

2.4.4. National Government and Law Model

The National Government and Law model focuses on the ideology that the Internet should be controlled by national governments by means of legal regulation for the same reason that they exert control within their borders (Collins, 2007). The national government will therefore be the regulatory body of all aspects of the Internet within its jurisdiction. This includes activities such as making important, fundamental, regulatory decisions around Internet-related activities that take place within its jurisdiction. The core focus of the national government would be to recognise the Internet as a human right and realign it accordingly. This will allow the national government to efficiently provide access to the Internet to all its citizens and not only to those who can afford it. They will also be in control of what Internet traffic to block and what traffic to filter and realign it through the regulatory frameworks. The funding of the Internet would be collected from the citizens' tax contributions and not necessarily only from those who use the Internet. If this is the case, then there would be little competition in the market, meaning that less innovation will take place. This in turn will make the Internet-related resources stagnate. The key fundamentals to the success of this model are that firstly, the national government must have full power over its territory and secondly, the citizens that use the Internet must do so within its borders. The success of the model is highly dependent on these two factors being present. Currently with most national governments, Internet regulations are already in place to some extent. This is due to the national government's critical role in the regulation of the country. A foundation, related to Internet-related markets, is therefore already well established in most national governments, which greatly assists with other Internet regulation modalities (Shackelford & Craig, 2014; Solum, 2008).

The National Government and Law model does come with some difficulties, which directly tie in with the two previously discussed factors that must be present for the model to work. Firstly, the fundamentals of the Internet architecture conflict with the notion that the national government must have full power over its territory (Xing, 2011). In the Code and Internet Architecture model (Section 2.3.3), it was emphasised that the Internet is extremely technical at its most basic level. For this reason, the national government can only do so much before it is required to make fundamental changes to the code and Internet architecture. Historically, no national government has had enough power to force a global Internet architecture modification. This reinforces the argument made that the Internet was not meant to be regulated by one national government only. The second difficulty relates to the view that citizens must use the Internet only from within its national borders as content created outside the national government's jurisdiction may be in direct violation of the government's regulations. National governments are hence required to regulate certain content by law,

which is in most cases an extremely difficult, time consuming and expensive task to perform. The ultimate solution to this problem would be to remove the content from the Internet, globally. This deed, however, will affect the entire Internet community, meaning that one national government would have domination over the Internet content (Solum, 2008).

A major obstacle to the successful implementation of the National Government and Law model comes in the form of large numbers of freely available technologies that allow the Internet user to bypass implemented national government's regulations. A common example is when an Internet user leverages on the functionalities of proxy servers, which trick the regulators in to thinking that the devices are stationed in another country. The proxy server technology permits a user to not adhere to the regulations of his/her country of origin and therefore falls within the regulatory environment of another country. This may permit a large percentage of the population to disobey the regulatory requirements of the nation. China is a prime example of such a case. This obstacle, combined with the immense costs, time and skills required to execute such a model, jeopardises the implementation of the full extent of the National Government and Law model (Xing, 2011).

2.4.5. Market Regulations and Economics Model

The Market Regulations and Economics model assumes that the essential decision-making process regarding the nature of the Internet, must be addressed in economic terms, such as market services and products (Solum, 2008). IG within the model would be regulated according to the market forces that stem from the economy within the jurisdiction of the national boundaries. The market economy is then guided by the supply and demand of all Internet-related services and products. The Internet-related resources should therefore be regulated according to the level of desire for each product and service and how much the market can offer its customers. A market economy allows for Internet-related services and products to be distributed in the most efficient way possible (Hirschey, 2009). The Market Regulations and Economics model should drive the decision-making process that governs the Internet according to market economics (Solum, 2008). The competition amongst the market forces allows innovation to flourish, which in turn accelerates the advancement of the Internet-related resources. This model, however, increases the gap created by the digital divide, which means that only those who can afford to pay for the Internet would be able to gain access to its vast resources. Those who cannot afford it are therefore excluded, meaning that possible future leaders, entrepreneurs, innovators, astronauts, etc. are left behind. Startup companies may also be blocked from entering the market space as they may not have the financial resources available to use fully the advantages of being connected. Those that have a

monopoly in the market will have full control of the market environment and will be able to implement their own costing models and regulations.

A current example that is used to demonstrate the economic approach is that of the Domain Name System (DNS) services offered by ICANN. DNS resources are a type of service used by clients to translate the physical IP addresses of devices, services and any other resources connected to the Internet into easily recognisable and memorable names for the user (Cheshire & Krochmal, 2013). The more easily recognisable and memorable the DNS name is, the higher its demand and consequently, its cost would be. A typical example would be www.facebook.com. The less recognisable and memorable the DNS name is, the lower its demand and consequently, cost would be. A typical example would be www.sfgbzbzbdd.rd. The same economic approach would be used for Internet-related web content. Youtube.com content is a good example of this. The highly desirable and/or valuable content, a.k.a viral content, found on website results in monetary rewards being paid to the creator whilst not be so desirable and/or valuable will not result in any money for the creator.

Collins (2007) combines the last two models, the National Government and Law and Market Regulations and Economics models, into one model which he titled Hierarchy and Markets. The characteristics of the models, discussed above, remain the same.

The five IG models as discussed above, all produced their unique advantages and disadvantages. The Internet community has realised this and has noted that there is no single model that is deemed adequate to provide an all-rounded solution to all the IG problems experienced. Although each model provides valuable benefits to IG, each model also presents various inadequacies that could cause misalignments in the Internet-related resources. It is also clear that the needs of the stakeholders will not be addressed by only one model. An alternative strategy must therefore be considered to ensure that IG is sufficiently regulated to ensure an improved Internet experience for the wider Internet community. The following section will examine what IG model is currently in place to provide an IG solution.

2.5. Multi-Stakeholder Model

The previous section presented the importance of IG in creating shared, evolving policies, standards and mechanisms to guide the development and use of the Internet for the benefit of the wider Internet community. Five IG models were identified in Section 2.3, each presenting their own IG focus area and offering their own advantages and disadvantages. It became apparent that a single IG model would not sufficiently achieve the vision of the Internet

and for that of the wider Internet community. Therefore, the questions remain "*Who is entitled to regulate the Internet in its entirety?*", "*What do these role players do to ensure it is regulated adequately?*", "*Why are they needed and in what capacity?*" and "*How do they govern the Internet?*

The World Summit on the Information Society (WSIS), which was held in two phases in Geneva, 10 - 12 December 2003 and in Tunis, 16 - 18 November 2005 presented the Internet community with the IG definition most adopted to date. The documents accepted by WSIS (2005) define Internet Governance as "the development and application by governments, the private sector and civil society, in their respective roles, of shared principles, norms, rules, decision-making procedures and programmes that shape the evolution and use of the Internet" (WSIS, 2005, p. 4). IG involves the management of numerous associated features which include focus areas such as technical infrastructures and architecture standards and policy matters which constitute how the Internet works and should be used. It is therefore apparent that IG can only be achieved with the collective involvement of governments, private sectors and civil societies. This effort is known to be the IG Multi-Stakeholder Model (MSM).

The IG MSM has been widely revealed as the preferred global model of choice for the past four decades (Almeida, Doneda & Rossini, 2016). It has been well received and many argue that the success of the Internet stems from this model (Cerf, 2015; Gurstein, 2014; Savage & McConnell, 2014). It brings together all major IG stakeholders which include, Civil Society and Internet users, Governments, the Private Sector, Transnational and International Organisations, Research, Academic and Technical communities all of which participate in their respective roles to make the current and future state of the Internet open, secure, trustworthy and accessible to all (Almeida, Getschko & Afonso, 2015; Almeida, Doneda & Rossini, 2016).

The model therefore encompasses functions, which include Internet values such as support, privacy, security, neutrality, transparency, freedom of expression and competition and allows for greater collaboration and co-ordination on various Internet regulation issues. The stakeholders therefore collectively address these issues, arriving at consensus through a bottom-up approach my means of sharing knowledge, skills and expertise that stem from user requirements, technical innovation, market opportunities and political interests (International Telecommunication Union, 2013).

The collaboration and co-ordination approach allows for the handling of various layers of traffic over the Internet through all communication platforms, which span local, national, regional and

international levels (Almeida, Doneda & Rossini, 2016). The outcome of the IG MSM is a communal network of networks that is beneficial to all who wish to use it. The product of the collaborative approach as presented in the MSM is that the core advantages of each of the five models are elevated whilst removing the disadvantages associated with each (Gurstein, 2014). The following section will identify and discuss the various stakeholders involved with IG.

2.6. Internet Governance Stakeholders

The MSM consists of a distributed set of actors, also known as stakeholders or role players, who are ultimately responsible for the operation, maintenance and evolution of the Internet (Cerf, 2015). Research articles identify four respective stakeholders which together play a pivitol role in the regulation of the Internet in its entirety (Senges & Horner, 2009). The four stakeholder groups are governments, the private sector, civil society and international and regional institutions. Stauffacher and Kleinwächter (2005), provide insight into each stakeholder, actors or role players, and their respective roles in IG as follows:

- Governments – The local government is ultimately responsible for the creation and implementation of the nation's ICT strategies, which are aligned towards the best interests of the country and its citizens. A counselling role is played by the private sector and civil society in this regard;
- Private Sector – The private sector, that is outside the control of the state, assists in the development and distribution of ICT-related technologies, applications, content and infrastructure. The private sector is a key player in the micro- and macro-market environment as well as in the wider sustainable-development environment;
- Civil Society – Civil society is critical in implementing ICT-related technologies as well as building the Information Society; and
- International and regional institutions (previously referred to as Transnational Institutions and International Organisations) – The International and regional institutions include any institutions and organisations, as well as international financial institutions, that use the ICT-related technologies, applications, content and infrastructure to grow and provide the necessary Internet resources for building the Information Society.   These international and regional institutions are then responsible for monitoring progress in achieving the IG vision (Stauffacher & Kleinwächter, 2005; WSIS, 2005).

This section addressed the question, "*Who is entitled to regulate the Internet in its entirety?",* The following section will examine the committees and groups that comprise the stakeholders as previously stated.

2.7. Internet Governance Committees and Groups

The IG stakeholders, on their own, are responsible for the operation, maintenance and evolution of the Internet. As the stakeholders do not always having the required influence, knowledge and skills to address IG in its entirety, the IG practices may become complex and even messy to some extent. In order to address this identified vulnerability, various committees and groups have been formed that address various IG issues (Cerf, 2015). Each committee and group then focuses on a specific IG issue in proportion to their identified influence, knowledge and skills on IG matters. Stakeholders then serve on a committee or in a group. All stakeholders can provide their input, according to their influence, knowledge and skills, on how the Internet must be governed.   This allows proficient committees and groups to address identified IG issues. The following sub-sections will identify each committee and group and briefly discuss their role towards IG.

2.7.1. Internet Architecture Board

The Internet Architecture Board (IAB), originally known as the Internet Activity Board, was founded in 1983 and chaired by Dave Clark (Internet Architecture Board, 2017). IAB currently consists of thirteen committee members, six of whom are nominated each year from the Internet Engineer Task Force (IETF) while the remaining members are approved by the Board of Trustees of the Internet Society. The thirteenth member of IAB is filled by the IETF Chair. Furthermore, the Internet Research Task Force (IRTF) chair serves as an ex-officio IAB member with no voting rights (Internet Architecture Board, 2017).

The core purpose of the IAB committee is to serve and help the IETF and IRTF. Its duties as according to the charter (Request for Comments (RFC) 2850) include:
- Serves as the confirming body for the Internet Engineering Steering Group (IESG) and IETF chair;
- Supervises the architecture for the procedures and protocols used by the Internet;
- Supervises the process used to create Internet Standards and attend to any improper executions thereof;
- Manages the creation and publication of the RFC document series and the administration of the various Internet assigned numbers; and
- Acts as a source of guidance and advice for the Internet Society's Officers and Board of Trustees regarding the architectural, technical, procedural and respective policy matters pertaining to the Internet and its enabling technologies (Internet Architecture Board, 2017).

In conclusion, the IAB operates in the following spectrum of Internet issues: Advice, Community Engagement, Policy, Research and Standards.

2.7.2. Internet Corporation for Assigned Names and Numbers

The Internet Corporation for Assigned Names and Numbers (ICANN) is a non-profit, public-benefit and International organisation which was created in 1998. Its main purpose is to operate the Internet's Domain Name System (DNS) as well as manage the unique identifiers for the Internet's systems. The unique identifiers refer to protocol parameter registries, IP addresses and top-level domain space (DNS root zone). In technical terms, ICANN is responsible for protocol identifier assignment, IP address space allocation, root server system management functions and generic (gTLD) and country code (ccTLD) Top-Level Domain name system management. In addition to these functions, ICANN also aids all Internet communities in keeping the Internet safe and secure, stable and interoperable. On an operational level, ICANN aids in developing Internet policies and competitive markets in the domain name space (Internet Corporation for Assigned Names and Numbers, 2013; Internet Corporation for Assigned Names and Numbers, 2016b).

In conclusion, the ICANN operates in the following spectrum of Internet issues: Community Engagement, Operations, Policy and Services.

2.7.3. Internet Engineer Task Force

The Internet Engineering Task Force (IETF) is the Internet's leading technical standards body, which consists of operators, network designers, researchers and vendors. The primary purpose of EITF is on short-term engineering and standards. It produces and markets an extensive range of high quality, relevant, technical and engineering, best-practice documents, which are used by the entire Internet community to design, use and manage the Internet. IETF delegated its duties to numerous smaller working groups, which are then tasked to address matters for a specific technical area. These areas include security, transport and routing (Internet Engineering Task Force, 2017).

In conclusion, the IETF operates in the following spectrum of Internet issues: Community Engagement, Policy and Standards.

2.7.4. Internet Governance Forum

The Internet Governance Forum (IGF) is an open forum, which consists of various stakeholders from the public and private sectors who have policy-making power. These

stakeholders gather annually to discuss, exchange information and share good practices related to Internet policy issues. The IGF provides a safe space for people to come together as equals, meaning that developing countries are able to participate in IG policy issues at the same level as do developed countries. This allows for all stakeholders to participate in the decisions made towards the future of the Internet. It should be acknowledged that IGF has no negotiated outcome, but focuses more on creating networking events where information and general good practices are exchanged, which in turn increases Internet opportunities and also addresses known problematic areas in the Internet (Internet Governance Forum, 2016).

In conclusion, the IGF operates in the following spectrum of Internet issues: Advice, Community Engagement and Policy.

2.7.5. Internet Research Task Force

The Internet Research Task Force (IRTF) endorses research on important Internet topics such as Internet protocols, technologies, architecture and applications. This is accomplished by creating focused and long-term research groups whereas its parallel organisation, EITF focuses on short-term research. Research Groups encourages long-term membership, which in turn endorses the development of teamwork and research collaboration in resolving research issues. Membership status is permitted on an individual basis instead of on an organisational level (Internet Research Task Force, 2017).

The research groups currently charted are: Crypto Forum Research Group (CFRG), Global Access to the Internet for All Research Group (GAIARG), Human Rights Protocol Considerations Research Group (HRPC), Internet Congestion Control Research Group (ICCRG), Information-Centric Networking Research Group (ICNRG), Measurement and Analysis for Protocols Research Group (MAPRG), Network Function Virtualization Research Group (NFVRG), Network Management Research Group (NMRG), Network Coding Research Group (NWCRG) and Thing-to-Thing Research Group (T2TRG) (Internet Research Task Force, 2017).

In conclusion, the IRTF operates in the long-term research spectrum of Internet issues.

2.7.6. Governments and Inter-Governmental Organisations

The local government is responsible for the development of laws, regulations and policies related to the Internet within its borders. Furthermore, governments are encouraged to participate in the MSM (Creative Commons Attribution, 2013). Inter-Governmental

organisations are international organisations that have only states as members. The decision-making authority therefore still resides with representatives from member governments. Inter-Governmental organisations transcend the local government's jurisdiction and which may result in major impact on the governmental and transnational actors within governments. To overcome this, Inter-Governmental organisations may choose to develop independent power bases and develop identities separate from those of founding governments (Berg, 2011).

In conclusion, Governments and Inter-Governmental Organisations operate in the following spectrum of Internet issues: Community Engagement and Policy.

2.7.7. International Organization for Standardization, Maintenance Agency (ISO 3166 MA)

The International Organization for Standardization, Maintenance Agency (ISO 3166 MA) outlines names and postal codes of geographic special areas of importance, dependent territories and countries. These are the letters and/or numbers that are captured when referring to the Internet-related resources as found in specific source countries and their relevant subdivisions. Some common examples include '.au' for Australia, '.za' for South Africa and '.fr' for France (International Organization for Standardization, 2017).

In conclusion, the International Organization for Standardization, Maintenance Agency (ISO 3166 MA) operates in the standards spectrum of Internet issues.

2.7.8. Internet Society

The Internet Society (ISOC) is involved in a wide range of Internet-related issues, which include governance, policy, development and technology. They create and endorse principles that inspire governments to make Internet-related decisions with their citizens' best interest at heart (The Internet Society, 2017). The purpose is to ensure a healthy, sustainable Internet for the entire Internet community. Furthermore, the ISOC also:

- Promotes public policies that enable open access;
- Facilitates open development of protocols, administration, standards etc. and the corresponding technical infrastructure;
- Organises events and opportunities that bring like-minded actors together to share their Internet-related knowledge and skills;
- Provides reliable and current information and educational opportunities. This include training workshops in developing countries;

- Promotes leadership programmes that include the development of IG leaders for the future; and
- Supports the local Chapters that serve the needs of the growing global Internet community (The Internet Society, 2017).

In conclusion, the ISOC operates in the following spectrum of Internet issues: Community Engagement, Education, Policy and Services.

2.7.9. Five Regional Internet Registries (RIRs)

The Five Regional Internet Registries (RIRs) manage the designated regional allocation and registration of the Internet resource management of the globe. The Internet resource management encompasses IP addresses and Autonomous System Numbers. The five RIRs of the globe are:

- Africa Network Information Centre (AFRINIC) – focusing on the Africa region;
- Asia Pacific Network Information Centre (APNIC) – focusing on the Asia Pacific region;
- American Registry for Internet Numbers (ARIN) – focusing on the Canada and the United States regions;
- Latin American and Caribbean Internet Address Registry (LACNIC) – focusing on the Latin America and Caribbean regions; and
- Reseaux IP Europeens (RIPE NCC) – focusing on the Europe, the Middle East and parts of Central Asia regions (Internet Corporation for Assigned Names and Numbers, 2016a).

In conclusion, the Five RIRs operate in the following spectrum of Internet issues: Operations, Policy and Services.

2.7.10. World Wide Web Consortium

The World Wide Web Consortium's (W3C) aim is to ensure that the World Wide Web (WWW) reaches its full potential by developing guidelines and protocols to ensure the long-term advancement of the Internet. The W3C also creates standards that allow for the WWW to be interchangeable for user and device, therefore allowing easy access to use the Internet (W3C, 2017).

In conclusion, the W3C operates in the standards spectrum of Internet issues.

2.7.11. Internet Network Operators' Groups

The Internet Network Operators' Groups are informal groups that collaborate on matters related to Internet network operations and regulation within forums. These groups have no formal power, however, the individual members in most cases do have some form of affiliation with other committees (Creative Commons Attribution, 2013).

The Internet Network Operators' Groups operate in the following spectrum of Internet issues: Advice, Operations, Policy and Services.

2.7.12. IG Committees and Groups Summary

The MSM stakeholders comprise various committees and groups who are ultimately responsible for the operation, maintenance and evolution of the Internet. These stakeholders implement an all-rounded IG approach which relies on the experts' influence, knowledge and skills regarding IG to address all technical and policy issues through open-debate processes. Some have argued that this practice is complex and even messy, but the majority have always realised the massive benefit this approach has had on the governance of the Internet. The MSM approach has guaranteed that the management of the Internet is known to be one of the largest co-operative efforts ever undertaken by mankind and has since been identified as one of the most successful technologies of all time.

Businesses and their leaders have specifically highlighted their support for the current MSM and have highlighted that stability, security and consistency in this regard are vital to the success of all businesses. Businesses stress the pivotal significance of maintaining an international, voluntary, open and consensus-based development and implementation of standards as guided by the private sector and market forces. The issues that businesses and their leaders are especially interested in are focused around public policy issues such as privacy, trade, security, education, spam, intellectual property protection, technology neutrality with respect to user choice and fraud, cybercrime and law enforcement cooperation. These issues directly and indirectly impact the promotion of economic/infrastructure growth and development, attract capital and encourage investment and stimulate innovation and creativity, which are key to the advancement of all (Hassan, 2005).

These sub-sections addressed the questions "*What do these role players do to ensure the Internet is regulated adequately?*", "*Why are the role players needed and in what capacity?*" and "*How do they govern the Internet?*". The following section will discuss the IG ecosystem, which was created to address the gap created by the rapid evolution of the Internet and

consequently answers the question, "*How do they keep the IG practices current in an ever-changing environment?*

2.8. Internet Governance Ecosystem

The IG environment, also known as the Internet Governance Ecosystem, is divided into three layers. The bottom layer is the physical infrastructure layer, which is focused on the technologies such as Internet Exchange Points (XP), terrestrial cables, undersea cables, satellites and wireless systems. The current actors or roleplayers that are responsible for this governance layer are Groupe Spéciale Mobile (GSM) Association, Institute of Electrical and Electronics Engineers (IEEE), Internet Engineering Task Force (IEFT), International Telecommunication Union (ITU), National ICT Ministries, National Regulators and Network Operators. The middle layer is the logical layer which is focused on services such as Root services, domain names, IP addresses and protocol parameters. The current actors that are responsible for this governance layer are Internet Corporation for Assigned Names and Numbers (ICANN) / Internet Assigned Numbers Authority (IANA), IETF, Number Resource Organization (NRO) / Regional Internet Registries (RIRs), International Organization for Standardization (ISO), European Telecommunications Standards Institute (ETSI), Top-Level Domains (TLD) Operators, Domain name Registrars, IEEE and World Wide Web Consortium (W3C) (ICANN Multimedia, 2015).

The top layer of the Internet Governance Ecosystem is the Economic and Societal layer. This layer is focused on areas which include Manufacturing and Trade, Entertainment, Education, Internet of Things, Economic and Social Development, Finance, Health Care, ICT, News and Media, Security, Civil and Human Rights and Public Sector and Taxation. The current actors that are responsible for this governance layer are Internet Governance Forum (IGF), World Economic Forum, NETmundial Initiative, W3C, Industrial Internet Consortium, Internet Society (ISOC), National Governments, Private Sector, Inter-governmental organisations, Civil Society, Academia and Law Enforcement Agencies (ICANN Multimedia, 2015).

The Internet Governance Ecosystem, like any other ecosystem, exists in an ever-changing environment. IG stakeholders are expected to use flexible and innovative decision-making mechanisms to address and respond effectively as changes in the IG ecosystem occur (Verhulst, Noveck, Raines & Declercq 2014). The IG Stakeholders realised this requirement and during 2013 and 2014, formed a board called the Global Internet Cooperation and Governance Mechanisms. A partnership, which was formed between the ICANN and the World Economic Forum (WEF), made this initiative possible. The purpose of this board was

to advance discussions on IG issues, for example the topics of privacy and security as introduced by Edward Snowden. The vision of this board was to create a framework, identify principles and processes to evolve the IG ecosystem and to produce a roadmap, which highlights the global Internet cooperation evolution. The roadmap would then guide the IG stakeholders in a formal structured manner to quickly and effectively address new IG issues (Global Internet Cooperation and Governance, 2014).

During the Global Internet Co-operation and Governance Mechanisms discussion, it was reaffirmed that the MSM remains the best model for IG and subsequently identified three fundamental design properties that must be included in the IG ecosystem. The three fundamental design properties are distribution, participation and layering. The distribution fundamental design property insists on including various stakeholders to build and operate through several structures and governance systems. The participation fundamental design property insists on inviting all stakeholders to contribute with IG issues. The layering fundamental design property insists on following the hierarchical structure of IG (Global Internet Cooperation and Governance, 2014).

The final roadmap or framework that was created by the board can be found in Figure 2.4 with Figure 2.5 depicting the elements found in the Issues Identification element. As previously discussed, the purpose of the framework is to use flexible and innovative decision-making mechanisms to address and respond effectively to changes in the IG ecosystem in a structured manner. The framework identifies four elements of the IG process, which are Issues Identification, Solution Mapping, Solution Formulation and Solution Implementation.

The first element is the Issues Identification element. The Issues Identification element will assist in identifying the source of the issue that must be addressed by the stakeholders. The reader will start at the edge of the sphere and work his/her way through the elements to the centre. The issue must be identified as technical or non-technical in nature. Once identified, the reader is requested to identify the region of the issue in the spheres. The options include local, national, regional and global. The desired type of solution must then be identified, which includes best practice, specifications, standards or policy model. The second element is the Solution Mapping element. Once the stakeholders are clear in the issue, the appropriate Distribution Group (DG) must either be created by means of stakeholder engagement or issued to the existing DG. The third element is the Solution Formulation element. The DG is now tasked to address the issue through solution formulation. The solution must be in line with the set IG values and principles. The fourth element is the Solution Implementation

element. This is the last step in the process which is focused on implementing the solution as developed by the DG.

The result of the Internet Governance Ecosystem Sphere is a well-thought-through process, which produces an all rounded solution that stems from a DG, equipped with effective and supportable structures, mechanisms and thus is qualified to address any new IG issue that may arise (Global Internet Cooperation and Governance, 2014). The sections addressed the questions of *"How do they keep the IG practices current in an ever-changing environment?".*

Figure 2.4: The Four Elements of the IG Process.
Source: Global Internet Cooperation and Governance, 2014, p. 11.
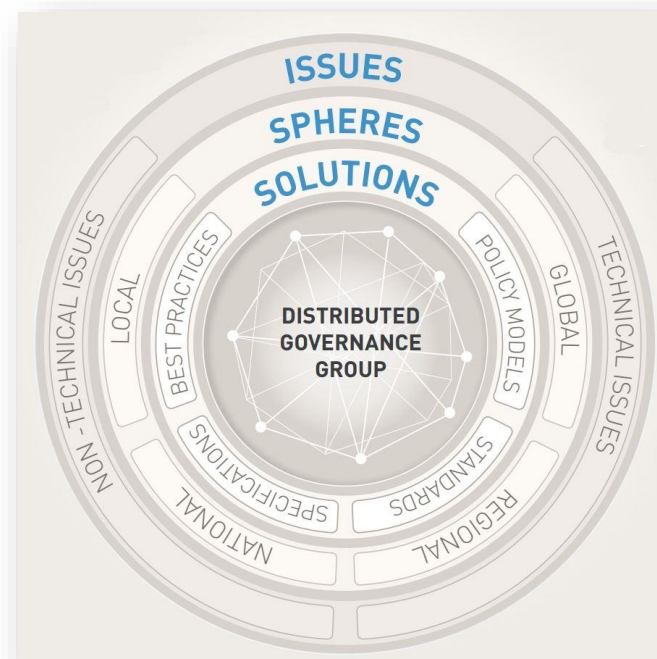
Figure 2.5: The Internet Governance Ecosystem Sphere as Created by Global Internet Cooperation and Governance Mechanisms Board.
Source: Global Internet Cooperation and Governance, 2014, p. 10.

One of these core changes that has a vital impact on the future of the USA and SA Internet will be dicussed in the next section. The section would therefore answer the question, "*How has this IG ecosystem influenced the current Internet environment and what is its status?*".

2.9. Net Neutrality

In June 2015, after a decade of debate and legal battles, the Federal Communications Commission's (FCC) *net neutrality* rules was upheld by the federal court (Downes, 2016; Williams, 2016). This came after two failed attempts to get the *net neutrality* rules approved, which was overturned during the previous submissions by the same court (Kang, 2016). The approval of the *net neutrality* rules is a clear indication of how America sees the future Internet as it has far-reaching implications on its regulatory framework surrounding the Internet (Kang, 2016, Paulas, 2017). These rules affirmed that the governing body identifies the Internet and supporting infrastructures as an essential information and communications platform for consumers, much like the telephone and power utilities. The rules state that the Internet should be accessible to all Americans and not be treated as a luxury item that does not need close government supervision. The *net neutrality* rules therefore aim to enforce the strongest possible Internet protections for both fixed and wireless networks, which in turn will confirm the Internet remains an open form of communication for all (Kang, 2016).

2.9.1. What is Net Neutrality?

The *net neutrality* rules are guided by three principles, which are to ensure that the Internet is fast, fair and open to the entire Internet community (Pramuk, 2015). The core motivation behind the *net neutrality* rules as listed as one of the MSM Internet values is therefore to make the Internet a public good or public goods and define access to the Internet as a human right. A *public good* is defined as a resource that is available for anyone to use at no additional cost without affecting its availability to others. A core component of the public good or public goods and as a human right is that the product or service be regulated by the governing body, as its function is to focus on the mutual benefit of all citizens and consequently reinforce the public-goods view of public production (Holcombe, 1997). This point was the determining component, which was added in the last submission attempt that ensures that the *net neutrality* rules were approved.

Previously, the Internet was governed by the private sector, which meant free market forces determined the Internet's efficiency and it expanded to where it was consumed most. This meant that private companies distributed their own packaged versions of the Internet to different constituencies, which in most cases meant the Internet went to those who could afford

it. Furthermore, innovation was a key driving factor as this was directly linked to the growth of a company's revenue streams. Under the new Title II Act, the public sector will govern the Internet, which means that the government, not the market forces, will allocate resources to ensure efficiency for all its citizens (Sambuli, 2016). This means that the Internet will be accessible to all and not only to those who are sufficiently wealthy to own Internet access. Under the regulation of the government, however, the Internet could suffer from a lack of competition and consequently innovation (Downes, 2016).

2.9.2. Net Neutrality Advantages

The *net neutrality* rules had a clear vision from the start, which focused on the Internet being classified as a human right, similar to the right to food, clean water, shelter, basic education, healthcare and electricity. The objective of the *net neutrality* rules was therefore to promote the Internet as a platform for access to information, freedom of expression, innovation and economic growth (Kang, 2016). In addition, it protects the rights of users to access legal content, services and applications, freely over the Internet. This means that the classification orprioritisation of higher priority traffic over other less valuable traffic in exchange for payment or other benefit of any kind should be demolished (Pramuk, 2015). ISPs are required to implement reasonable traffic management practices to enhance the quality of the services being offered to users whilst still ensuring transparent and easily understandable information about these practices (Mcleod, 2016).

The *net neutrality* rules will permit micro-businesses to enter the marketspace and to use the Internet to reach consumers and compete in the global marketplace (Kang, 2016). Previously, entrepreneurs with start-up companies were forced to pay large amounts of money to enter the space and then were only grouped with all entry-level Internet traffic prioritisation groups. The larger and well-established companies in most cases paid for their traffic to be given priority, meaning that their customers got a much better service and consequently, Internet experience (Pramuk, 2015). The overall customer rating for the larger companies would therefore be better and would almost always reaffirm that the customers would return to their sites. The *net neutrality* rules levelled the playing fields by demolishing paid prioritisation of traffic and hence prevented anti-competitive behaviour. Herewith, the small companies have an equal opportunity in online traffic handling with well-established companies (Cole, 2015). Furthermore, this also contributes to eliminating the digital divide as companies can further increase users' choices in products and services and consequently reduce their costs.

2.9.3. Net Neutrality Disadvantages

The idea behind the *net neutrality* rules are simple, meaning that ISPs are prohibited from blocking or slowing down access to websites or accepting payment to prioritise Internet traffic (Downes, 2016). Despite this being a straightforward idea, it has proven exceedingly difficult to translate into policy. This does not stem from the rules themselves, but from the process followed by the FCC to finally get the rule accepted by the courts. To overcome the two failed attempts to get the *net neutrality* rules appoved, the FCC reclassifed broadband access as a public utility and therefore place it under Title II of the Communications Act (Downes, 2016). Title II of the Communications Act is an approximately 300 page document consisting of broad and open-ended regulatory arcana (Pramuk, 2015). Title II of the Communications Act gives the FCC full authority to regulate telecommunications providers as utilities (common carriers), with many arguing that this introduces the risk of government overreach (Boorstin, 2015; Brodkin, 2014).

The relationship will therefore change from Internet regulators and consumers, to Internet regulators and regulators, who will now be their true customers. Furthermore, the cost of utilities has proven to be particularly high and known to exceed their benefits even for traditional infrastructure (Downes, 2016). This reclassification of telecommunications service under Title II of the Communications Act placed the *net neutrality* rules in the middle of the extremly technical Internet architecture and highly complex principles of administrative law (Downes, 2017).

Public utilities, which the Internet now forms part of, do not compete for market share (Downes, 2016). Public utilities are regulated as monopolies, whilst Internet access is no monopoly. If the Internet is regulated as a monopoly, it means that the fierce competition that drove innovation and lower prices will quickly disappear (Downes, 2016). The financial gain that drives innovation will stagnate, resulting in below-industry standards advancement in Internet technologies. Over the past 20 years, investors have invested $1.5 trillion dollars into competing network infrastructures which resulted in the USA having four times more network connectivity than any other country and the most fibre and most advanced mobile networks (Downes, 2016).

Compared to the telephone service industry, which has been progressing extremely slowly for decades with poor services and high prices. The internal corporate governance structures, corruption, competitive inertia and deteriorating facilities have resulted in simple information services taking years to get approval from regulators. The previously risk-taking industry will

therefore change its focus to risk-averse or playing-it-safe industry, according to the power supply strategy (Downes, 2016). The following sub-section will discuss the current state of the Internet as influenced by the *net neutrality* rules.

2.9.4. Current State of Internet Freedom

The United States, which currently has an active *net neutrality* rule active, received an Internet freedom score of 18/100 in 2016, one point up from 2015 (19/100). This is an extremely good score which placed the United States in 4th position (Freedom House, 2017b). South Africa, which is currently in the process of gazetting the *net neutrality* rules (Mcleod, 2016), received an Internet freedom score of 25/100 in 2016, two points up from 2015 (27/100). This places South Africa in 12th position out of the 65 countries (Freedom House, 2017a). The South African government, civil society and the private sector have raised access to the Internet and related resources as a core concern, which led the private and public role-players to band together to expand the ICT sector. This has led to the advancement of access to quality and relatively affordable Internet access in SA, predominantly amongst the low income communities through government subsidised wifi projects. Furthermore, open access to the Internet is stressed in the current legal and regulatory framework, meaning no restriction may be placed on access to ICT resources nor on the Internet content. The ICT Internet infrastructure and services are privately-owned, which allows them to be self-regulated. The monopoly, specifically in the fixed-line market, remains a challenge as broadband and mobile data costs remains relatively high compared to other countries.

During July 2016, South Africa voted against the United Nation's resolution for "the Promotion, Protection and Enjoyment of Human Rights on the Internet" (Freedom House, 2017a). The core focus of this resolution is to safeguard access to the Internet as an important human right. South Africa sided with countries such as Russia, China and Saudi Arabia, who are all considered Not Free countries by the *Freedom on the Net* reports (Freedom House, 2017a). The South African deputy permanent representative noted that the resolution failed to take into account hate speech and incitement, both areas connected to South Africa's post-apartheid society. Recently, two bills have been introduced that will obstruct the future of the Internet. These are the Film and Publications Amendment Bill and the draft Cybercrimes and Cyber Security Bill (Freedom House, 2017a). The Film and Publications Amendment Bill which was introduced in 2015 was criticized for threatening to impose intermediary liability and a censorship regime on South Africa's online content whilst also introducing a new registration fees on video streaming services which will hamper local content creation. Netflix was forced to pay R795 000.00 registration fee to distribute content under this new Bill (Freedom House,

2017a). The civil society complained heavily regarding the first release of the draft Cybercrimes and Cyber Security Bill. It was argued that it would threaten to infringe on privacy rights, freedom of expression and access to information (Freedom House, 2017a).

This section addressed the questions of ""*How has this IG ecosystem influenced the current Internet environment and what is its status?*". The following section will conclude Chapter 2.

2.10. Summary

This chapter addressed RQ_1 which states, "*What national and international governance structures are available that influence the management of the Internet?*". The chapter completed RO_1 which was to identify the national and international governance structures that influence the management of the Internet.

Chapter 2 commenced by introducing the key IT governance frameworks that are adopted to govern and manage IT governance and therefore, the Internet. Chapter 2 continued to defined IG and reviewed the five available thought processes for IG models as defined by Solum (2008), with support from Collins (2007) that can be adopted to efficiently and effectively govern the Internet. It was identified in the literature that each model does not have the clout to address the immense responsibilities and requirements of IG. The literature study therefore continued to discover what the current, implemented national and IG structures entails. The MSM was therefore identified, which presented the various stakeholders involved with IG and their respective structures that were created to address specific IG issues. The chapter continued by discussing the recently implemented IG ecosystem sphere which is a roadmap or framework used to address any new arising IG issues. The Internet as a public good was argued and supporting evidence gathered from the current state of the IG ecosystem, was presented.

The review of the MSM led to the realisation that the currently implemented MSM is a combined effort of all five IG models as identified by Solum (2008), with support from Collins (2007). The MSM is therefore known as a hybrid model. The MSM integrates the benefits of each model whilst reducing or removing their respective drawbacks. It should be acknowledged that IG is extremely sophisticated and diverse by its very nature and therefore requires a complex regulatory system to ensure that it is managed properly. The most accepted IG model, therefore, requires an optimal mix of all 5 IG models, which includes transnational institutions, international organisations, national governments and market regulations with respect to the Internet's changing policy and technical environment. The

MSM, although complex and sometimes messy, satisfies this demanding need. The MSM is committed to a vision of an 'Internet for everyone' and as such, has argued towards making the Internet a public good. The Internet as a basic human right means that a product or service should be regulated with the focus on the mutual benefit of all citizens and consequently reinforces the public-goods view of public production. The Internet would consequently become available to all and not just to those who are able to afford it.

Chapter 3 will present the current Internet management practices with emphasis on HEIs and research institutes. Therefore, the research objective of this chapter would be focused on RO_2, which is to develop and evaluate a business model canvas for NREN, SANReN and TENET. This will be achieved by asking RQ_2, which questions *"What is the current business model canvas for NREN, SANReN and TENET?"*.

3. INTERNET RESOURCES MANAGEMENT

3.1. Introduction

Chapter 2 presented the five available IG models that can be used to regulate the Internet. Thereafter, the current global IG structures were discussed. It was highlighted that all five IG models are incorporated into the MSM. The IG ecosystem, which is used to address any new issues that arise in the ever-evolving Internet environment was then discussed. The chapter concluded by emphasising the movement towards reclassifying the Internet as a public good.

Chapter 3 reviews current literature, which will assist the researcher to critically summarise current knowledge in the respective field of study. In addition, the literature review provides a contextual view within which the research study is placed.

This chapter addresses RQ$_2$ which states, "*What is the current business model canvas for NREN, SANReN and TENET?".* The objective of the chapter is to develop and evaluate the business model canvas for NREN, SANReN and TENET. Current literature studies are reviewed to find a suitable answer to the identified research question. Figure 3.1 illustrates an overview of the research objective for this chapter.

Chapter 3 highlights the current Internet management practices with emphasis on HEIs and research institutes. Firstly, the business model in general and business model canvas are discussed, which lay the foundation for the purpose of business and services offerings as discussed in the remainder of this chapter. The chapter continues by elaborating on the global NRENs (National Research and Education Networks) and its business purpose and services offered. Once completed, the focus shifts towards the South African NRENs, which are SANReN CA (South African National Research Network Competency Area), referred to as SANReN, and TENET (Tertiary Education and Research Network of South Africa). For each entity, a detailed elaboration of the business is covered and each section concludes with the respective NRENs business model canvas, as approved by the respective CEO. A common business focus is realised with the progression from the global NREN to the local NRENs. The chapter concludes by discussing some of the current key Internet management issues experienced by the Internet management community. See Figure 3.2 for a Structural Overview of Chapter 3.
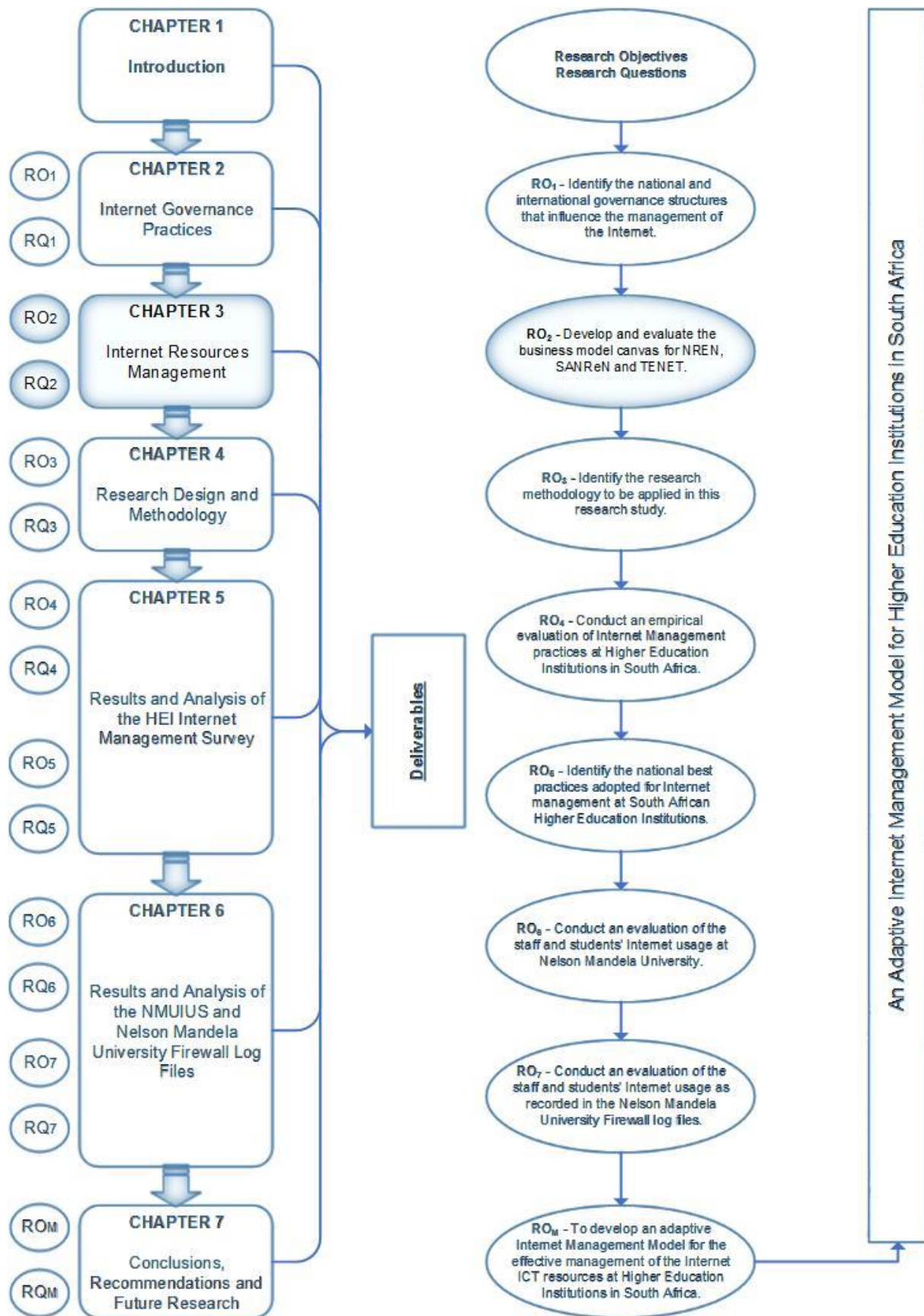
Figure 3.1: Chapter 3 Overview of the Research Objective.

| Chapter 1: Introduction |
| Chapter 2: Internet Governance Practices |

Chapter 3: Internet Resources Management

3.1. Introduction
3.2. Business Model
3.3. Business Model Canvas
3.4. Global NREN
3.5. South Africa's NREN
3.6. Key Internet Management Issues
3.7. Summary

| Chapter 4: Research Design and Methodology |
| Chapter 5: Results and Analysis of the HEI Internet Management Survey |
| Chapter 6: Results and Analysis of the NMUIUS and Nelson Mandela University Firewall Log Files |
| Chapter 7: Conclusions, Recommendations and Future Research |

Figure 3.2: Structural Overview of Chapter 3.

3.2. Business Model

The term *business model* has been part of various scientific discussions since the late 1950s. Since its inception, it was repeatedly discussed in literature studies but in a very inconsistent manner (Wirtz, Pistoia, Ullrich & Gottel, 2016). It is not until the technology boom in the late 90's that the term business model became a management tool. Its focus, however, was on business or process modelling i.e. the operative activity. With the continuous advancement of technology and the birth of online business, the term business model surpassed the focus being an operating plan for creating an appropriate information system and evolved into an integrated presentation of a business plan that contributes to the success of management through a well-defined decision-making process (Wirtz, Pistoia, Ullrich & Gottel, 2016).

Today, the term *business model* facilitates the analysis, testing and validation strategic choices of a business by creating value, for businesses, customers and society (Osterwalder & Pigneur, 2010; Shafer, Smith & Linder, 2005). It links the two dimensions of business activity, value creation and value capture. Value creation identifies the customer(s) and how they engage, whilst value capture identifies how value is delivered and monetised (McGrath, 2010; Teece, 2010). The *business model* is therefore a business blueprint that addresses the

questions of "who is the customer(s)?", "what does the customer(s) value?", "how will the company make money?" and "what is the underlying economic logic that explains how we can deliver value to customer(s) at an appropriate cost?" (Baden-Fuller & Haefliger, 2013; Battistella, De Toni, De Zan & Pessot, 2017; Doganova & Eyquem-Renaultb, 2009).

There are various generic forms of business models available that can be used to document a business's value creation and value capture activities (B2B International Beyond Knowledge, 2017). The most widely adopted business model is the Business Model Canvas (BMC). The BMC is used by companies such as IBM, Deloitte, Ericsson, Government Services of Canada and the Public Works (Osterwalder & Pigneur, 2010). The BMC is discussed in the following section.

3.3. Business Model Canvas

Osterwalder and Pigneur (2010) developed the BMC with the aim of creating a business model concept that is simple, relevant and intuitively understandable whilst not overshadowing the critical importance and complexity of how a business operates. The BMC is logically divided into the four main business areas, being Customers, Value Offer, infrastructure and Financial Viability. The four main areas are further divided into nine basic building blocks, which are the Customer Segments, Value Proposition, Distribution Channels, Customer Relationships, Revenue Streams, Key Resources, Key Activities, Key Partnerships and Cost Structure. Figure 3.3 depicts the BMC with the nine building blocks. The outcome is a strategic tool that serves as a shared language used to describe, visualise, assess and change business models (França, Broman, Robert, Basile & Trygg, 2017; Osterwalder & Pigneur, 2010).

For the purpose of this thesis, the BMC is adopted to describe, visualise and assess the different strategic choices of the Internet Management role-players. Each role player's business model will be drafted by reviewing current literature. Thereafter, the SA NRENs business models will be distributed to the respective CEOs and requested to be evaluated. The responses will be captured and the final business models will be discussed. The use of the BMC will assist the researcher to provide a common approach to detect and compare the respective business areas across the Internet Management industries. It is expected that all Internet Management businesses should follow a similar business model as they are guided by the same Internet Governance structures. It is expected that all South African Higher Education Institutes should have similar business models as they are guided by the same Internet Management structures. The following section discusses the global NREN and identifies its BMC.
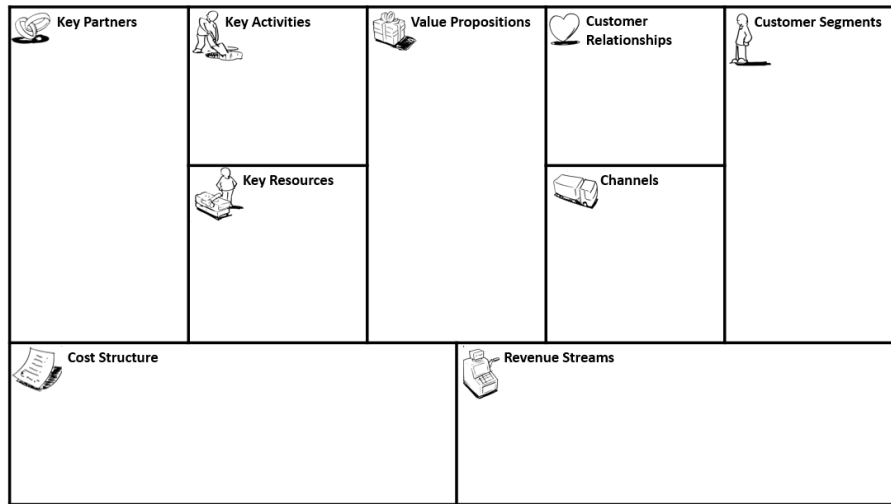
Figure 3.3: The Business Model Canvas by Osterwalder and Pigneur.

Source: Osterwalder and Pigneur, 2010, p. 44.

3.4. Global NREN

Globally, the National Research and Education Network (NREN) is a group of highly specialised Internet Service Providers (ISPs) that provide a seamless, high-speed large scale, low-latency, dedicated network infrastructure and network services to research and education communities for national, regional or global collaborative projects (Villalón & Hermosa, 2016). The network infrastructure and network services are separate from the commercial Internet infrastructure and services. NREN is therefore the link between the global Internet and NREN network. NREN is responsible for disseminating the IG key objectives as identified by the 2005 World Summit on the Information Society. NREN's primary focus is to provide advanced ICT Services by the means of critical network connectivity and network services to HEI and research institutes and national and international Communities of Practice (GÉANT Limited, 2014). NREN is also known to support schools, education colleges, libraries, museums and other public institutes and in some cases, other sectors, which include governments and healthcare (Abbott & Taylor, 2015).

At HEIs, staff members, students, lecturers, teachers and administrative staff are able to access critical resources and work together whilst not bound by a physical location by using modern networking and computing facilities. The users are then able to access academic and scientific resources and support collaboration in teaching, learning and research (Foley, 2016). This in turn helps the country to promote economic development and to build human capital (International Telecommunication Union, 2010).

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NREN has grown to the point where it has become the core foundation for the research infrastructures as well as the cyberinfrastructure. The NREN infrastructure is the underpinning bedrock on which other cyberinfrastructure mechanisms and large range of specific value-added services reside (Wright, 2012). NREN therefore provides the network infrastructure and network services that drive educational reform which in turn leads to the advancement of research and innovation and contributes to achieving the goals set at 2003 Geneva and 2005 Tunis of becoming a Knowledge Society (Janz, 2013; Vuletić & Sevasti, 2010; WSIS, 2005).

On a Local Area Network (LAN) or Wide Area Network (WAN) level, each local university, research institute, school, etc. is responsible for its own internal campus level network connectivity and network services. Before being allowed connectivity onto a NREN, the local institution is expected to have reached the correct ICT maturity level. All institutions are therefore expected to prove to NREN that they follow good Internet governance practices and implement adequate Internet management practices, with a key prerequisite of having a sound ICT Policy. This is to ensure that the advanced services offered to the institutions are not jeopardised by the internal ICT services practices and ICT support systems (Janz, 2013).

Outside the boundaries of the local university, research institute, school, etc., NREN takes ownership and therefore control. NREN operates outside the boundaries of the local entity and functions at a national and international level with typically a single NREN in each country. At the national level, NREN is responsible for the network infrastructure and network services that interconnect the local networks of the research institutes and HEIs of each country. The locally appointed NREN is responsible at this level as it assists with proper business alignment with the country's education setting, particular regulations and political requirements (Janz, 2013). Examples of local NRENs include: SANREN, GARNET, RITER, TogoREN, NigerREN and NgREN. Typically, only one NREN is appointed per country and the governance model of this NREN may vary according to the requirements of the country. Some NRENs can be operated by a third party under contract, separately incorporated or forming part of the local government departments (GÉANT Association, 2014).

On the international level or regional level, NREN is responsible for shared inter-continental and cross-border backbones connectivity between continental or sub-continental research and education networks (UbuntuNet Alliance, 2016). In some cases, this function is outsourced to a limited extent to other companies such as Delivery of Advanced Network Technology to Europe (DANTE) and GÉANT Limited as in the European context (Dyer, 2009; Vuletić & Sevasti, 2010). Examples of international NRENs include: North America, Latin

America, Caribbean, North Africa and the Middle East, Sub-Saharan Africa, Eastern Partnership, Central Asia, Asia-Pacific and Pacific Islands.

There are various governance models used by NRENs around the world. The most commonly adopted NREN governance model is one that is registered as a not-for-profit limited company, or trust, which is owned by members. The company's common revenue streams are government subvention, user service fees and membership fees. Operating costs are generally funded by the fees and any capital expenditures are generally funded by government grants. The government ministry may play a major part in how the NRENs are funded and how they should operate, especially in countries with mostly public universities, but it is still considered best practice to allow the users and their business requirements to drive the operation. The board should consist of a majority representation from the academic community but with no government representation. This independence allows for the NREN to attract and retain highly skilled and talented staff, which is not always possible in the public sector due to salary scales and structures. As previously mentioned, this is the most commonly adopted governance model. There are, however, successful exceptions to the presented model, which include India and Pakistan, both owned and run by their national government (Foley, 2016).

NRENs serve a vital purpose in e-Science, e-Learning and e-Research strategies. A common approach to servicing commodity Internet traffic is adopted that aids in the co-ordination and development of national and international communication networks and services. Additionally, NRENs have extended their focus to provide advanced services to satisfy the extended needs of the research and education communities (Wright, 2012). These services are documented in the GÉANT Common NREN Information Model and include network and connectivity services, middleware services and collaboration support services. Each service category is comprised of a large range of specific services to be added on and will be explained in the following sub-sections (Abbott & Taylor, 2015).

3.4.1. Network and Connectivity Services

The core business purpose of NREN is to provide network and connectivity services to the country's research and education network. NREN aims to provide a dedicated high-performance national network that delivers consistent high-quality and high-bandwidth traffic for the research and education network. The users can therefore expect a level of reliability, performance and control that is impossible to realise over the public Internet. NREN is able to achieve this level of network and connectivity services as follows:

- NREN uses its global footprint to implement cutting edge network technologies, such as dark fibre, all at a reduced cost;
- NREN serves as the main contact point for national network negotiations for the research and education stakeholders;
- NREN economically manages the network capacity and performance; and
- NREN can organise effective international connectivity (between NRENs, partners, general Internet etc.).

NREN is subsequently able to take on a leading role in the investigating, designing, developing, implementing and monitoring of the country's research and education network infrastructure and network services. The overall success of the research and education network would otherwise not be possible if attempted by individual stakeholder organisations (Abbott & Taylor, 2015; GÉANT Association, 2014).

3.4.2. Middleware Services

Middleware is the term used for software that acts as a bridge between different, often complex and already existing platforms, for example, an operating system or database and its application, especially on the network (Oxford Dictionaries, 2016). In the case of NREN, middleware services are the services installed to bridge the gap between the network infrastructure and its users (GÉANT Association, 2014). NRENs offer two essential middleware services, these are Security Services and Authentication and mobility services. Both these services are explained next.

3.4.2.1. Security Services

Internet-connected users and systems permanently face risks of being exploited by cybercriminals. The development of advanced malware, spam and Distributed Denial of Services attacks, have led to a consistently increasing number of attacks and damage (Bendovschi, 2015). NRENs have taken note of these attacks on their networks and are now offering a range of security services and advice to detect and remove or reduce the impact of a successful attack. This, in turn, assists institutions to create a safe and secure Internet experience for its users. NRENs adopted good IT security governance by implementing security policies, appointing a Chief Information Security Officer, training security response teams (e.g. Computer Emergency Response Team (CERT)), being compliant with formal security standards and best practice document (e.g. ISO/SANS 27000 series), etc. (GÉANT Association, 2014).

3.4.2.2. Authentication and Mobility Services

NREN provides a state-of-the-art service that allows specific user-groups to gain access to the NREN network when visiting other institutions. The groups, which includes staff, students, faculty, etc. are based on the user's identity and role as provided and managed by their home institutions. The services allow users to gain access to the permitted services irrespective of the user's or service's physical location. The authentication credentials are verified by the user's home institution whilst the authorisation is done by the visiting institution (Tekeni, Thomson & Botha, 2014). The most commonly used authentication and mobility service is *eduroam*. *eduroam* is a secure roaming access service, which was developed by the European NRENs. NRENs have adopted *eduroam* in 69 countries as of 2014 and it is still being adopted in a growing number of countries in other regions (GÉANT Association, 2014).

The authentication and mobility services such as *eduroam* provide access to a variety of services such as (Abbott & Taylor, 2015; GÉANT Association, 2014):

- Library services and resources;
- Collaboration tools;
- Document delivery;
- Catalogue systems;
- Mailing-lists subscriptions services;
- Web-conferencing services; and
- Web portals and e-Learning tools.

Additional services included in some regions are:

- Web- and video-conferencing;
- Streaming video portals;
- Multi-point conferencing unit booking systems;
- Software licensing repositories;
- Webshops;
- A variety of data services, software services, sensors, grid computing and cloud computing; and
- Science gateways.

3.4.3. Collaboration Support Services

Collaboration support services are products and services that are provided based on an interdependent peer-to-peer model with the main focus of helping users and systems (TechTarget, 2016). NREN uses many types of products and services to provide support

between the Communities of Practice and users (GÉANT Limited, 2014). These products and services will be discussed next.

3.4.3.1. Network Collaboration tools

Collaboration technology plays a central role in knowledge creation and innovation, which is the foundation of research and education (Razmerita, 2013). Collaboration tools help users and the Communities of Practice to save on travel costs, save on communication costs, gain faster access to knowledge, gain faster access to area experts and increase overall user satisfaction (Majumdar, 2015). NREN has embraced this practice in the following way:

- Connecting the institution's IP telephony deployment(s) or separate users by means of VoIP and numbering schemes;
- Group collaboration services which come in the form of a grouping of services allow collaborative groups to collaborate with one another effortlessly, independent of their physical location;
- Deliver a high-quality video/audio-based collaboration environment for video- and web-conferencing;
- Central multimedia content repositories or an online presentation repository for remote teaching and learning (Abbott & Taylor, 2015).

3.4.3.2. Network e-Science and e-Research Resources

e-Science is a system-integrated complex set of telecommunication, computer information and social communication technologies, that offers the functions achievement and solving of real science problems across all disciplines (Veretennikova, Pasichnyk, Kunanets & Gats, 2015). This, together, with a complex set of technologies is known as e-Infrastructure and is supported by the combined NRENs. The e-Infrastructure are accessible through web-based portals and Science Gateways. Once accessed, a wide variety of computing power, storage communication, software services, sensors and data would be available to the user as provided by the participating institutions. NRENs across the globe are responsible for supporting the e-Infrastructure, which in turn allows for the successful implementation of e-Science (Abbott & Taylor, 2015).

3.4.3.3. Support Services

A vast number of NRENs have adopted additional softer services as part of their service portfolio. These added services are linked to some form of business function or business process. These additional services include:

- **Training, Dissemination and Project Development Support**

Many NRENs have a business unit dedicated to customer support. The customer service units publish the services being offer on their websites. Amongst these offerings are best practice guidelines which are well accepted by institutions. These best practice guidelines range from technical guides to campus-networking best practice guides (Abbott & Taylor, 2015). Other services being offered by almost all NRENs are training courses, national user-conferences, best practice workshops and visiting events. Likewise, some regional NRENs offer NREN leadership training and training for project preparation (GÉANT Limited, 2014). All these value added services are instilled to strengthen the relationship with its customers by meeting their growing expectations.

- **Brokerage and Professional Services**

In the service of their clients, NREN facilitates the buying and selling of products and services between the buyers and sellers. By doing so, NREN uses its knowledge and expertise to engage with the market on behalf of the clients to gain considerable savings. Examples include the negotiation of bulk software licensing deals at a national level for e-learning, generic and other applications thus achieving economies of scale. Additionally, NRENs also embark on framework procurement for network and associated equipment for their expansion. NRENs then permit the clients to use these negotiated terms and conditions to purchase their own institutional network equipment. This leads to considerable cost-saving initiatives (GÉANT Limited, 2014).

- **Software Development**

Although software development is not part of NRENs service offerings, many NRENs develop software that will assist with addressing the clients' needs and those of the wider international community. Eleven of the GÉANT NRENS own intellectual property rights to certain software whilst twenty-one are involved in open-source software development (GÉANT Limited, 2014).

- **E-Learning and Massive Open Online Course (MOOCs) Support**

MOOCs are online self-guided courses, which permit millions of learners worldwide to access unlimited and open access learning opportunities via the Internet (Milligan & Littlejohn, 2016). HEIs are a major driver in this regard as many HEIs have adopted MOOCs as a learning platform, which forms part of their coursework (Olsson, 2016). Students are educated through a mixture of traditional course content such as recorded lectures, reading material and data used for problem solving. Furthermore, MOOCs allow students and lecturers to interact with one another through various collaborative

features. NRENs have realised the adoption rates of MOOCs and provide an advisory service to HEIs. The advisory services include guidance on procuring the correct technology and how to setup the supporting ICT infrastructure, in order to achieve optimal MOOC delivery to national and international students (Abbott & Taylor, 2015).

3.4.4. Value of NREN

A well-defined and properly governed NREN can be of great value to the research and education communities. By creating a dedicated network infrastructure, combined with the network services as discussed above, the national and international NRENs are able to produce the following values to its users:

- Create a high bandwidth, high quality dedicated national and international research and education network;
- Specialised managed (faster, cheaper, dedicated etc.) network access across the country and globe;
- Reliable network reinforced by up-to-date security policies;
- Effective and efficient network links to the public Internet and internally connected network across national borders to international networks;
- National negotiation for network-related resources as per the client's needs. These resources include software licences, hardware provision and maintenance or support contracts;
- Independent access to any assigned institutional service from any physical location by means of one set of user credentials; and
- Single sign-on access to resources of different institutions as authorised by the managed group-access. Resources include computing, communication, software, sensors and data (Abbott & Taylor, 2015).

The values produced by the network infrastructure and supporting services listed above successively introduce a wide range of secondary supporting services and initiatives. These added services and initiatives include:

- Delivery of online collaboration tools;
- Development of advanced ICT resources for e-Infrastructure and e-Science. Resources, which include computing power, storage communication, software services, sensor and data;
- Communities of Practice need creation though science gateways or one-stop-shops;
- Best practices and networked services training and support;
- Organising and hosting conferences and best practices sessions for users;

- Leadership training;
- Providing software development support as well as providing a platform for conducting rigorous, transparent and replicable software/hardware testing;
- Establishing open online courses, e-learning and distance learning educational programmes; and
- Guidance on project preparation, development of inter-regional international initiatives and international funding opportunities (Abbott & Taylor, 2015).

Figure 3.4 depicts the NREN business model as per Osterwalder and Pigneur (2010) BMC. The high-level NREN business model canvas was drafted by the researcher by reviewing the prescribed literature on NREN which included Abbott and Taylor (2015), Foley (2016), GÉANT Limited (2014) and Janz (2013). From the NREN business model it is clear that NREN is focused on providing advanced network services and added value for the Academic and Higher Education community at an affordable cost. NREN delivers advanced IT and communication services, specialised security and identity protocols and specialised services via the physical network infrastructure and skilled staff. NREN receives money from government subvention, user service fees and membership fees and these funds are used to operate the network and provide the required advanced services and also for investments that are necessary to implement the network and the services. NREN has formed partnerships with the government, utility companies (fibre), telecom providers and academic communities.

3.5. South Africa's NREN

In the South African landscape, the locally appointed or national NREN is the South African NREN (SA NREN). As at 2015, SA NREN serves 25 Universities, 5 Institutes of further education, 26 Research institutes, 2 other types of institutions (libraries, museums, archives, cultural institutes) (GÉANT Association, 2014). The various SA NREN roles and responsibilities are distributed between two organisations, which are firstly, the South African National Research Network (SANReN) Competency Area (CA) at the Council for Scientific and Industrial Research (CSIR) Meraka Institute and secondly Tertiary Education and Research Network of South Africa (TENET). The SA NREN is not only responsible for providing an Internet service to the above identified Internet community, but it is also responsible for instilling the IG policies and mechanism as well as a vision of the Internet as a human right (public good).

Key Partners	Key Activities	Value Propositions	Customer Relationships	Customer Segments
• Government • Utility Companies (Fibre) • Telecom Providers • Academic Community	• Advanced information technology (IT) and communications services • Specialised security and identity protocols • Specialised Services (Middleware)	• Advanced network services and the added value for education and research at an affordable cost	• Connection tariffs (NREN Membership)	• Academic and Higher Education community
	Key Resources • Skilled staff • Network Infrastructure		**Channels** • Local Network • Last Mile • National Backbone • International Bandwidth	

Cost Structure	Revenue Streams
• OPEX - operate the network and provide the required advanced services • CAPEX - investments that are necessary to implement the network and the services.	• Government subvention • User service fees • Membership fees

Figure 3.4: NREN Business Model Canvas.

SANReN represents the government interests and its core focus is on the designing and procuring of network links and equipment. TENET represents the interests of institutions and its core focus is on operating and administering the research network (Mooi & Botha, 2016; Wright, 2012). Collaboratively, SANReN CA and TENET are responsible for the management of the South African dedicated network infrastructure and network services to research and education communities. Together these institutes have formed a strong partnership, which is aligned with the set national development objectives, as well as providing a well-balanced communication platform for the benefit of the Internet-user community (TENET, 2017). The combined effort and progress made with the rollout of the NREN backbone in SA can graphically be seen in Figure 3.5.
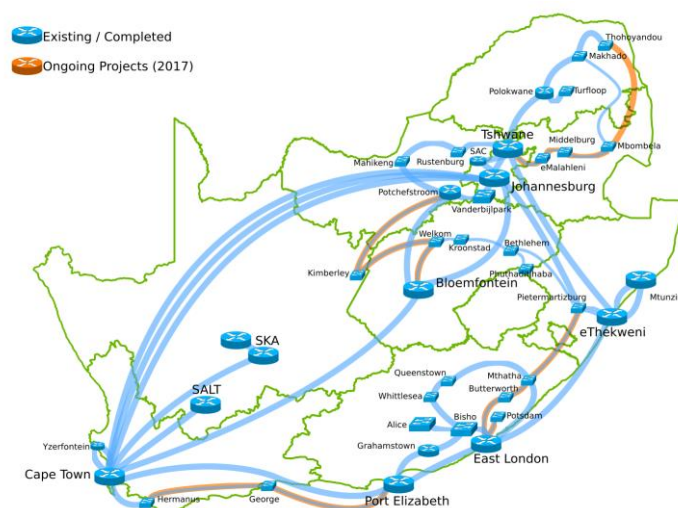
Figure 3.5: Geographical Map of South African Backbone.
Source: SANReN, 2017.

The following sub-sections elaborate on the locally appointed SA NREN.

3.5.1. SANReN CA

The SANReN CA, better known as SANReN, was established in 2003 and was tasked by the Department of Science and Technology (DST) with the planning and implementation of the South African Cyberinfrastructure initiative. Since then SANReN CA's responsibilities have grown significantly. SANReN CA is currently responsible for the overall design, acquisition and roll-out of the national and international Gigabit per second and higher range network infrastructure and network services in South Africa, dedicated to education, research science and innovation Internet traffic. SANReN CA, therefore provides a research platform, which is detached from the commercial Internet. Furthermore, SANReN CA is also responsible for the development and incubation of advanced services. This approach ensures alignment with the South African government's stance on the cyberinfrastructure as well as ensuring that South

African researchers contribute to the global knowledge production endeavour. It is clear that SANReN CA plays a critical role in the National Integrated Cyberinfrastructure System (NICIS), together with the Centre for High Performance Computing (CHPC) and the Data Intensive Research Initiative of South Africa (DIRISA) (SANReN, 2017; Wright, 2012).

SANReN CA is managed and implemented by the CSIR's Meraka Institute, which is situated in Pretoria. SANReN CA benefits by using CSIR's on-site support infrastructure and services, which include HR, procurement, financial, legal, audit an other. services. SANReN CA therefore conducts its business in compliance with the CSIR Approved Framework policies, procedures and guidelines. SANReN is, however, not a formal CSIR Competence Area, Research Group or Laboratory, but is classified as a separate unit. Furthermore, it is not funded by the CSIR but is fully funded by the National Treasury with a Medium-Term Expenditure Framework (MTEF) budgetary line-item in the DST budget. The SANReN CA's manager reports directly to the Meraka Institute Executive Director and forms part of the Meraka top management team. All CSIR Cyberinfrastructure initiatives are expedited by the Meraka Institute Executive Director (SANReN, 2017; Wright, 2012).

Figure 3.6 depicts the SANReN CA business model as per Osterwalder and Pigneur (2010) BMC. The SANReN CA BMC was drafted by the researcher by means of reviewing the prescribed literature on SANReN CA, which included SANReN (2017) and Wright (2012). The SANReN CA BMC was then validated and updated by the SANReN CA CEO, Leon Staphorst (Staphorst, 2016). From the SANReN CA business model it is clear that SANReN CA is focused on enabling and accelerating science, education and innovation in South Africa by providing superior connectivity, advanced services and thought leadership, provide a research platform to encourage and conduct research in high speed networking and enable world-class research, facilitate innovation and development within the NSI and, enable accelerated Human-Capital Development through the network's use.

These values are for HEIs, Research Council, National Research Facilities, other research institutions performing research and Institutions involved in innovation (e.g. incubators). SANReN CA design and implement the SANReN high-speed network are dedicated to research, education and innovation traffic as well as to developing and incubating advanced services to maximally use the capacity provided by SANReN to full capacity. This is accomplished through DST MTEF funding, existing SANReN infrastructure (PoPs, metro networks, national backbone, WACS), SANReN staff and shared services (HR, Legal, Finances, Procurement, IT) provided by the CSIR. SANReN CA is fully funded by the

Key Partners

- Department of Science and Technology.
- TENET.
- DHET.
- USAf.
- ASAUDIT.
- IT directors of Science councils.
- Science projects of national interest (e.g. SKA, MeerKAT, SARIR).
- Telecommunication infrastructure and equipment providers.
- Other NRENs.
- Regional RENs.
- Other NICIS entities (CHPC and DIRISA).

Key Activities

- Design and implement the SANReN high-speed network dedicated to research, education and innovation traffic.
- Develop and incubate advanced services to maximally use the capacity provided by SANReN.

Key Resources

- DST MTEF funding.
- Existing SANReN infrastructure (PoPs, metro networks, national backbone, WACS).
- SANReN staff.
- Shared services (HR, Legal, Finances, Procurement, IT) provided by the CSIR.

Value Propositions

- Enabling and accelerating science, education and innovation in South Africa by providing superior connectivity, advanced services and thought leadership.
- Provide a research platform to encourage and conduct research in high speed networking.
- Enable world-class research, facilitate innovation and development within the NSI, enable accelerated Human Capital Development through the network's use.

Customer Relationships

- University IT directors (ASAUDIT) and IT teams.
- IT directors and teams of science organisations
- Science engagement with power users of SANReN.
- E-Research centres of various universities.
- Various ad-hoc platforms (e.g. SLARG, CHPC national annual meeting).

Channels

- Business Plan goals.
- Contracts and Tenders.
- Project Management.
- Direct conversation with technical staff of participating organisations.
- Consultations and meetings held with vendors.

Customer Segments

- HEIs.
- Research Council.
- National Research Facilities.
- Other research performing institutions.
- Institutions involved in innovation (e.g. incubators).

Cost Structure

- Network infrastructure and equipment.
- Services development hosting equipment.
- Network usage and maintenance.
- Network operations and maintenance.
- Staff remuneration.
- HCD.
- Collaborative projects with other NRENs and RRENs.

Revenue Streams

- Fully funded by Department of Science and Technology.
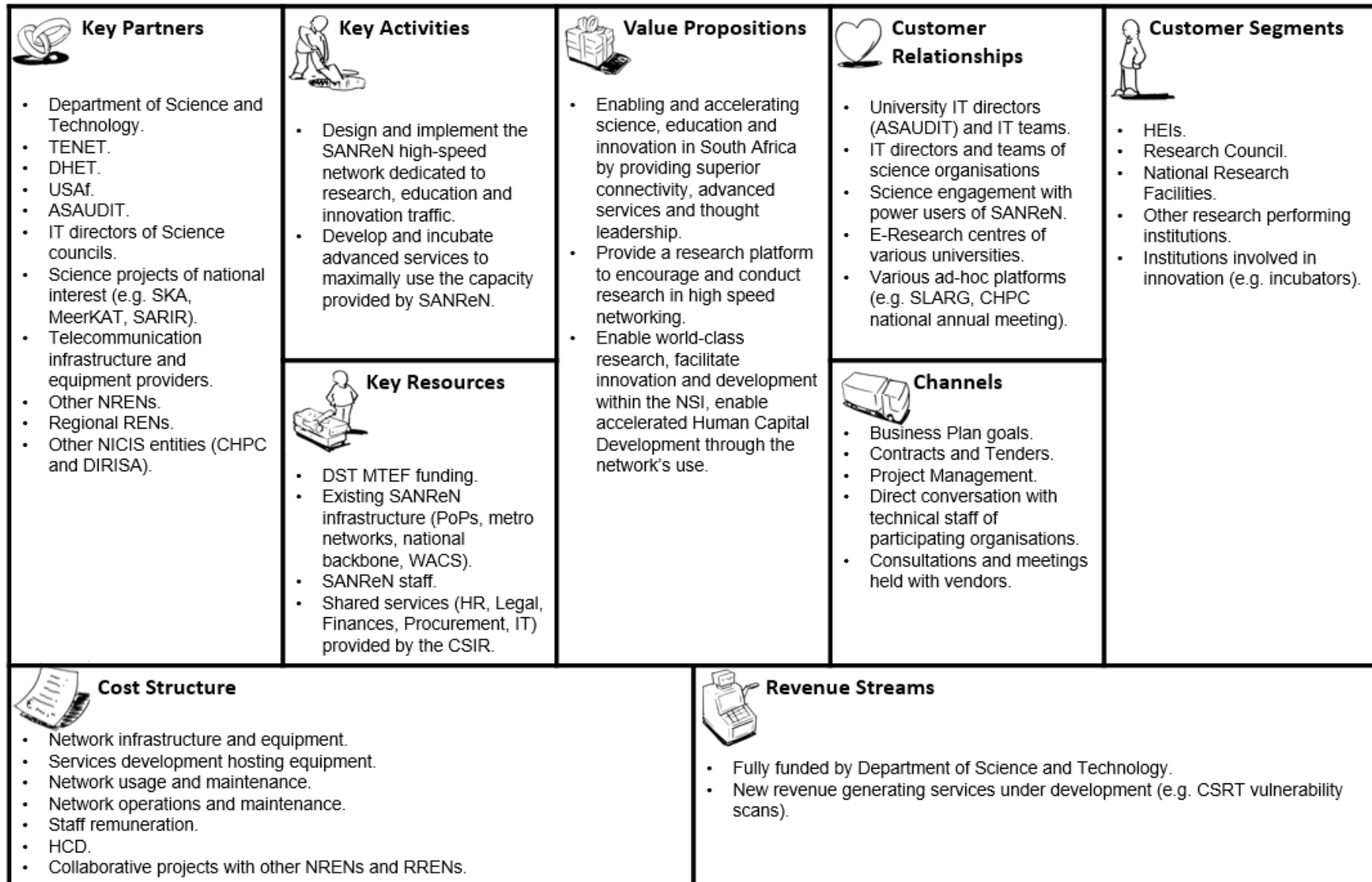- New revenue generating services under development (e.g. CSRT vulnerability scans).

Figure 3.6: SANReN CA Business Model Canvas.

Department of Science and Technology and through new revenue-generating services under development (e.g. CSRT vulnerability scans).

The revenue streams are put towards network infrastructure and equipment, services-development hosting equipment, network usage and maintenance, network operations and maintenance, staff remuneration, HCD and collaborative projects with other NRENs and RRENs. SANReN CA have formed partnerships with the Department of Science and Technology, TENET, DHET, USAf, ASAUDIT, IT Directors of Science Councils, Science projects of national interest (e.g. SKA, MeerKAT, SARIR), Telecommunication infrastructure and equipment providers, other NRENs, regional RENs and other NICIS entities (CHPC and DIRISA).

3.5.2. TENET

TENET is a non-profit organisation that was established by the South African public universities in 2000. It was envisioned that TENET would be the driving force, which would infuse collaborative networking amongst universities, science councils and associated support institutions (Banda & Khomba, 2013). Today, TENET operates the TENET network infrastructure and network services to HEI campuses of South African education and research institutions and associated support institutions in the public sector (TENET, 2017). TENET services, contained in the REN Service Agreement include, instilling direct connectivity with campuses of all participating HEIs, access to the commercially available Internet via peering and transit connections, access to research and education networks and routes worldwide, network applications, which are dependent on the supporting TENET network infrastructure and network performance management services (Greaves, 2013). In addition to these main services, TENET also acts as a Local Internet Registry that manages allocations of IPv4 and IPv6 addresses within the AfriNIC domain, acts as an administrator and moderator of the *AC.ZA* Internet Domains and solicits donations to fund capacity-development programs. These services are aimed at meeting the business requirements of the Internet-user community and are guided by the collaboration agreement set with SANReN CA (TENET, 2017).

TENET is governed by the TENET Board, which constitutes 13 Directors of ICT Department in HEIs. The Chairperson and the CEO, who are in the number of the Directors, are appointed by the Board. The other 11 members are elected by the members. All public HEI and science councils qualify to participate as members of the board. The CEO is responsible for the operational control of TENET. Supporting the CEO with the operational control are three

executive officers and 11 other staff members, who are mostly network engineers. To support the workforce, TENET uses expert consultants on a regular basis. TENET's head office is situated in Wynberg, Cape Town. TENET's Network Operations Centre is situated in Johannesburg and is manned by the remaining 4 staff members. The members meet annually in June at the formal TENET Annual General meeting (Banda & Khomba, 2013; TENET, 2012).

As TENET is a non-profit organisation, it only recovers its full cost of service delivery through services charged as determined by the Board. This means that there are no funds received from the Government or donors as with SANReN CA. As at 30 September 2017, TENET had a client base of 358 campuses and 77 institutions. Furthermore, they are also incubating an entity primarily serve the TVET colleges with its own client base of 35 campuses and 18 institutions (Jonathan, 2017). With all clients, a formal service agreement titled REN Service Agreement is signed by both parties, which guides specific ordering, service level agreements, billing and payment processes. Furthermore, it binds the clients to comply with the set TENET Acceptable Use and Connection Policies (TENET, 2017).

Figure 3.7 depicts the TENET business model as per Osterwalder and Pigneur (2010) BMC. The SANReN CA BMC was drafted by the researcher by means of reviewing the prescribed literature on TENET, which included Banda and Khomba (2013) and TENET (2012). The TENET business model canvas was then validated and updated by the TENET CEO, Duncan Greaves and TENET Specialist Admin Officer, Richard Jonathan (Greaves & Jonathan, 2016). From the TENET business model it is clear that TENET is focused on providing research networking services (Internet and REN connection) at a low cost to Higher Education Institutions, Research Centres and schools (through the e-Schools Network). TENET delivers network management and configuration of equipment and 24/7/365 Network Operating Centre (NOC) operations services via the physical network, network infrastructure and highly skilled engineers. TENET receives money through monthly agency fees and these funds are used for peering and international transit, dark fibre operations and maintenance, hosting solutions and staffing (Engineers). TENET have formed partnerships with SEACOM, UbuntuNet Alliance, CSIR - MERAKA Institute, Department of Science and Technology and Department of Higher Education and Training. The following section will discuss some of the key issues experienced by many HEIs that hinder the optimal usage of the Internet resources.
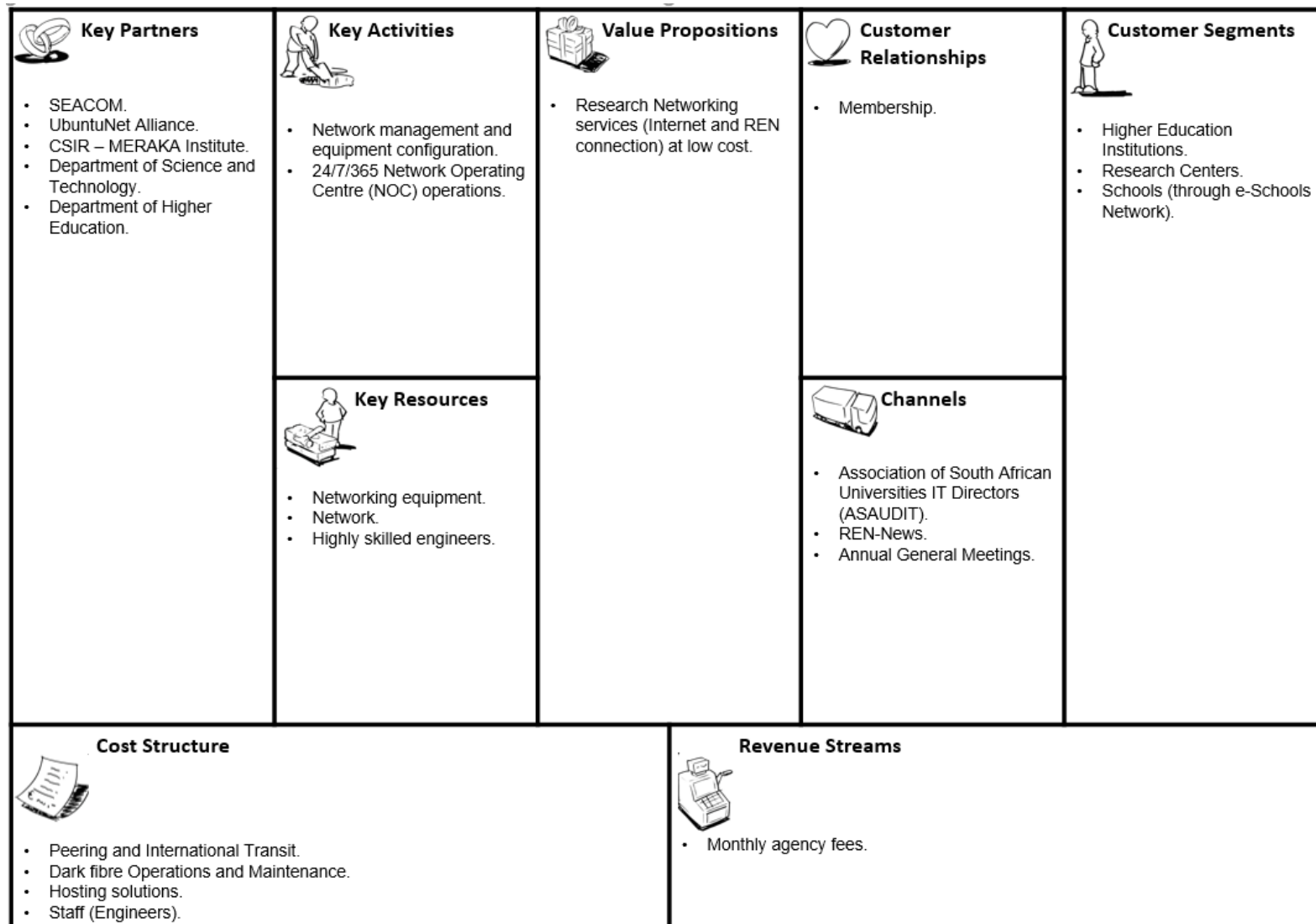
Key Partners	Key Activities	Value Propositions	Customer Relationships	Customer Segments
• SEACOM. • UbuntuNet Alliance. • CSIR – MERAKA Institute. • Department of Science and Technology. • Department of Higher Education.	• Network management and equipment configuration. • 24/7/365 Network Operating Centre (NOC) operations. **Key Resources** • Networking equipment. • Network. • Highly skilled engineers.	• Research Networking services (Internet and REN connection) at low cost.	• Membership. **Channels** • Association of South African Universities IT Directors (ASAUDIT). • REN-News. • Annual General Meetings.	• Higher Education Institutions. • Research Centers. • Schools (through e-Schools Network).

Cost Structure	Revenue Streams
• Peering and International Transit. • Dark fibre Operations and Maintenance. • Hosting solutions. • Staff (Engineers).	• Monthly agency fees.

Figure 3.7: TENET Business Model Canvas.

3.6. Key Internet Management Issues

Staff and students are bringing more Internet-enabled devices into the University environment. These devices require an active Internet connection, which adds continuous, rich Internet traffic onto the already congested network, Internet bandwidth and other ICT resources. According to Cisco (2016), the average amount of smartphone traffic per user grew by 43 percent in the last year whilst the average amount of tablet traffic per user grew by 280 percent in the last year (Cisco, 2016). Table 3.1 provides the 2015 and 2020 per devices predicted growth rate in MB per month. It is clear that there is an expected increase that will take place in the next few years. Furthermore, the content being accessed by the Internet users requires more bandwidth and faster computing resources due to its richness. These devices include Bring Your Own Device (BYOD), Cloud computing, Voice over IP (VOIP) and Internet of Things (IoT) also known as Internet of Everything (IoE). This rapid and practically uncontrollable and unsupported growth introduces an imbalance into the business purpose, users' requirements and the ageing and sometimes stagnated ICT resources. This phenomenon is known as the thruway effect. The thruway effect occurs when a new road is built to alleviate traffic. If successful, the new road will not only receive abundant traffic, but the traffic on the older roads will also increase. The same can be seen as the ICT infrastructure advances. The act of Internet advancement only seems to make the situation worse, which places geater demands on the ICT resources that are nearing the end of their life cycle and those that are already past their end of life, also known as abandonware (Fleck & McQueen, 1999).

Table 3.1: Summary of Per-Device Usage Growth, MB per Month.

Device Type	2015	2020
Non-smartphone	23 MB/month	116 MB/month
M2M module	164 MB/month	670 MB/month
Wearable device	153 MB/month	558 MB/month
Smartphone	929 MB/month	4 406 MB/month
Tablet	2 576 MB/month	7 079 MB/month
PC	2 679 MB/month	5 232 MB/month

Source: Cisco, 2016, p. 28.

The popularity of the digital environment and Internet of Things (IoT) or Internet of Everything (IoE) is impacting all aspects of academic and educational practices because of their central responsibility and significant role in supporting research, learning, information and knowledge

activities in universities (Makori & Osebe, 2016). Universities across the world have adopted information communication technology systems in order to create an environment conducive for students to engage in learning and gain access to information resources (Shukla, Agarwal & Shukla, 2012). In an environment built around Internet-enabled technology, the unregulated and counterproductive use thereof will hinder the growth of the organisation.

Cyberloafing, also known as cyberslacking, is the term used when employees in a work environment participate in activities outside the scope of their daily obligations. The same applies to students who use the HEI Internet to engage in activities outside the scope of their learning tasks. The results with the constant advancement of technology in the work and educational environment makes cyberloafing the prevalent method of wasting time (Akbulut, Donmez & Dursun, 2017). These cyberloafing activities include, amongst others, accessing personal emails, browsing sport, news, adult content, using chatrooms and reading blogs and it is identified as a form of Internet misuse (Yılmaz, Yılmaz, Öztürk, Sezer & Karademir, 2015).

In a typical workplace setting, research found that the factors that are associated with cyberloafing are gender, income level, educational level and workplace autonomy. Research found that the typical cyberloafer is unfulfilled in his/her job, they are younger workers, males, with higher education levels, higher-status jobs and higher earnings (Garrett & Danziger, 2008; Hargittai & Shafer, 2006; Jackson, Ervin, Gardner & Schmitt, 2001; O'Neill, Hambley & Chatellier, 2014; Vitak, Crouse & LaRose, 2011; Weiser, 2000). Users are more prone to cyberloafing activities if it is an acceptable practice within the organisational culture, well-documented and understood in the organisational rules and regulations. (D'Abate, 2005; Lim & Chen, 2009; Stanton, 2002). A satisfactory control to address cyberloafing is the implementation of an Acceptable Use Policy and deterrence mechanisms. These controls were found to be effective only when combined with an effective awareness strategy, threats of termination and active monitoring and enforcement of the policy (Ugrin & Pearson, 2013).

There are countless literature studies dedicated to identifying the economic loss, distraction from actual work and weaker system performance due to cyberloafing. At the other end, some researchers argue that those users who use the Internet for cyberloafing tend to do so for restorative and entertaining purposes, which increases productivity. It is referred to as a stress-reliever that adds variety to the daily, almost repetitive, work routine (Lim & Chen, 2009; Sonnentag, 2003). It is also found that partaking in non-work related online activities restores a user's attention better than other types of enjoyable break activities (Coker, 2013).

The environment and surrounding controls are, however, vastly different in an HEI environment. Employees are linked directly or indirectly to making profits for the company and employers have therefore implemented various countermeasures to address cyberloafing. Students on the other hand are considered by many as clients and are therefore not as restricted in the learning environment when compared to employees. Furthermore, students tend to use their own devices to work from whilst staff use company devices (Akbulut, Donmez & Dursun, 2017). The aim for companies should therefore be to use the Internet resources to strike a balance between a loss of productivity and the concern for the users' wellness though the implementation of physical, technical and operational Internet controls (Baturay & Toker, 2015).

Case and Young (2001) realised the immense negative impact that cyberloafing had on users' productivity levels and developed an Internet management framework to help manage the users' Internet abuse (Case & Young, 2001; Young, 2010). Figure 3.8 presents the initial Internet management framework presented by Case and Young (2001). This framework approached Internet management from the extremes of a proactive perspective to a reactive perspective. The framework identified four management behaviours in addressing Internet abuse, which include hiring, policy, enforcement, and termination/rehabilitation. From a proactive perspective, potential new employees had to be screened for Internet addiction before being employed. This was accomplished by using clinical assessment tools to proactively identify possible online abuse behaviours. Continuing with the proactive response, the adoption of acceptable Internet-use policies assists management to document acceptable and unacceptable Internet usage practices. Thereafter, enforcement should be completed by implementing Internet usage controls into the technological infrastructure. This could include controls such as usage monitoring, filtering, shaping, blocking etc. From a reactive perspective, the termination and rehabilitation, with rehabilitation occurring before termination, should be conducted in the event of Internet misuse (Case & Young, 2001; Young, 2010).
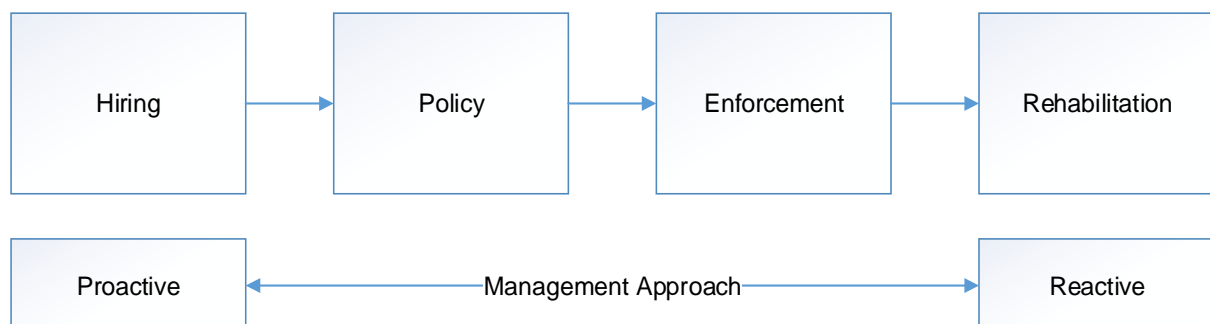

Figure 3.8: Internet Management Framework from Proactive to Reactive Approaches.
Source: Adapted from Case & Young, 2001 and Young, 2010.

The framework presented above did, however, presented a few shortcomings. Firstly, it did not account for new digital media and secondly, the recommendation of screening the interviewees for Internet addiction was based on clinical testing methods and not so much job performance testing (Young, 2010). Over and above the shortcomings listed above, it was also not practical in an educational environment where students also form part of the Internet community. Testing students for Internet addiction during the application processes is just not feasible. Young (2010) reviewed the Internet management framework accoring to the identified shortcomings (excluding the educational environment shortcoming) and presented an updated framework. The new framework designates both prevention and intervention methods to address Internet abuse and replaces the screening of potential new employees into post-employment training. Furthermore, it also addresses shortcomings regarding the hiring concerns of iGeneration (Generation Z) college graduates. The framework now focuses more on how organisations should best use acceptable Internet use policies which include clear directives of Internet monitoring aimed at enforcing employees to comply with organisation policies (Young, 2010). Figure 3.9 presents the revised Internet management framework presented by Young (2010).
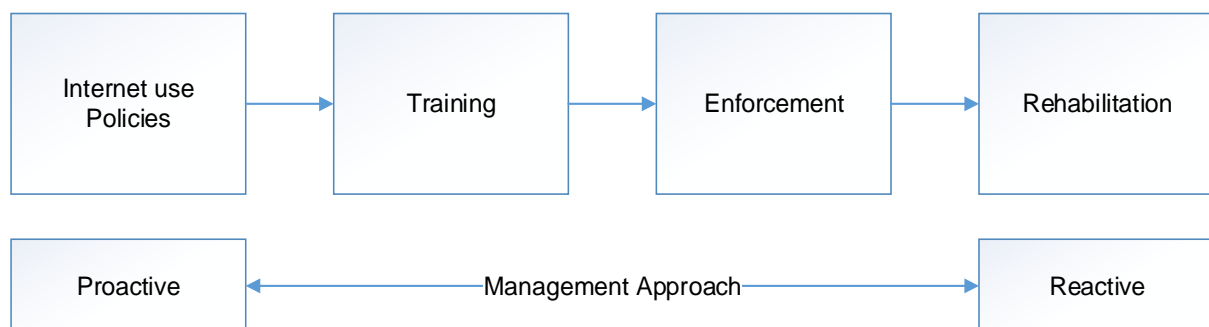

Figure 3.9: Revised Internet Management Framework from Proactive to Reactive Approaches. Source: Adapted from Young, 2010.

The revised Internet management framework approaches Internet management in a similar manner as its prior version, with the only difference being the first two management behaviours. It approaches Internet management from the extremes of a proactive perspective to a reactive perspective. The framework identified four management behaviours in addressing Internet abuse, which include Internet use policies, training, enforcement, and rehabilitation. From a proactive perspective, the organisation should draft and implement an acceptable Internet use policy. The policy must set out prohibited uses, cover the rules of online behaviour, access privileges and list the penalties for violations such as vandalism of the system and security violations. The acceptable Internet use policy must also be signed by all new employees and regular reminders must be sent to notify them that their online

behaviour may be monitored and inappropriate behaviour will lead to disciplinary actions taken against them.

Continuing with the proactive response, the next management approach is the adoption of employee training programmes focused on Internet misuse in the workplace. Studies have shown that Internet usage training and how the Internet can be abused is an effective means to prevent Internet abuse (Case & Young, 2002). Some of topic areas of such a training programme should include identify what is considered acceptable and unacceptable Internet user behaviour, listing the warning signs of abuse in the workplace, identifying risk factors in a user's life that may contribute to Internet abuse and emphasising the seriousness of policy violations (Case & Young, 2004). The next proactive management approach in the Internet-management framework is enforcement. After the acceptable Internet use policy has been implemented and users have received training, it is time to monitor the users' Internet behaviour and enforce the policies (Young, 2010). Many options to monitor users' behaviour are available with some features being included in the standard Internet management software and hardware solutions.

The last management approach, which is a reactive response, in the Internet-management framework is rehabilitation. Previously, termination was included but no longer due to the high hidden costs that stem from increased turnover rates and recruitment and retraining expenses that accompany employee terminations. In addition, it creates a climate of distrust, resentment and fear which undermines productivity and co-operation among those using their Internet according to the acceptable use policy. A rehabilitation programme, similar to an alcoholism or drug addiction rehabilitation programme, should come in the form of an Employee Assistance Program (EAP), which assists the users to restore their physical, sensory and mental capabilities that were lost due to the addiction (Young, 2010). The following section concludes this chapter.

3.7. Summary

This chapter addressed RQ_2 which states, "*What is the current business model canvas for NREN, SANReN and TENET?*". The chapter completed the RO_2 which was to develop and evaluate the business model canvas for NREN, SANReN and TENET.

Chapter 3 highlighted the current Internet management practices with emphasis on HEIs and research institutes. This chapter elaborated on Global NREN and its business purpose and services being offered. Thereafter, the focus shifted to the South African NRENs, SANReN

CA and TENET. For each entity, a detailed elaboration of the business was discussed and concluded with its respective NREN business model canvas. It was realised that a common business focus was present as one moves from the global NREN to the local NRENs. The chapter concluded by discussing some of the key Internet management issues currently impacting businesses.

Chapter 4 provides a comprehensive explanation of the research methodology followed in this thesis. Therefore, the research objective of this chapter would be focused on RO_3, which would be to identify the research methodology to be applied in this research study. This will be achieved by asking RQ_3, which questions *"What research methodology can be used for this study?"*.

4. RESEARCH DESIGN AND METHODOLOGY

4.1. Introduction

Chapter 3 highlighted the current Internet-management practices with emphasis on research institutes and the South African HEIs. It continued with a discussion on the Global NREN and its business purpose and services being offered. Thereafter, the focus shifted to the South African NRENs, SANReN CA and TENET. For each NREN, a detailed elaboration on the business was discussed and concluded with its respective business model canvas. It was realised that a common business philosophy was present in both the global NREN and to the local NRENs.

Chapter 4 provides a comprehensive explanation of the research design and methodology followed in this thesis, which will aid with the reproduction process for any future studies. This chapter specifically elaborates on the research design and methodology with reference to the layered approach as used by the research onion (Saunders, Lewis & Thornhill, 2012). These references include the research philosophy, research approaches, research strategies, time horizons and techniques and procedures.

This chapter addresses RQ₃ which states, "*What research methodology can be used for this study?".* The objective of the chapter is to identify the research methodology to be applied in this research study. Current research methodology practices are reviewed and suitable research methodologies are extracted and presented. Figure 4.1 illustrates an overview of the research objective for this chapter.

Chapter 4 highlights the research design with guidance from Saunders and Tosey's (2013) Research Onion. The chapter commences with a discussion on what is meant by research and what research design is used for this study. It continues with a detailed analysis of each step of the research onion: research philosophy, research approaches, research strategies, time horizons and techniques and procedures. The chapter concludes by summarising the applied research methodology for this thesis. See Figure 4.2 for a Structural overview of Chapter 4.
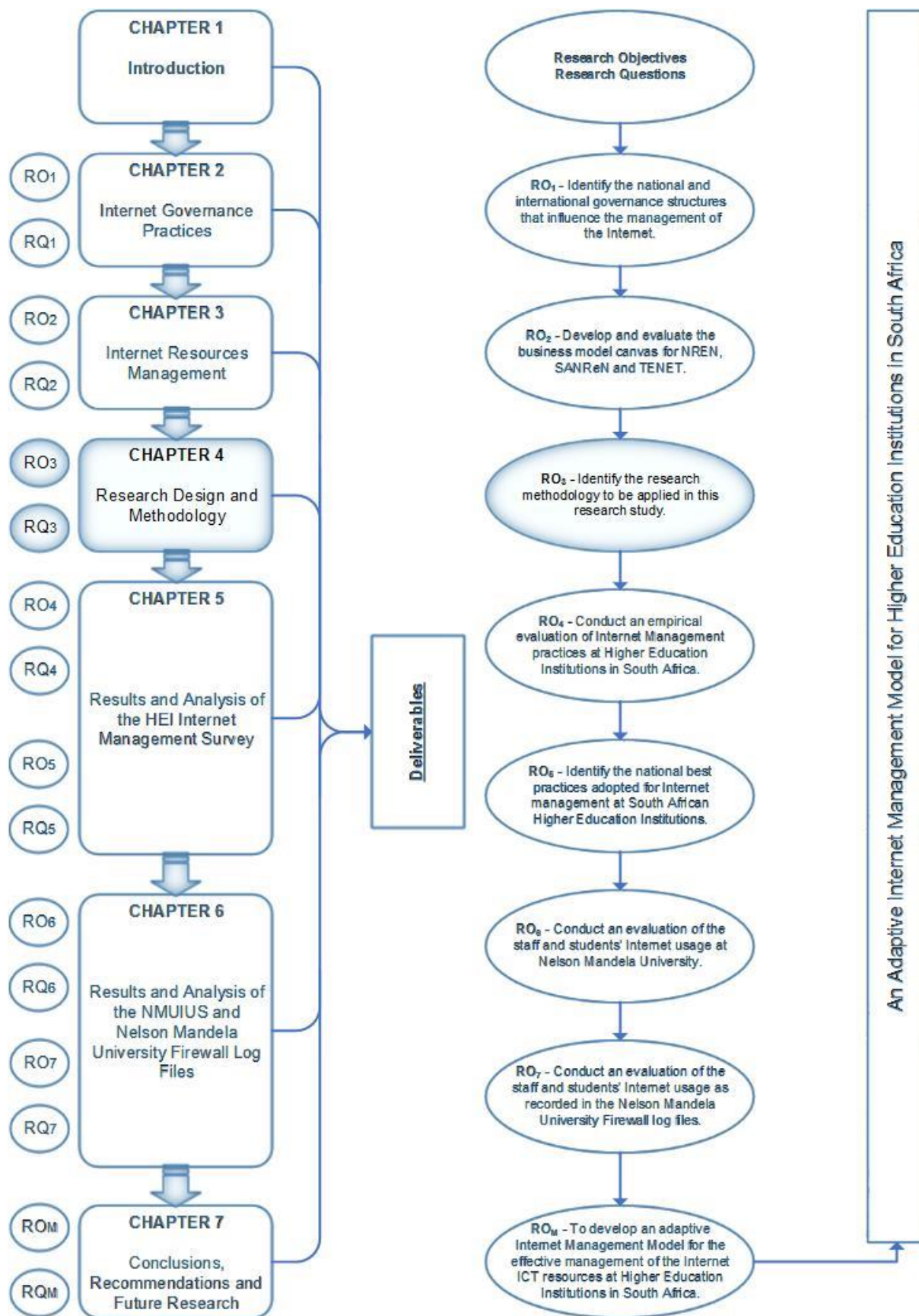
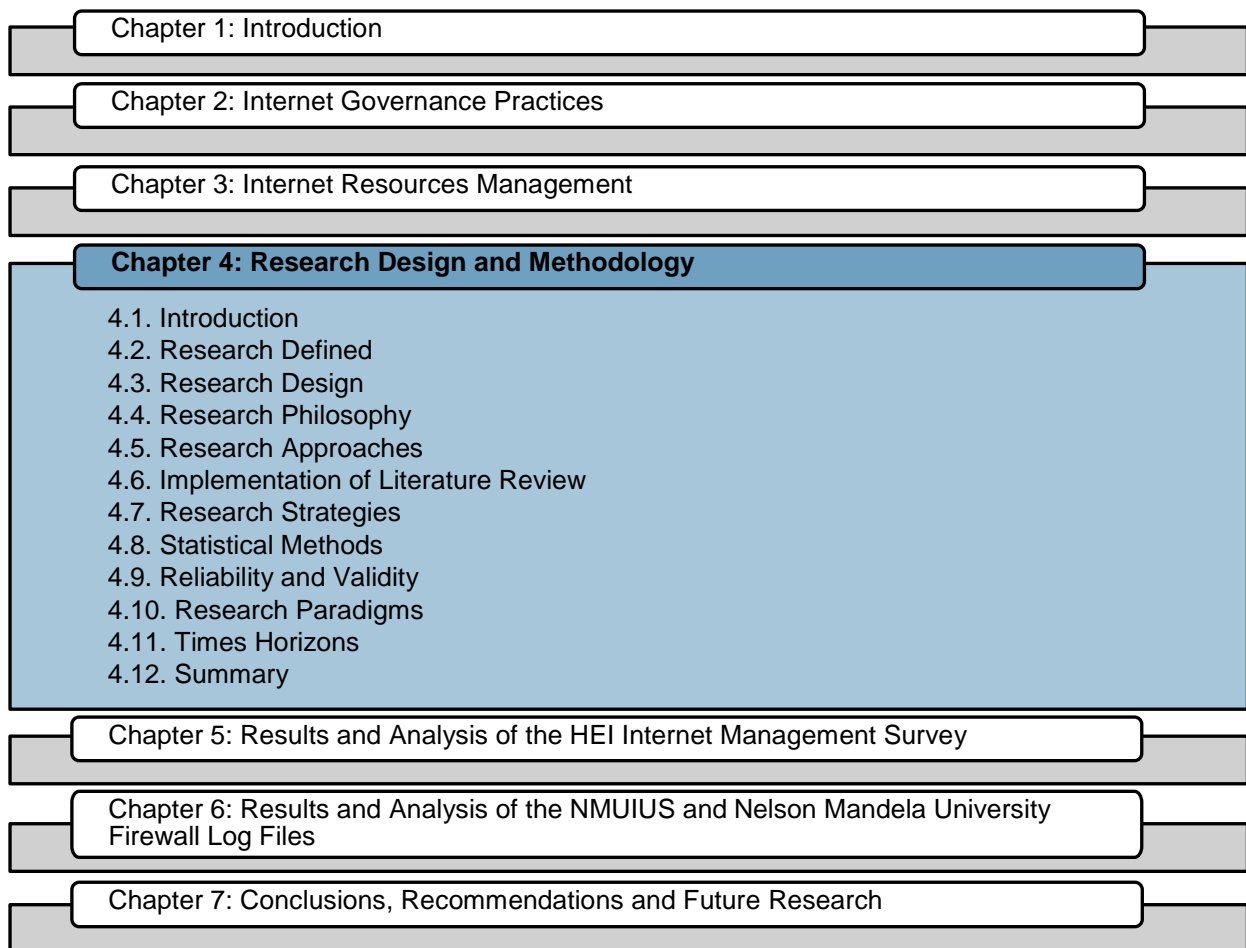Figure 4.1: Chapter 4 Overview of the Research Objective.

| Chapter 1: Introduction |
| Chapter 2: Internet Governance Practices |
| Chapter 3: Internet Resources Management |

Chapter 4: Research Design and Methodology

4.1. Introduction
4.2. Research Defined
4.3. Research Design
4.4. Research Philosophy
4.5. Research Approaches
4.6. Implementation of Literature Review
4.7. Research Strategies
4.8. Statistical Methods
4.9. Reliability and Validity
4.10. Research Paradigms
4.11. Times Horizons
4.12. Summary

| Chapter 5: Results and Analysis of the HEI Internet Management Survey |
| Chapter 6: Results and Analysis of the NMUIUS and Nelson Mandela University Firewall Log Files |
| Chapter 7: Conclusions, Recommendations and Future Research |

Figure 4.2: Structural Overview of Chapter 4.

4.2. Research Defined

Research in its simplest form is described as the use of systematic and organised effort to investigate and solve a specific problem. The purpose of conducting research is to locate the hidden truth which has not been exposed up to a point (Sekaran & Bougie, 2016). This basic description does, however, only touch the surface of a very extensive and complex practice. Kumar (2008) states that research is an original contribution to the existing body of knowledge to warrant its development. It is the journey to uncover the truth with the aid of study, observation, comparison and experiment. In brief, research is the search for new knowledge through the application of objective and systematic methods to recognise and present a resolution of an identified problem. The systematic and organised effort concerning the generalisation and fomulation of a theory is also forms part of the research process (Kumar, 2008).

Kumar's (2008) definition of research presents a number of key focus areas that must be present for an investigation process to be classified as a research study. Firstly, the

investigation process must make a *systematic in inquiry*. Secondly, it must be an *original contribution* to the existing body of knowledge. Thirdly, the purpose of the investigation must be to raise a research question or series of research questions and then apply *scientific and systematic procedures* to these presented question(s) to obtain answers. Fourthly, the investigation must be focused on a *specific field* or *specific subject* within the existing body of knowledge. Lastly, the research must be committed to *inaugurate facts or principles* (Kumar, 2008). The following section identifies and elaborates on the research design of this study.

4.3. Research Design

Research design is identified by the research community as the process of identifying and discussing the overall design or structure that will be adopted during the research study to test the thesis statement (Krippendorff, 2012). Maxwell (2013) presents an interactive model of research design, which consists of five components that address a specific set of research concerns and must therefore be presented in the research design stage. These include goals, conceptual framework, research questions, methods and validity (Maxwell, 2013). Addressing these concerns assists the researcher to align the main thesis statement as accurately as possible with the gathered evidence (data). Once the required evidence has been identified, only then may the research proceed to obtain the evidence.

The process of obtaining the required evidence must adhere to a sound and systematic research process. If this is not the case, the research result will not be classified as a significant scientific contribution. The research onion, as created by Saunders and Tosey (2013), can be used as a guiding structure to develop a coherent and fitting research design, which can be both justified and explained. Furthermore, it provides context and boundaries within which evidence-collection techniques and analysis procedures must be selected (Saunders, Lewis & Thornhill, 2012).

For the purpose of the thesis, the research onion is adopted not only for its stature in the research community, but also for its easy-to-use systematic categorisation of research according to the set stages. The research methodology chapter follows the analogy used by Saunders, Lewis & Thornhill, (2012) who describe the research strategy as peeling back each of the succeeding onion layers. This should be attempted whilst taking into account the implications of choice of method, strategy(ies) and the time horizon for design. The layers of the research onion are depicted in Figure 4.3. The first layer, the outer layer, is known as the Research Philosophy layer and focuses on establishing the applicable philosophy needed for the research study (Section 4.4). These philosophies include positivism, realism and

interpretivism. The second layer focuses on identifying the research approach used for the research study (Section 4.5). These approaches include deductive or inductive. The third layer focuses on determining the research strategy (ies) to be adopted in the research study (Section 4.7). These research strategy (ies) include experiment, survey, case study, grounded theory, ethnography and action research and highlight the plan, which addresses the research questions. The fourth layer focuses on discovering the time horizons used in the research study (Section 4.11). These time horizons include cross-sectional and longitudinal. The last layer, the inner layer, of the research onion focuses on ascertaining the procedures and techniques used for the data collection and data analysis of the research study (Sub-sections within 4.7.1, 4.7.2 and 4.7.4, respectively).

The following section will identify the research philosophies as delineated by the research onion and identify the philosophy adopted for the study.
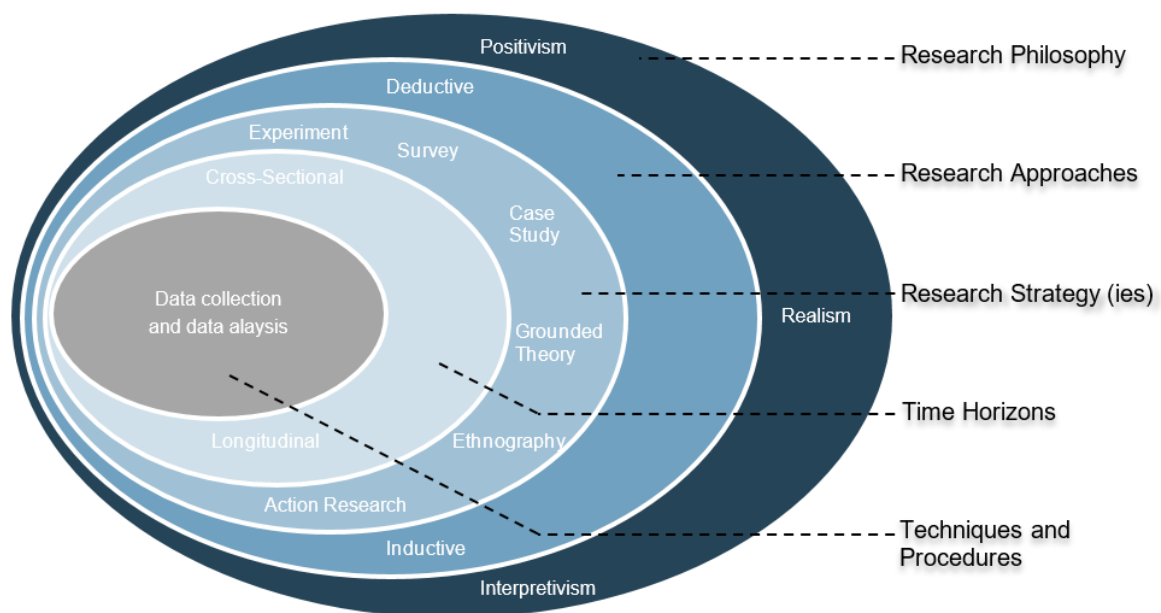

Figure 4.3: The Research Onion.
Source: Saunders & Tosey, 2013, p. 59.

4.4. Research Philosophy

The first layer, the outer layer, of the research onion is dedicated to identifying the research philosophy. The term philosophy, refers to a set of beliefs that study the nature of knowledge and the advancement thereof. Research philosophy, therefore, refers to the philosophical

framework that directs how scientific research views the world and how the research should be executed. It is built around the assumption that reality is something that can be objectively established and described through research. These assumptions consequently form the basis the study's research methodology and research strategy. Hence, the decisive factor when determining which research philosophy to follow derives from how the researcher views the correlation between the nature of knowledge and the process by which it is advanced. The outcome of the chosen research philosophy influences the final adopted research methodologies and research strategies (Collis & Hussey, 2014; Hair, Celsi, Money, Samouel & Page, 2015; Saunders, Lewis & Thornhill, 2012).

According to Saunders, Lewis & Thornhill (2012), there are three major ways of approaching research philosophy. These different beliefs about the world and the nature of knowledge are grouped into positivism, interpretivism and realism. The three research philosophies are discussed in the following sub-sections.

4.4.1. Positivism

Positivism adopts the philosophical stance of natural science, which means that the researcher plays an observable role in the social reality, which leads to the construction positive information as it can be verified scientifically. This, in turn, means that there is logical and mathematical proof that exists for every assertion. The researcher is independent or external to the gathering of the data process and can therefore neither influence nor be influenced by the variable or a group of subjects of the research (Collis & Hussey, 2014). The research strategy adopted for the research study would in most cases focus on using existing theory to develop hypotheses (Saunders, Lewis & Thornhill, 2012). A hypothesis will then be tested and either accepted or not accepted, in whole or part (Wegner, 2012). This leads to the further development of the theory, which is tested by further research. The positivist paradigm is implemented in this research study.

4.4.2. Interpretivism

Interpretivism adopts a philosophical stance that the social reality is not objective but in fact highly subjective, as it cannot be defined by a generic set of laws. This approach allows the researcher to gain insight into the complicated reality and allows for the context and the situation to be viewed independently. It is argued that the insights gained as previously discussed are forfeited with the positivist way of thinking. A critical aspect of the interpretivist paradigm is that the researcher has to take an empathetic stance as the act of investigating on its own has an effect on it. During the research process, the researcher enters the subject's

social reality and tries to understand the world from the subject's point of view. This aids the researcher to gain a deeper understanding of the subject's interactions, actions and motives. The interpretivism paradigm is relevant in the business and management research environment, specifically in the field of human resources management, organisational behaviour and marketing (Collis & Hussey, 2014; Saunders, Lewis & Thornhill, 2012).

4.4.3. Realism

Realism is very similar to the positivistic paradigm in the sense that it relates to a scientific approach to the development of knowledge and focuses on the fact that reality is independent from the phenomena under study. Realism applies equally to the psychological, social and physical reality (Chirkov, 2016) . Therefore, it emphasises that objects have an existence independent of the human mind and identifies what the human senses can sense as the truth (Saunders, Lewis & Thornhill, 2012). The difference between the two paradigms is that realism claims that no form of science relies exclusively on observable empirical evidence. Realism believes that there are always hidden aspects of any form of reality that are hidden beneath the observed subject. The focus would therefore be to reveal the hidden aspects that bring about the observable regularities (UK Essays, 2015). As previously mentioned, the positivist paradigm will be implemented in this research study. The following section defines research approaches and discusses the adopted approach for this study.

4.5. Research Approaches

The second layer of the research onion focuses on selecting the appropriate research approaches. There are two broad reasoning approaches to research, which are deductive and inductive reasoning. The two approaches are graphically illustrated in Figure 4.4.

Deductive reasoning is referred to as the top-down research approach as it works from theorising to practice or data. It is best suited for problems or topics where a wealth of literature is available, on which the researcher can build the theoretical framework and hypotheses or propositions. Deductive reasoning begins with a theory about a problem or topic and consequently narrows it down to a more specific hypothesis that can be tested. The process then proceeds by further narrowing when observations are collected to address the hypothesis. This allows the researcher to test the hypothesis with specific data on the identified theory (Anderson, Gold, Stewart & Thrope, 2015; Trochim, 2006).

INDUCTIVE

Practice to Theorising

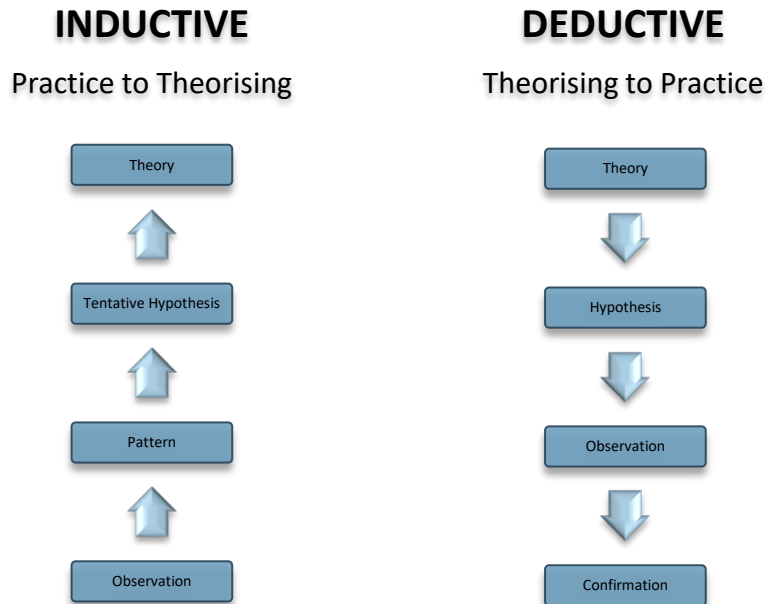**DEDUCTIVE**

Theorising to Practice

Figure 4.4: Inductive vs. Deductive Reasoning.

Source: Adapted from Anderson, Gold, Stewart & Thrope, 2015 and Trochim, 2006.

Inductive reasoning is referred to as the bottom-up research approach as it moves from data or practice to theory. The approach begins by making specific observations in order to better understand the nature of the problem. Thereafter, patterns and consistencies surrounding the collected data will be detected which allows for the formulation of a hypothesis that can be explored. The aftermath is the development of some general theories. The deductive reasoning approaches are best suited for problems or topics that are not well defined, there is limited literature available, or when there no consensus is reached in the available literature. (Anderson, Gold, Stewart & Thrope, 2015; Trochim, 2006).

For the purpose of this research study, deductive reasoning is adopted as the study progresses from theorising to practice. The following section elaborates on the literature review process adopted for this research study.

4.6. Implementation of Literature Review

The following sub-sections introduce the topic of literature reviews, describe their purpose and explain the literature review process followed for this research study.

4.6.1. Literature Review Defined

Collis and Hussey (2014) define a literature review as "a critical evaluation of an existing body of knowledge on a topic, which guides the research and demonstrates that the relevant

literature has been located and analysed" (Collis & Hussey, 2014, p. 306). Sekaran and Bougie (2016) elaborated on the definition by adding that the existing body of knowledge must contain unpublished or published documentation on the identified topic. Furthermore, it must contain data information, ideas and evidence compiled from a specific point of view to express certain views or achieve certain goals on the nature of the topic and how it is to be investigated and the effective evaluation thereof in relation to the research findings being proposed (Sekaran & Bougie, 2016). From the definitions it is clear that, the literature being reviewed must be current and cover all the major trends, questions and issues in the field of study. The literature being reviewed should include archival sources, conference papers, dissertations, journal articles, books, film, presentations and lectures, legislation, online sources, treatises and theses, which encompass any work previously published in the specific field of study (Collis & Hussey, 2014).

4.6.2. Purpose of Literature Review

The process of conducting a literature review permits the researcher to position his/her efforts to existing knowledge and then to build on this knowledge. It helps the researcher to recognise what studies have been conducted before and to identify their strengths and weaknesses and significance. A literature review provides insight into the field of study, its relevant terminology and key terms and insight into the research methodologies without reinventing the wheel, all of which cannot be accomplished without prior literature reviews. The review allows the researcher to gain subject matter knowledge from which new ideas, perspectives and approaches will stem (Kumar, 2008). This guarantees that the study builds on the strengths of the existing body of knowledge whilst eliminating the weaknesses simultaneously. It is therefore imperative that the process of conducting literature reviews must be comprehensive, critical and contextualised and must be conducted on current research studies, reviews of literature and theoretical articles (Hofstee, 2006).

The review of the literature process should summarise, describe, evaluate and clarify literature reviews. A thorough, substantive, sophisticated literature review establishes the foundation of credible knowledge for a respected research study, which allows for the advancement of collective understanding as well as making a contribution to the existing body of knowledge (Boote & Beile, 2009).

4.6.3. Literature Review Process for this Study

Keywords are general words or phrases used to capture the essence of the subject in a specific field of study. Keywords were adopted in this research study to increase the likelihood

of locating the most accurate, current and relevant knowledge required to address the research questions and research objectives. Keywords were used on all occasions during online searches and on multiple occasions, in the index of the books, to acquire the pertinent literate reviews. During the writing of the research alignment plan, the researcher identified multiple keywords for the general field of study, as well as multiple keywords for specific targeted areas within the field of study. Boolean operators such as 'AND', 'OR' and 'NOT' were adopted extensively to connect and define the relationship between the keywords as required to strengthen the search results. The majority of keywords were enhanced as the research continued.

The official online Nelson Mandela University library system called SEALE, a.k.a. OPAC System, ResearchGate, Google Books, Google Scholar and Mendeley recommendations were used extensively to find current online accredited publications. Furthermore, physical books were used which were especially supportive in the specific focused areas of research. The online search method adhered to the following advantages as presented by Collis and Hussey (2014):

- Easy access to publication from numerous online devices;
- Able to search through and re-arrange near real-time publications as per the publication date;
- Searches are executed over multiple study areas with one search;
- Keywords can be used and altered as seemed fit for the relevant search criteria; and
- Real-time searches are executed over millions of publications within seconds to those that adhere to the chosen keywords (Collis & Hussey, 2014).

The researcher opted for using the advanced search feature, as this allowed for the hits to be listed according to publication date. The researcher also ensured that all publications older than 2000 were excluded. The researcher then downloaded and imported the publications into Mendeley. Thereafter, all articles were reviewed according to relevance and currency. All downloaded publications were imported into Mendeley and categorised according to category, author, title, year, published in and added date. Each publication was then scrutinised within Mendeley and the respective important areas were highlighted, commented on, tagged and noted. This allowed the researcher to effortlessly return to any important area of interest within the publication. The processed publications were then shared with the supervisor and co-supervisor for input and approval. The following section defines and elaborates on the research strategies.

4.7. Research Strategies

Layer three of the research onion (Figure 4.3) focuses on identifying the research strategies. A research strategy is the holistic vision which specifies how the research study will be conducted. The research strategy is developed by firstly, identifying the primary and secondary research questions for the research study and secondly, identifying the focus areas or research objectives that stem from the research questions, which must be addressed before the research is complete. A key component to the research strategy is to include a thorough risk assessment, which includes identifying and mitigating possible risks imposed on the study. This in turn will assist in achieving the desired research objective without interference. The research strategy, therefore, acts as a guiding document which gives directions for the planning, execution and monitoring of the research study with special emphasis on building on the research methodology's strengths, removing the research methodology's weaknesses and addressing the research methodology's constraints (Krippendorff, 2012).

According to Saunders and Tosey (2013)'s third layer of the research onion, the research strategies include:

- Experiment;
- Survey;
- Case Study;
- Grounded Theory;
- Ethnography; and
- Action Research (Saunders & Tosey, 2013).

For this research study, two surveys and a review of the Nelson Mandela University firewall logs were used to achieve the required objectives. The two surveys are the Higher Education Institute Internet Management Survey (HEIIMS) and the Nelson Mandela University Internet Usage Survey (NMUIUS). The Nelson Mandela University firewall log is an extract of all the Firewall data of all Nelson Mandela University Internet users who used the Internet on all mediums for the duration of the captured logs. In addition to the surveys, a case study research strategy was also adopted. The Nelson Mandela University was selected to be the subject of the single case. As can be seen from the discussion above and the discussion that will follow, the survey and Firewall data will form part of the case study. Both surveys and the firewall logs analyses will be discussed individually in the following sub-sections. The first discussion will be on the HEIIMS.

4.7.1. HEIIMS

The succeeding sub-sections will define survey research and elaborate on the process followed for the HEIIMS description, survey scale, validity and reliability, survey respondents, survey distribution and data analysis.

4.7.1.1. Surveys Research Defined

A survey is a system for collecting primary or secondary data from a limited, yet reliable number of individuals. These individuals, known as the sample, are presumed to have the required information to address the set thesis statement. The purpose of the study is then to generalise the collected information from the sample to the well-defined body of individuals or objects known as the population who have a shared, binding characteristic or trait. Many researchers choose surveys as a data collection method when there is a need to gain access into the populations' attitudes, behaviour and knowledge. Surveys are generally associated with a positivist study and are very popular in the field of business research as they allow the researcher to collect both qualitative and quantitative data on a wide range of research questions. Surveys can be created as structured questionnaires such as Internet self-completion or postal questionnaires, or can be created as unstructured questionnaires such as in-depth interviews which are conducted via telephone discussion or by face-to-face-interviews (Collis & Hussey, 2014; Hofstee, 2006; Sekaran & Bougie, 2016).

A structured interview format in the form of a survey, was adopted as the primary data collection method in this research study. Each population group were asked the same set of structured questions and were requested to provide feedback on the same section of possible answers. The survey method discussed above therefore applied to both research strategies.

4.7.1.2. HEIIMS Description

The HEIIMS is compiled in various sections. The purpose of the structure is to provide a clear and simple explanation of the study, which will assist in leading the respondents through the purpose of the survey, methodology, participation benefits, questions and conclusions. The aim of the structure is to assist with maximising the response rate. The HEIIMS was introduced by means of a cover letter which includes the topic area, field of study, background and purpose of study, confidentiality statement and benefits of participating for both the respondent and the HEI sector. The overview of the HEIIMS started by thanking the participant for his/her valued input into the study. This was followed by highlighting the importance of the study to the field of research as well as giving an estimated time to complete. A brief overview of the HEIIMS structure was then covered with the emphasis on how this connects to the Business

Model Canvas. The overview concluded by emphasising that the respondents' personal information would be kept confidential and that participation provided automatic consent for the captured information to be used in this research study. The researcher's contact details and acquired REC-H reference number: H16-BES-BUS-015 was then included. See Appendix D - HEIIMS.

The HEIIMS was firstly created in Questionpro, which is the Nelson Mandela University approved online survey tool for research. Shortly after the creation, it was realised that the structure and flow of the survey made it difficult to navigate through the questions and also made the survey appear extremely lengthy. To address these issues, an alternative survey was created using Microsoft Word with Developer Mode enabled. This allowed for the HEIIMS to be structured in such a way that it guided the respondents to follow the programmed question structures. Furthermore, questions that focused on the same topic but with a different audience were now positioned next to one another, saving on space and time to complete. All questions were focused on the outcome and were therefore kept to a minimum. The ICT Governance questions were created after reviewing the report titled 'Developing a successful governance strategy' by The National Computing Centre (2007). The Business Model questions were adopted from Osterwalder and Pigneur (2010) and were realigned to fit the Internet management theme. Following this process helped to ensure that all questions appeared straightforward, remained standard according to current industry practices and hence required minimal assistance or guidance from the researcher.

The HEIIMS was divided into twelve sections. These were:
- Section 1: Biographical Information captured the respondent's biographical information which included, Title, Name and Surname, Email Address, Job Title, Faculty/Department and Duration in this position. Additional questions include 'Would you like to receive feedback on the findings of the survey?' and 'Would you like to receive feedback on the findings of the study titled 'An Adaptive Internet Management Model for Higher Education Institutions in South Africa'?' As stipulated in the overview, this information captured in Section 1 will only be used to identify the credibility of the respondent and to provide feedback if requested;
- Section 2: General University Information captured the University's personal identifiable information;
- Section 3: ICT Governance captured how the University aligns the ICT strategy with the institutional strategy to ensure the effective and efficient use of ICT in enabling the HEI to achieve its goals; and

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- Section 4: Customer Segments to Section 12: Cost Structure raised probing questions regarding the HEI's Internet Management Business Model Canvas. These included Customer Segments, Value Proposition, Distribution Channel, Customer Relationships, Revenue Sources/Streams, Key Activities, Key Resources, Key Partnerships and Cost Structure.

The majority of the questions were in the form of structured questions such as multiple choice and 5 point Likert Scale type questions. As few as possible open-ended questions were used in this survey and all respondents were requested to answer these questions in a bullet point format. A character limit of 100 characters was set on all open-ended question fields.

4.7.1.3. HEIIMS Scale, Validity and Reliability

The structure of the HEIIMS stems from a combination of previously used surveys and available reports and books. The overview, Biographical Information and General University Information sections stem from an Internet management questionnaire created by the South African Regional Universities Association (SARUA). SARUA was the South African Universities Internet Service Provider at that time and used the survey to determine what Internet Management products and services their customers required. The ICT Governance section stems from the report titled 'Developing a successful governance strategy' by The National Computing Centre (2007). The report guided users in analysing key areas in their environment to create a successful governance strategy. The rest of the HEIIMS focus on determining the HEI Internet Management Business Model Canvas (Figure 5.13). To assist the researcher with this, the categories and questions used in the Business Model Generation handbook authored by Osterwalder and Pigneur (2010) were adopted for this survey.

The new survey (HEIIMS) focused on determining the respondent's status, work environment and to determine his/her respective HEI Internet Management Business Model. Each section focused on collecting information relevant to the specific business model building block (or section). For example, the Customer Segment section is used to determine the different groups of people who will be using the Higher Education Institution (HEI)'s Internet while the Revenue Sources/Streams section is used to determine the representation of the cash an institution generates from each Internet user segment. A thorough collection of possible outcome scenarios were identified and listed next to each question. The participants only had to select the answer(s) relevant to their HEI.

The scales that were used ranged from closed questions such as Multiple choice (fact), to Multiple choice (opinion), Likert Scale questions and short open-ended questions. All questions were kept as structured as possible and all questions were mandatory. Each respondent was asked to indicate his/her HEI stance towards the Internet Management practices. These questions were formulated to address each identified topic or area and ensured that the relationship to the primary research question and the secondary research questions were adhered to.

The HEIIMS went through multiple changes. The questionnaire was originally created with structured questions. It was then submitted through the official Nelson Mandela University procedure for general review by the Ethics Committee. Some minor changes were requested and once updated, the questionnaire was signed off by an Ethics Committee official. Thereafter, a general review process between the researcher and promoters highlighted that a business model should not be forced into a direction by stipulating possible answers and that the respondents must be open to freely give their respective responses by means of open-ended questions. The HEIIMS was amended and Section 4 - Section 12 were changed to open-ended questions. The study was approved and the pilot study commenced.

During the pilot study, which was completed by the Nelson Mandela University Director: ICT Services Delivery and Operations and the Nelson Mandela University Deputy Director: Service Delivery, it was determined that the target audience for this survey required an extensive business management background to be able to complete the business model as the current format required. This presented a risk to the validity and reliability of the survey as not all target audience members were equipped with a business qualification or had business model experience. After a lengthy discussion between the researcher and promoters, the survey was returned to its original state and the choices of answers were expanded to ensure that all possibilities were included.

A second pilot study was then conducted using the latest version of the survey. The Nelson Mandela University Director: ICT Services Delivery and Operations and the Nelson Mandela University Deputy Director: Service Delivery then completed the survey with ease. Together these individuals have more than 40 years Internet management experience. Their input on the current Internet practices ensured that all aspects of Internet management were covered in the survey. Thereafter, the survey was distributed at the Association of South African University Directors of Information Technology (ASAUDIT) event. During the event, many ICT Directors approached the researcher and asked for guidance on Section 9: Key Activities.

Guidance was given as requested. Thereafter, the research added a guideline sentence to each open-ended question in Section 9: Key Activities that allow the respondent to better understand the question. The same explanations used during the ASAUDIT event were used. The survey went through five revision phases before it was released to the target audience.

4.7.1.4. HEIIMS Respondents

The fifth layer of the research onion focuses on recognising the techniques and procedures used in the research study for data collection and data analysis. Every individual in the population group for the HEIIMS is either a Chief Information Officer (CIO), ICT: Director, ICT Deputy Director or ICT Manager. A critical requirement to allow them access to the test to participate in this study is that Internet Management must be a KPI (Key Performance Indicator) in their job portfolio. RQ_4 requires a sample of ICT business leaders. The requirements of the same were fulfilled by the Chief Information Officer, ICT: Director or ICT Deputy Director. These are the individuals who must ensure that the business value of the HEI's Internet resources were maintained as demanded by set HEI strategy.

The HEIIMS required one ICT business leader who directs the HEI's Internet resources to complete the survey. These individuals, one from each HEI, were the target audience. Fortunate for the researcher, all these individuals are members of the committee called the ASAUDIT. The ASAUDIT committee comprises University ICT Directors or their representatives, who meet regularly at events to discuss current ICT-related topics as experienced in the HEI environment. It also serves as a platform to facilitate collaboration amongst the various ICT Departments in the various SA HEIs.

The ASAUDIT committee was set to have their first General Institutional meeting for 2017 at the North-West University, Potchefstroom on 19 - 20 April. The researcher used this opportunity and arranged access to the event with the Coordinator, Ms Val Theron. Ms Val Theron agreed and provided the researcher with a stand at the main entrance of the venue. Furthermore, she distributed the survey electronically (cover letter with attached survey) to all members two weeks before the scheduled meeting date and requested them to complete it and email it back to the researcher or hand it to him at the event. Ms Val Theron also used the emails to follow up with outstanding surveys as well as request additional participation, after the ASAUDIT event took place. A total of 18 HEIs were represented at the General Institutional ASAUDIT committee meeting.

The following results were produced from the various channels:

- 1 x completed survey was received from the pilot study;
- 1 x completed survey was received from the emails, prior to ASAUDIT event;
- 5 x completed surveys were received at the ASAUDIT event; and
- 3 x completed surveys were received from the emails after to ASAUDIT event.

There was only one precondition set for respondents to qualify for participation in the study. This was that the respondent was the key decision-maker related to the direction that the HEI Internet Management resource would be taking. This respondent would therefore have the required Internet Management business knowledge required.

4.7.1.5. HEIIMS Distribution

The HEIIMS was drafted by using Microsoft Word 2016. Once the survey was completed, the Design Mode function was activated. This function allowed the researcher to build rules into the flow of the questions and the answer structure. Furthermore, the edit function was removed, which guided the respondent to only edit the answer area. No other part of the survey was editable. The final survey was a hard-coded and secure document which guided the user from one question to another. As one question was answered, the capture field would automatically move to the next question's answer field. This allowed for a quick, easy and painless completion of the survey process.

The primary method of data distribution was completed at the ASAUDIT event. Hard copies of the HEIIMS were distributed and collected as they were completed. A total of 18 HEI representatives attended the ASAUDIT event. A secondary method of data distribution was completed via email. An email was sent to all IT Directors via the ASAUDIT Coordinator, Ms Val Theron. The HEIIMS was attached to the email and was channelled through the ASAUDIT Co-ordinator to all ICT Directors. A total of 25 emails was sent. See Appendix E – HEIIMS Distribution Email. Another channel was used as a pilot study. Nelson Mandela University was used as a pilot study due to the researcher's affiliation to Nelson Mandela University. In total, 5 ICT Directors responded who participated at the ASAUDIT event, 4 ICT Directors responded to the email and 1 ICT Director participated in the pilot study. All respondents met the set preconditions.

4.7.1.6. HEIIMS Data Analysis

The data from the HEIIMS was captured into Microsoft Word 2016 by the respondents. The hard-copy data collected were captured onto the Questionpro online survey tool. Thereafter,

the data were transferred, processed and tabled into Microsoft Excel by the researcher required by the Nelson Mandela University statistician. At the same time, the data were reviewed and all incomplete and corrupt records were removed from the datasets. The data were then submitted to the Nelson Mandela University statistician, Dr Jan Du Plessis, for analysis. Descriptive and Inferential statistics techniques were used to analyse the results and to draw conclusions.

An analysis was conducted on all the findings. Thereafter, only the most valuable/important/relevant findings were scrutinised and discussed to ensure that the research study stayed within the set scope. Furthermore, the calculations from the findings were rounded off to zero decimal places for better visual representation, however, the calculations conducted internally were not rounded off and remained unchanged. This was adhered to, to ensure accuracy was maintained throughout the entire data calculation process. In addition, Cronbach alphas were calculated to establish the reliability of the instruments. The following sub-sections will elaborate on the research strategy for the NMUIUS.

4.7.2. NMUIUS

The following sub-sections elaborated on the NMUIUS's description, survey scale, validity and reliability, survey respondents, survey distribution and data analysis.

4.7.2.1. NMUIUS Description

The covering letter of the NMUIUS familiarised the reader with the topic, study area, background and purpose of study, confidentiality statement and benefits of participating for both the respondent and the HEI. The overview in the survey highlighted the importance of the study for the research and the HEI community and gave the expected time for completion. The overview continued by stressing that no personal information would be captured during the completion of the NMUIUS. The overview concluded with the researcher's contact details and approved Ethics Committee reference number: H16-BES-BUS-015. See Appendix F – NMUIUS.

The NMUIUS was created by using the recommended Nelson Mandela University online survey toolkit called Questionpro. Questionpro is found at https://www.questionpro.com and is freely available to all Nelson Mandela University staff and students. The majority of Questionpro survey creation tools were used during the creation of the NMUIUS, meaning that the questions were structured in such a way that forced the respondents to follow the programmed route. All questions were aligned with the available literature and research

results. This assisted in keeping the questions focused, easily interpretable and to a minimum which ensured that minimal assistance or guidance was required from the researcher.

The NMUIUS was divided into six sections. These were:
- Section 1: Demographical Information captured the respondent's demographical information, which included Gender, Age, Campus Placement, Affiliation Type and personal Internet connection off campus (fixed line and mobile connection);
- Section 2: Governance captured the governance aspects of the Internet at Nelson Mandela University, which included knowledge and acceptance of the Nelson Mandela University General ICT and Acceptable Use policy. It continued by asking the number of devices used to connect to Nelson Mandela University's Internet, the primary device used to access Nelson Mandela University's Internet and its primary Internet value requirements;
- Section 3: Usage and Access Duration to Section 5: Primary Purpose presented the participant with the duration of various Internet usage and uses of the Nelson Mandela University Internet. These included Usage and Access Duration, Content and Primary Purpose; and
- Section 6: Management asked the respondents to rate the Nelson Mandela University Internet's value requirements and Management practices of the Nelson Mandela University Internet Services. It should be noted that the question regarding Internet price was removed on purpose as the instability of the #feesmustfall movement still remains. The researcher did not want to draw attention to fact that there are costs associated with the Nelson Mandela University Internet.

All questions were in the form of programmed and structured questions which include a 5 point Likert Scale and multiple choice type questions. No open-ended questions were used in the survey. The research did, however, include his email address in the invitation, thereby allowing for feedback or clarification to be received on the NMUIUS.

4.7.2.2. NMUIUS Scale, Validity and Reliability

The NMUIUS was created by reviewing other currently available Internet usage surveys. A list of surveys was identified and the most reliable and valid were processed. These surveys were then reviewed and the common theme was extracted and adapted into the Nelson Mandela University environment. Various other internal processes, systems and reports were used in the alignment process. Table 4.1 presents the list of Internet usage surveys as discussed. The Nelson Mandela University Internet management report (MANCO report), the annual

Nelson Mandela University Blended Learning device adoption rate report and Nelson Mandela University Internet firewall classification categories were used as a guidelines to realign the NMUIUS to the current Nelson Mandela University environment and requirements.

Table 4.1: Survey Items Literature Sources.

Survey Title	Survey URL
Internet Behaviour Questionnaire	http://www.idemployee.id.tue.nl/g.w.m.rauterberg/ibq/ibq_engl.html
Internet Usage Survey	http://www.questionpro.com/a/showSurveyLibrary.do?surveyID=170821
Survey of Computer and Internet Use	http://www.haverford.edu/psychology/ddavis/webforms/ma.paper.02.q1.html
Web and Internet Usage Questionnaire	http://www.cc.gatech.edu/gvu/user_surveys/survey-1998-10/questions/use.html
Internet Usage Questionnaire	https://www.surveymonkey.com/r/?sm=oh969UNLuYNmoLYEFVaCcoYj9ZPfsmdnEf1NJylP7QM%3d

Furthermore, the cyberloafing approaches or constructs created by Blanchard and Henle (2008) and reused by Kalayci (2010) and Yaşar and Yurdugül (2013) were adopted for Section 4: Content and the Firewall Log data. These approaches or constructs were, however, adapted to fit the Fortiguard firewall categories (Blanchard & Henle 2008, Kalayci 2010, Yaşar & Yurdugül 2013). The cyberloafing approaches or constructs are a grouping of similar levels of activities used to measure cyberloafing. Originally it was grouped into minor cyberloafing activities such as receiving, checking and sending personal email, surfing mainstream web sites including financial, news, auction, sports, and stock sites and shopping online and serious cyberloafing activities such as personals and gambling sites, chatrooms, virtual communities, updating one's webpage, downloading music and reading blogs. This approach was adopted and aligned with the Fortigate firewall categories, which are already logically grouped as the cyberloafing approaches or constructs requirements demanded. See Appendix H for the 6 Web Filtering categories.

Five Point Likert Scale type questions were used as far as possible. The Likert Scale, also known as intensity rating scale, is the most commonly used information-gathering scale in the social sciences, marketing, business and medicine fields. The Likert Scale is used extensively for gaining insight into individuals' personalities, emotions, attitudes, opinions and their descriptive environment. It aims to quantify constructs which can not directly be measured in

many cases. This weakness is addressed by asking the participants to respond to each question and statement in terms of their own level of agreement or disagreement. This typically presents itself in the form of a one to five response rating scale which is Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree. Various other one to five responses rating scale can also be adopted, as guided by the input required from the question or statement (Collis & Hussey, 2014; Gliem & Gliem, 2003).

These responses are then listed in the survey as guided by the question and statement and assigned a 5 point Likert Scale rating. The ratings from the NMUIUS included:
- None (1), Less than 1 hour (2), 1-3 hours (3), 4-5 hours (4) and More than 5 hours (5).
- Daily (1), Weekly (2), Monthly (3), Less Often (4) and Never (5).
- Very Poor (1), Poor (2), Average (3), Good (4) and Excellent (5).

In addition to the 5 Point Likert Scale type rating scales, multiple choice (fact) questions were also used for a large part of the remaining questions. These were presented in drop-down boxes and drag-and-drop boxes, which contained a number of pre-identified possible answers. All questions were mandatory, however, some questions were pre-programmed to skip questions based on the initial answer. This assisted the participants not to be forced to answer questions that were previously seen to be irrelevant to their circumstances. Each participant was asked to indicate his/her view on the respective question and statement. These questions and statements were formulated to address each identified topic or area as per the Nelson Mandela University environment and ensured alignment to the RQ_M and RQ_X.

For both surveys, the questions adopted in the surveys adhered to the Questionnaire Content guidelines as provided by Hofstee (2006) and Collis and Hussey (2014). Once complete, both surveys were scrutinised by two senior Professors at Nelson Mandela University, Professor André Calitz (Computer Sciences) and Professor Margaret Cullen (Business School). Thereafter, it was presented to the Nelson Mandela University statistical consultant, Dr Jan Du Plessis, who fine-tuned the survey to ensure it was aligned for reliability and validity purposes. Subsequently, both surveys were submitted to the Nelson Mandela University Ethics Committee. The Committee reviewed the surveys and a few amendments and requirements were set to ensure reliability and validity. The HEIIMS were also reviewed by the Nelson Mandela University Director: ICT Services Delivery and Operations and the Nelson Mandela University Deputy Director: Service Delivery and additional enhancements were recommended. During each review process, numerous recommendations by experts in industry were recommended and incorporated.

4.7.2.3. NMUIUS Respondents

This sub-section forms part of the fifth layer of the research onion, which focuses on identifying the techniques and procedures used for data collection and data analysis. The population group for the NMUIUS comprises any person who uses the Nelson Mandela University Internet regularly, therefore the population is the Nelson Mandela University Internet users. The respondents who are both staff members and students participated as their dominant affiliation. RQ_6 requires a sample of Nelson Mandela University Internet users as these are the individuals who use the Nelson Mandela University Internet to perform their daily work and personal obligations, which in turn guarantees the overall sustainability of Nelson Mandela University.

The NMUIUS required a large number of current Nelson Mandela University Internet users to participate in the study. An email was compiled, which introduced the research topic which also included the hyperlink to the survey. The email was then approved by the authorities and distributed via the Communication and Stakeholder Liaison Department by means of a Memo to all Nelson Mandela University Internet users.

There were two preconditions set for respondents to qualify for participation in the study. Firstly, each respondent had to be a currently registered Nelson Mandela University user. This was the case as access to the ICT resources is only provided to registered Nelson Mandela University users and is removed shortly after affiliation with Nelson Mandela University ceases. Secondly, the respondents had to use the Nelson Mandela University University's Internet on a regular basis. This was the case as they would have used the Internet to gain access to the research study invitation.

4.7.2.4. NMUIUS Distribution

The NMUIUS was created by using the Nelson Mandela University approved QuestionPro survey tool. The QuestionPro survey tool is a professional survey creation toolkit used by companies such as Toyota, Samsung, United States Postal Services, Hyatt, Siemens and Stanford University. Its international presence, platform independency, reporting features, security and validation and logic gives it a major advantage over its competitors (QuestionPro, 2017). The approved QuestionPro survey tool was therefore used for all the surveys creation and was set as the survey tool for this research study.

An email was used as the distribution tool for the survey. The NMUIUS was introduced and a hyperlink was included to the survey. This invitation was sent to the Communication and

Stakeholder Liaison Department which served as the gatekeeper for distribution. A Memo was sent, which means it was sent to all Nelson Mandela University Internet users who has access to their emails. See Appendix G – NMUIUS Distribution Email. A total of 678 Internet users who met the two set preconditions responded.

4.7.2.5. NMUIUS Data Analysis

As discussed in the previous section, a professional online survey tool called QuestionPro was used to create the NMUIUS. This allowed for the easy export of the captured data by using the reports function within the survey. The data were then exported by using the export function and the results were presented in a Microsoft Excel .csv file which contained the grouped raw data as well the processed data for each question. Included in the processed data were the mean, confidence interval, standard deviation and standard error. The processed data were then reviewed and all incomplete and corrupt records were removed from the datasets. The data were then analysed by Nelson Mandela University statisticians, Dr Danie Venter and Dr Jan du Plessis. Both Descriptive and Inferential statistics techniques were used to analyse the results and to draw conclusions.

An analysis was conducted on all the findings. Thereafter, only the most valuable/important/relevant findings were scrutinised and discussed to ensure that the research study stayed within the set scope. Furthermore, the calculations from the findings were rounded off to zero decimal places for better visual representation, however, the calculations conducted internally were not rounded off and remained unchanged. The calculations were not rounded off to ensure that accuracy was maintained throughout the entire data calculation process. In addition, Cronbach alphas were calculated to establish the reliability of the instruments. The following sub-section will elaborate on the research strategy for the Case Study.

4.7.3. Case Study

The following sub-sections will define a case study, explain what is its purpose and then discuss the use of a case study for this study.

4.7.3.1. Case Study Defined

A Case Study is used to gain in-depth knowledge of a single phenomenon in its natural setting by adopting a variety of methods (Collis & Hussey, 2014). There are two aspects to this definition that are vital to cases studies, these are: firstly, a case study is only focused on a single case, where the data are gathered directly from a particular organisation, a team or

group, events, processes, person or any other similar situation, and secondly, that the case must be analysed within its real-life context when the boundaries between context and the phenomenon are not clearly evident (Hofstee 2006; Yin 2011).

Yin (2011) continued to by adding two more characteristics to the definition of a case study. Yin (2011) stipulates that a case study copes with a technical distinctive situation in which there will be many more variables of interest than data points, but one result. He continues by adding that case studies also benefit from following a logical design, data collection techniques and specific approaches to data analysis (Yin, 2011).

Case studies rely on multiple sources of evidence, such as archival records, open-ended interviews, focus interviews, structured interviews and surveys, observations and documents. These data sources should all converge and support the same fact. This leads to greater validity and reliability compared to using only a single data source (Collis & Hussey, 2014; Yin, 2011).

4.7.3.2. Purpose of a Case Study

Case studies are used when the researcher seeks to gain access to the knowledge and experience of the respondents in the specific problem area. This will ensure that facts brought into focus in the relevant context so that situational knowledge can be produced (Mason, 2002; Yin, 2011).

4.7.3.3. The Use of a Case Study for this Study

A case study will be used for this study at the Nelson Mandela University, a comprehensive South African Higher Education Institute situated in the Port Elizabeth, Eastern Cape and George, Western Cape. The University was identified for the case study for the following reasons:

1. It is considered a typical university in size as it is not considered a small nor big university. It is therefore average in size in number of students, staff, campuses, faculties, departments, etc.; and
2. The researcher resides in the ICT Services department and has access to all the required people, information and systems to be able to draw the raw data from, for example, the Firewall data which is protected by various levels of physical, technical and operational security controls. To gain access to this type of data from other Universities and be able to execute the collection process would be extremely difficult and time consuming.

The method for collecting the evidence for the case study will be the use of the NMUIUS and firewall logs, as discussed throughout this chapter. This will assist the researcher to determine what the Internet users say about what they use the Internet for and what they actually use the Internet for. The following sub-section will elaborate on the research strategy for the Firewall Logs Analysis.

4.7.4. Firewall Logs Analysis

The following sub-sections define a firewall, explain what the purpose of a firewall is and then discuss the use of a Firewall and relevant logs for this study.

4.7.4.1. Firewall Defined

A firewall is either a software based program, which is installed on a local device or a physical piece of hardware installed on the network that helps to filter malicious threats. These malicious threats can be hackers, viruses, worms, Trojan Horses, scams, phishing attacks, fake websites, etc. that try to gain access to our computer or network and must be kept out (Microsoft, 2014). A firewall is identified as the first line of defence as it serves as a 'wall' between a device and the network and the outside world.

4.7.4.2. Purpose of a Firewall

A firewall serves as the first layer of protection by protecting a device and network against a wide range of threats targeting applications, data and users (Fortinet, Inc., 2017). All traffic is directed through the firewall and the firewall then filters the traffic according to what it is programmed to do. The Access Control Lists (ACL) or rules serve as filters which indicate what data or transactions are accepted and what are not accepted. A firewall then monitors all internal and external traffic that passes through it and takes action againts the traffic according to its ACL. The end result is a security control that blocks certain identified sites to ensure that only business-driven Internet resources are accessed. This reduces legal liability and non-productive Internet usage and consequently lowers bandwidth costs (Kim & Choi, 2005).

Figure 4.5 indicates a basic transaction that takes place on a firewall. In this example, three data packages are sent to the internal user from the Internet. These are a Facebook friend request, an email containing a virus and a link to a phishing website. The firewall receives the three data packages, opens them and compares them to the programmed ACL. The ACL indicates that the Facebook request is safe and is accepted into the network. The ACL then recognises that the email containing a virus and a link to a phishing website are malicious and

takes action that the data packages be discarded. All actions and data packages are captured into the firewall's log database for review.

4.7.4.3.The Use of Firewall Data for this Study

At Nelson Mandela University, a Fortigate Firewall 1000C boundary firewall is in operation. This is a physical device that is installed in a server room and monitors all traffic that enters and exits the Nelson Mandela University environment. The firewall therefore is situated between the Nelson Mandela University network and the Internet. All Internet traffic is routed through the ACL for processing. All actions and data packages are captured as raw data in the firewall logs database. The raw data provides information such as, source and destination address, user information, Fortiguard categorisation and website address, date, time etc. This practice is standard to most Firewalls and their setup. For the purpose of this research study, the source address and Fortiguard categorisation will be used. The source address will be either a staff or student IP address and the Fortiguard categorisation is the classification of the accessed website address. See Appendix H - Fortiguard Categorisation Criteria.
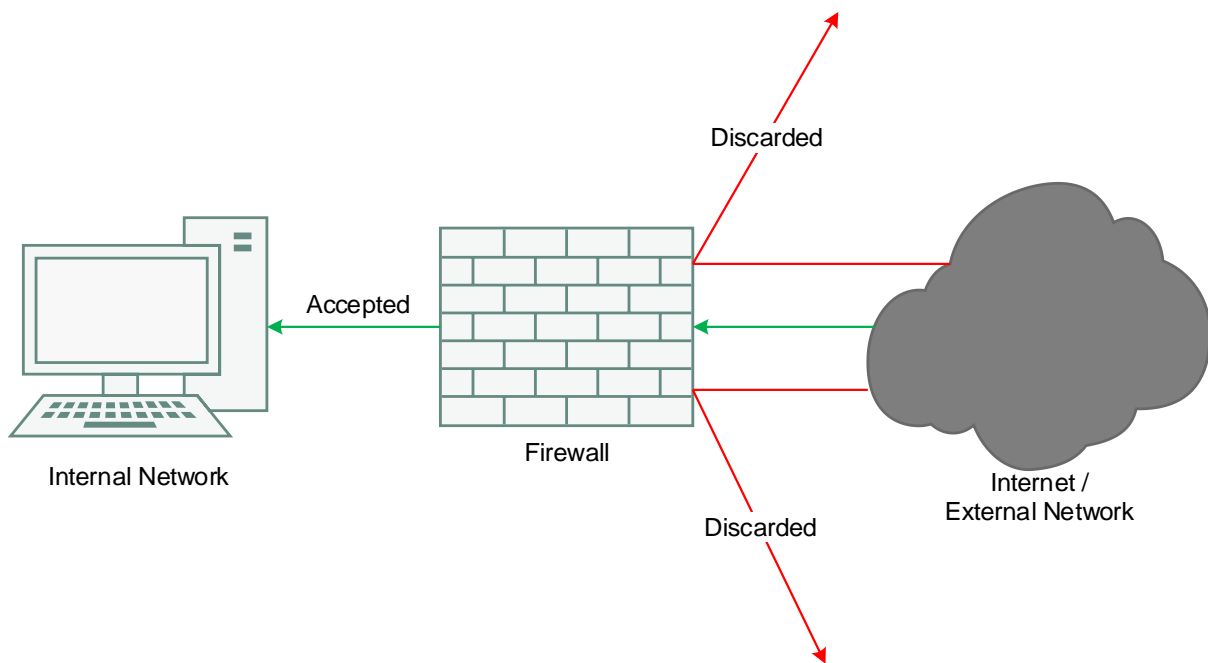
Figure 4.5: How a Firewall Works.

The raw data that are captured by the firewall log database are then imported into Sawmill, which is the Nelson Mandela University log file analysis and reporting software package. A set of import rules were created by the System Engineer: Database/Firewall that would import the raw Firewall data into the set Fortiguard Categorisation Criteria according to the staff and

student IP addresses. This process is known as web log/usage mining which serves to analyse logged data, which is then used to mine knowledge that can be used for user-behaviour analysis which in turn contributes to improving the Internet resource management and consequent business processes (Appice, 2017; Pabarskaite & Raudys, 2007). The result would be a completed database with Firewall data usage of each user group which is filtered according to the set Fortiguard Categorisation Criteria. For example, for May 2014 the staff accessed 17.3GB of social media website data. Meaning that social media was the 10th most used category for the month, which represented 12 percent of all traffic captured for May 2014.

The reports had to be generated for each user group and for each month. This is due to the immense processing power required to complete one profile report, keeping in mind that the generating of a report took a few days and had to run continuously, mostly during business hours. This ensured that the researcher and System Engineer: Database/Firewall do not cause a denial of service attack on Nelson Mandela University network, subsequently restricting service on the firewall. The student and staff category profile built took approximately 36 hours per profile to complete for that specific month. This means that in total, 75 days (2 and a half months) were spent generating the student data and 75 days (2 and a half months) were spent generating the staff data. This equates to approximately 5 months spent generating staff and student Firewall data. This includes successful generations only and excludes the testing and numerous failed attempts of generating Firewall data. When the process above is completed, the researcher will have the raw data per profile group per category.

Once the two profile reports were completed for the specific month they needed to be analysed and adapted to the correct format. The data were captured in a .csv format file and the data were presented per category bytes (file size). The raw data then had to be split using the Text to Columns function and separating the data by means of a comma. The rows then had to be sorted by category to ensure there was alphabetical order, thus ensuring a common format to all. The sent and received data were then added into a total accessed column for that month. An independent staff and student Excel document were then used to capture and process the total of each month, according to its relevant Fortiguard category and for the duration of the full period. The following formula was then run on each total Fortiguard category to present the amount in a logical and clear size. For example, converting 2 498 135 216 800 bytes into 2.3TB.

The excel formula is:

=ROUND(E2/1024^INT(LOG(E2,1024)),1)&INDEX({"","ki","Mi","Gi","Ti","Pi"},LOG(E2,1024)+
1)&"B"

Accommodating the total size was the total percentage used. The percentage of each category as compared to the full amount was therefore also calculated to present the Internet usage in a logical and clear manner. The total for each category of the full period of 01 January 2014 to 26 February 2016 was then compared to the same category as captured in the Nelson Mandela University Internet Usage Survey, per profile. Due to capacity issues and the move to new Internet systems, the data from March 2016 onwards was lost and unrecoverable. This presented a holistic view of what the Internet users said they were using the Internet for and what they were actually using the Internet for.

The following section identifies the statistical methods used in the research study.

4.8. Statistical Methods

The qualitative method of analysis, which is based on the interpretive research philosophy will be applied to all open-ended questions. The quantitative method of analysis will be applied to Lickert Scale type questions, which is based on the positivism research philosophy. The data collected from all surveys will be captured, categorised, coded and sorted which is key to the successful analysis and interpretation of the data. Patterns and relationships are then proffered and conclusions are drawn, which are accommodated by a narrative summary. Content analysis will then be used to analyse the data whilst taking into account the theories and frameworks of the research study (Hofstee, 2006).

Both descriptive and inferential statistics were used during the quantitative method of data-analysis process. Descriptive statistics will be used to organise, summarise and extract the key information and turn it into meaningful information. The purpose of descriptive statistics is to measure the central spread and tendency of the collected data. Central tendency includes mean, median and mode while spread includes range, quartiles (first, second and third), absolute deviation, variance and standard deviation (Wegner, 2012). Additional statistical analyses adopted in the research study included the Cohen's d practical significance test, chi^2 test with Cramér's V test for practical significance and the paired difference t-test.

Cohen's d practical significance test uses the group's means to measures the practical significance of inferential. The result draws attention to how many standard deviation intervals

the group's mean falls above or below or the control groups' mean (Rubin, 2013, p. 91). The standard deviation intervals used to interpret the Cohen's d test are 1) Not Significant: < 0.20, 2) Small: $0.20 < |d| < 0.49$, 3) Medium: $0.50 < |d| < 0.79$ and 4) Large: $|d| > 0.80$ (Gravetter & Wallnau, 2009, p. 264). A portion of the questions within the surveys will be tested using the Cohen's d test.

Accompanying Cohen's d practical significance test will be the significance testing method, which is used to detect patterns such as the relationship between variables occurring by chance alone. The variables used in significance testing include the degrees of freedom *(df)* and the probability (p-value). If the p-value is < 0.05 then a statistically significant relationship exists between the variables. If the p-value is ≥ 0.05 then no statistically, significant relationship exists between the variables. It is, however, imperative that the sample size and the effect size be determined as appropriate compared to the population size when conducting the test for statistical significance of relationships between variables (Wegner, 2012).

Cramér's V is the most widely reported effect size for the Chi^2 based measures of association. Contingency tables can be calculate with any number of columns and rows. Cramér's V gives good norming from 0 to 1 regardless of table size, but only when the row marginal equals the column marginal. Values close to zero specify no association while values close to 1 specify a strong association (Warner, 2013). Table 4.2 clarifies the diverse practical significance interpretation intervals used to interpret the significance of some of the research findings captured in the data gathering process (Gravetter & Wallnau, 2009). For a 5 point Likert scale, the interpretation intervals 1) Very Negative: 1.0 - 1.79; 2) Negative: 1.80 - 2.59; 3) Neutral: 2.6 - 3.5; 4) Positive: 3.41 - 4.20 and 5) Very Positive: 4.21 - 5 will be used.

The paired-tailed test (paired t-test) method can be used to compare two population means where two samples can be paired with one another. These samples must be alike and must be subject to different conditions (Motulsky, 2014; Shier, 2004). The Chi^2 test is based on frequency count data, which is used to compare a set of expected frequencies that describe the null hypothesis to a set of observed frequencies obtained from a random sample. The Chi^2 test then measures the difference between the observed frequencies and the expected frequencies. If the difference is < 0.05 indicating that there is a 5 percent confidence level, the null hypothesis is accepted, which means the results are statistically significant. If the difference is < 0.05 indicating that there is a 95 percent confidence level, the null hypothesis is rejected, which means the results are not statistically significant (Wegner, 2012).

The one-factor analysis of variance (One-factor ANOVA) testing method was adopted to calculate whether there is a statistical relationship between the factor and the response variable, which indicates dependency between the two measures. A statistical relationship can only be found between the factor and the response variable when the minimum mean of the sample of one level is found to be different from the mean of the other sample. No statistical relationship is found when the factor has no influence on the outcome of the response variable and the two measures are statistically independent of each other. The Multivariate ANOVA (MANOVA) testing method was used where a multiple, dependent variable and independent variable had to be included in one ANOVA model (Wegner, 2012). When unequal sample sizes that have equal variance are found, the parametric post hoc test called Scheffe's test to determine which groups of means are significant.

Table 4.2: Practical Significance Interpretation Intervals.

Practical Significance Interpretation Intervals			
Inferential Test: Statistic	**Small**	**Moderate**	**Large**
t-Test: Cohen's *d*	$0.2 < d < 0.49$	$0.5 < d < 0.79$	$d > 0.8$
ANOVA: Eta squared	$\eta^2 < .09$	$.09 < \eta^2 < .25$	$\eta^2 > .25$
Chi² Test: Cramér's *V*			
df* = 1	$.10 < V < .30$	$.30 < V < .50$	$V > .50$
df* = 2	$.07 < V < .21$	$.21 < V < .35$	$V > .35$
df* ≥ 3	$.06 < V < .17$	$.17 < V < .29$	$V > .29$
Correlation: *r*	$.10 < r < .30$	$.30 < r < .50$	$r > .50$
* df = minimum (Rows − 1, Columns − 1)			

Source: Gravetter and Wallnau, 2009.

Type I and/or Type II errors must be avoided whilst conducting a hypothesis test. A Type I error (error of the first kind) presents itself as a false positive. A false positive means that the researcher rejected the null hypothesis when it is in fact, true. The recommended method to mitigate Type I errors would be to apply a more stringent level of significance. An example would be to assign a p value of < 0.01 rather than < 0.05. A Type II error (error of the second kind) presents itself during a false negative. A false negative means that the researcher does not reject the null hypothesis when it is in fact, false. The recommended method to mitigate Type II errors would be to reduce the level of significance or increase the sample size. An example would be to reduce the p value from < 0.20 to < 0.05. It should be acknowledged that Type I and Type II errors are interlinked, meaning that decreasing the presence of one will

increase the presence of another one and vice versa (Wegner, 2012). A balance must therefore be maintained.

4.9. Reliability and Validity

There are two characteristics that constitute the credibility of the research findings, these are reliability and validity (Collis & Hussey, 2014). Reliability and validity of the measuring procedures are influenced by the probability of drawing statistical significance, the probability of being able to learn something new from the study and the degree to which meaningful resolutions can be drawn from the data analysis (Leedy & Ormrod, 2015). Both characteristics must be met for the research study to be deemed as a valuable contribution to the specific field of study and consequently accepted into the research community. Figure 4.6 depicts the differences between reliability and validity.
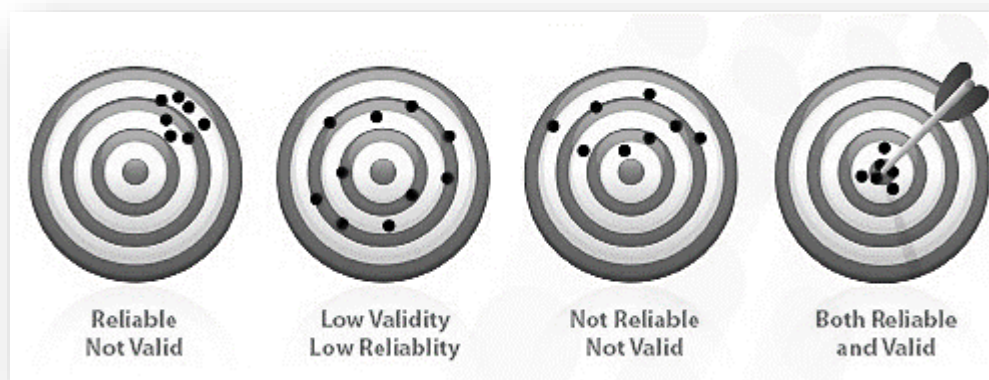
Figure 4.6: Reliability and Validity of Data
Source: Shuttleworth, 2009.

The following sub-sections discussed these two aspects individually, starting with reliability.

4.9.1. Reliability

Reliability refers to the degree of the consistency of the measurement, the precision and accuracy of the measurement procedures over time (Collis & Hussey, 2014). If the total population returns the same score with equal values when the same test is repeated in the same environment, the research study is classified as reliable (Thanasegaran, 2009). Reliability tends to be the ideal testing method in positivist studies while it is found to not be as popular for interpretivist studies (Collis & Hussey, 2014).

A research study will be reliable when it meets the following characteristics as defined by Cohen, Manion & Morrison, (2011):

- Trustworthy;
- Dependable;
- Replicable across participants;
- Replicable over time;
- Consistent; and
- Replicable with the instrument used (Cohen, Manion & Morrison, 2011).

When testing for reliability of a research study, the researcher has a number of available tests to select from. These include:

- Stability: Test-Retest Correlation

  The stability test (test-retest correlation) delivers an indication of stability over time (Shah, 2009). This requires that the same test to be completed twice on the same population and in the same environment. The results of both tests are then analysed and compared to each other by using correlation coefficients. If the resulting correlation coefficient measurement is close to one, it is classified as having a high reliability. If the result measurement is close to zero, it is classified as having a low reliability. A noticeable weakness with the stability test is during the retest process, the respondents may recall their previous answers and therefore duplicate their previous responses. This will create an artificially high reliability (Collis & Hussey, 2014).

- Equivalence

  The equivalence test requires the same test to be completed using the same measuring instruments, on the same population and in the same environment but by different researchers (Collis & Hussey, 2014). An alternative method known as multiple-forms reliability could also be used whereby the researcher measures the same concept with different instruments (Shah, 2009). The advantage of the equivalence test over the stability test is that it cannot be affected by the memory affect.

- Homogeneity: Internal Consistency

  The homogeneity test (internal consistency test) involves measuring the instrument responses by means of calculating the internal consistency. The selected measuring instrument for internal consistency is Cronbach's alpha coefficient which is used to determine how closely related a set of items is as a group. It should be acknowledged that Cronbach's alpha coefficient is not a statistical test but a coefficient of reliability. The established intervals for Cronbach's alpha coefficient are as follows:
  - Cronbach Alpha ≥ 0.90 = high reliability;

- Cronbach Alpha ≥ 0.80 = moderate reliability;
- Cronbach Alpha ≥ 0.70 = low reliability; and
- Cronbach Alpha ≤ 0.70 = unacceptable reliability (Collis & Hussey, 2014; Maree, et al., 2012; Nunnally, 1978).

From the established intervals above, it is clear that a high coefficient value equates to a high reliability whilst a low coefficient value equates to an unacceptable reliability. For basic or exploratory research, the Cronbach's alpha coefficient value of 0.50 and above is argued to be acceptable. The three ways to check internal consistency are split-half correlation, average inter-item correlation and average total-item correlation (Collis & Hussey, 2014; Maree, et al., 2012; Nunnally, 1978; Shah, 2009).

Table 4.3 presents the different methods of testing for reliability. It stresses the fact that multiple independent observations, focused on the same sample group are required to prove reliability. The greater the number of independent observations taken on a measurement of a concept at different points of time or forms, the more freedom there is to establish reliability (Shah, 2009).

Table 4.3: Types of Reliability.

		Time Dimension	
		Multiple-Time-Point Study	**Single-Time-Point Study**
Forms	**Multiple**	Equivalence Stability	Equivalence
	Single	Stability	
Items	**Multiple**	Homogeneity Stability	Homogeneity
	Single	Stability	

Source: Shah, 2009.

4.9.2. Validity

Validity refers to whether the research study truly measures what the researcher set out to measure and how truthful these results are (Collis & Hussey, 2014). In plain English, does

the research study hit the target dead centre, the target refers to the set research objectives? The full list of requirement for consistency is illustrated in Figure 4.5.

There are a number of validity assessment strategies that can be selected. Amongst these are:

- Criterion (Pragmatic Validity)

  Criterion or Pragmatic validity is the process of adopting a well-established measurement procedure to create a new procedure to measure the construct. Amongst the list of measuring procedures are structured interviews, surveys, etc. however, for measuring procedures to qualify, it must generate quantitative data. There are two criterion or pragmatic validity tests that can be used, each focusing on a different timeframe. These are concurrent validity and predictive validity and will be summarised next.

  a) Concurrent Validity

  Concurrent validity is the process of adopting a well-established measurement procedure to create a new procedure to measure the construct. Furthermore, it must be conducted when two different measurement procedures are performed concurrently (Lund Research Ltd, 2012).

  b) Predictive Validity

  Predictive validity is used to examine whether a measurement procedure can be used to make accurate predictions and must be completed in accordance with theory (Lund Research Ltd, 2012).

- Construct Validity

  Construct validity refers to the complication that there are a number of situations that are not directly observable such as anxiety ambition motivation and satisfaction. It is surmised that these hypothetical constructs exist as factors that explain the observable situation. Construct validity is key in business research (Collis & Hussey, 2014).

Construct validity allows for three types of evidence to be obtained which is based on the research problem. These are discriminant validity, convergent validity and hypothesis-testing which will not form part of this research study (Lund Research Ltd, 2012).

- Face Validity

  Face validity (appearance, logical or surface validity) means that the measurement procedure used does absolutely represent or measure what it is intended to represent

or measure (Collis & Hussey, 2014). Face validity is classified as the most typical form of validity as it is the simplest form of validity to produce. It should be acknowledged that it is the weakest form of validity as it is mostly based on subjective logic. This means that a researcher can look at the items and agree that the test is a valid measurement procedure just by its face value (Lund Research Ltd, 2012; Shah, 2009).

- Content Validity

  Content validity is the degree to which the elements within a measurement procedure are representative and relevant to the content that the procedure will be measuring (Lund Research Ltd, 2012). An appraisal is indefinitely made that the content of the measure is representative of the universe of content of the concept being measured (Shah, 2009).

It is supplementary to the validity of the measurement procedure discussed above. It is pivotal that the research study completely complies with the validity requirements. The researcher must focus on interpreting the findings of the actual study correctly and additionally, ensure that the results are generalised to the wider population. Two validity requirements empower the researcher to draw meaningful and strong conclusions about the study (Persson & Wallin, 2012). The two validity requirements are internal- and external validity and are elaborated on next.

- Internal Validity

  Internal validity refers to the internal factors that affect the research study itself. Some of the major variables cannot be controlled, which refers to a design problem, or problems with the research instrument, which refers to a data collection problem. Any independent variables that have an effect on or cause change in the dependent variables may cause the study to be considered internally invalid (Berg & Latin, 2008). Campbell and Stanley (1966) identify eight types of extraneous factors that can affect internal validity, if they are not controlled. These are maturation, history, instrumentation/task, sensitivity testing, selection, statistical regression, experimental mortality and selection interactions.

- External Validity

  External validity refers to the degree to which the findings can be generalised to a larger population or other environments. The study is considered as externally invalid if the findings of the research study cannot be applied to contexts outside the scope of the

study (Berg & Latin, 2008). Campbell and Stanley (1966) identified four factors that negatively affect a research study's external validity. These are pretesting, interaction, setting and multiple treatments or interventions.

Table 4.4 graphically illustrates the different types of validity able to promote validity and identified the three criteria which differentiate them. The three criteria are 'where to start', 'evidence' and 'criteria' for demonstrating validity. Construct validity can be the most valuable resource as both theory and empirical data must be declared during the validity process. This attribute also makes construct validity the most valuable in theory construction (Shah, 2009).

Table 4.4: Types of Validity.

Validity Types	Where to Start	Evidence	Criteria
Judgmental (Pre-Data)			
Face Validity	Indicator	Judgmental	What's there
Content Validity	Concept	Judgmental	What's not there
Data-Based (Post-Data)			
Criterion-Related Validity 1. **Concurrent** 2. **Predictive**	Criterion Group 1. Criterion manifesting currently 2. Criterion occurring in the future	Empirical	Empirical Criterion Prediction
Construct Validity	Theory	Empirical	Theoretical Criterion Convergent Discriminant Hypothesis-testing

Source: Shah, 2009.

The following section defines the three research paradigms and identifies the research paradigm used in this research study.

4.10. Research Paradigms

Research paradigms are the philosophical frameworks that guide researchers as to how the scientific research should be conducted. As previously discussed, the two research paradigms are positivism which is derived from quantitative methods and interpretivism which is derived from qualitative methods. The two main methods of analysis are discussed in the following sub-sections (Collis & Hussey, 2014; Morgan & Smircich, 1980, Yilmaz, 2013).

4.10.1. Quantitative Research

The quantitative method of analysis focuses on conducting research in the natural sciences and is still widely used widely in social sciences (Collis & Hussey, 2014). Quantitative research is a type of empirical research that uses numerical data which is analysed by means of mathematical equations, such as statistics to explain an occurrence (Yilmaz, 2013). The quantitative method of analysis emphasises that valid knowledge stems from objective evidence that can be scientifically verified. It depends on deductive research to interpret data and structure the importance as derived from the data. Furthermore, it endorses the belief that the social and psychological phenomena have an objective reality that should remain external to the subject(s) being studied (Collis & Hussey, 2014, Sekaran & Bougie, 2016, Yilmaz, 2013). The researchers should consequently put distance between themselves and the studied subjects and therefore adopting an outsider's view (Mason, 2002). The quantitative method of analysis therefore adopts an objective stance by maintaining independence from the static reality. Hence, it is argued that the act of investigating the social reality has no effect on reality (Collis & Hussey, 2014).

4.10.2. Qualitative Research

Qualitative data falls at the opposite end of the continuum paradigms, opposite to quantitative data. Results are not derived from statistical procedures or other means of quantification (Yilmaz, 2013). The qualitative method of analysis depends an inductive research approach to interpret and structures the meaning derived from data. Furthermore, it endorses the belief that the social reality is subjective and shaped by human perceptions (Collis & Hussey, 2014). The researcher therefore develops a strong, empathetic relationship with the subject(s) being studied as he/she is seen as having an insider's view (Creswell, 2007; Mason, 2002, Sekaran & Bougie, 2016).

Researchers who adopt a qualitative method of analysis study research problems by investigating the interpretations, perceptions, understandings and meanings which individuals or groups ascribe to a social or human problem (Creswell, 2007; Mason, 2002). An emerging qualitative research approach is then used to collect the data directly from the subject(s) within its natural setting (Creswell, 2007). The qualitative method of analysis therefore aims to understand how a social experience is created and given meaning, which stems from the inextricably connected relationship between the knower and the known (Yilmaz, 2013). The collected data are identified as the primary source of data for research (Collis & Hussey, 2014).

4.10.3. Mixed Methods

The mixed method is the blend of qualitative and quantitative research methods, techniques, languages, concepts or approaches into a single study method. It allows for multiple forms of data to be gathered through different research methods and research strategies in ways that discard their weaknesses whilst building on the selected method's strengths and offsets certain method biases. Mixed methods therefore allow for increased value as well as potential complexity (Harwell, 2011).

4.10.4. Research Paradigm for this Study

For this research study, the mixed method approach is adopted but greater emphasis of the methods being focused on qualitative research. The purpose is to gain insight into the attitudes, behaviour, experience and knowledge of the individuals in the given research problem. The qualitative and quantitative data collected are used to support the researcher in structuring and interpreting the findings that are derived from the data to better understand the complex reality of the research environment and research-related problem. Furthermore, data in a numerical form is collected in an objective and systematic method from the selected sample groups and the findings are generalise to the larger populations. The following section discusses the time horizons.

4.11. Time Horizons

The fourth layer of the research onion focuses on the research time horizons. The two time horizons are cross-sectional studies and longitudinal studies. The following sub-sections will describe cross-sectional and longitudinal studies, discuss what the aim is of both studies and conclude with the use of cross-sectional and longitudinal studies for this research study.

4.11.1. Cross-Sectional Studies Defined

Cross-sectional studies (one-shot or prevalence studies) are adopted when a researcher is required to gather findings from data located across a section of the population at approximately the same time (single time point) or possibly over a period of days, weeks or months. The term cross-section implies that data are collected using interviews or questionnaires from a diverse sample, which includes people of different ages, genders, beliefs, backgrounds, educational levels, income levels, etc. The gathered data then offers the researcher a 'snapshot' into the particular situation at that approximate timeframe, which provides for a comparison of various diverse gathered variables. A cross-sectional study is an observational one, which means that the gathering of the data is documented without any manipulation or interference from the subject, its environment or by the researcher (Bailey,

1994; Collis & Hussey, 2014; Hair, Celsi, Money, Samouel & Page, 2015; Monsen & Van Horn, 2008; Sekaran & Bougie, 2016).

4.11.2. Purpose of Cross-Sectional Studies

Most surveys are in theory cross-sectional studies as they gather findings from data located across sections of the population at approximately the same time, which is the case for this research study. The aim of cross-sectional studies is to describe a population by concentrating on their common variables or gathered variables of specific interest at approximately the same time or over a short period (Levin, 2006; Sekaran & Bougie, 2016).

4.11.3. Cross-Sectional Studies for this Study

As previously discussed, the HEIIMS and NMUIUS were drafted, reviewed, amended, finalised and distributed amongst the population groups. The HEIIMS was sent to all HEI Internet Directors and was used to determine what the current HEI's Internet Management Business Model is. The NMUIUS was sent to all current Nelson Mandela University Internet users and it was used to determine their Internet usage patterns when using the Nelson Mandela University Internet.

Furthermore, all websites that are accessed on the Nelson Mandela University Internet by its users must travel though the Nelson Mandela University Fortiguard firewall. As the traffic travels inbound and outbound through the firewall, all websites accessed with related metadata are captured and stored in the systems' log files according to the Nelson Mandela University retention schedule. The researcher used the log files to extract all websites access by the staff and students during the period of 01 January 2014 - 29 February 2016. The extracted data were then analysed and captured into the various Fortiguard categories with the respective frequency of usage. The purpose was to determine what website categories were being used and the frequency.

Consequently, a cross-sectional study was adopted as this was the best suited to comparing the different population groups, the HEI Internet Directors and Nelson Mandela University Internet users, for that period in time. The previous versions of the HEI Internet Management Business Model and Nelson Mandela University Internet usage before and after this timeframe will fall outside the scope of this research study. The study process allows for the researcher to compare the various common variables which were collected at the same time and draw conclusions to best fit the purpose of the research objectives as required.

4.12. Summary

This chapter addressed RQ_3 which states, "*What research methodology can be used for this study?*". The chapter completed the RO_3 which was to identify the research methodology to be applied in this research study. Current research methodology practices were reviewed and suitable, applicable research methodologies were extracted and discussed.

Chapter 4 commenced by defining what is meant by research. This was followed by discussing the research design with emphasis on the research onion. Thereafter, the chapter used the research onion model and peeled back the layers of the research onion. Each discussion therefore focused on the research philosophy, research approaches, research strategies, time horizons and techniques and procedures. The chosen methods for this research study are positivism, deductive reasoning, surveys, cross-sectional studies and case study. These are the methods used in the study as per each layer of the research onion.

Chapter 5 identifies and discusses the national best practices adopted by Higher Education Institutions for the management of their Internet. Therefore, the first research objective of this chapter will be focused on RO_4, which will be to conduct an empirical evaluation of Internet management practices at Higher Education Institutions in South Africa. This will be achieved by asking RQ_4, which questions "*What are the current Internet Management practices at Higher Education Institutions in South Africa?*". Once completed, the combined findings will constitute the SA HEI Internet Management Business Model. Therefore, the second research objective of this chapter will be focused on RO_5, which will be to identify the national best practices adopted for Internet management at South African Higher Education Institutions. This will be achieved by asking RQ_5, which questions "*What are the national best practices adopted for Internet management at South African Higher Education Institutions?*".

5. RESULTS AND ANALYSIS OF THE HEI INTERNET MANAGEMENT SURVEY

5.1. Introduction

Chapter 4 focused on identifying the research methodology practices adopted for this research study. The chapter followed the research onion layer approach and presented the adopted methodologies as per its structure. The chapter identified the research philosophy, research approaches, research strategies, time horizons and techniques and procedures. The chosen methods for this research study are positivism, deductive reasoning, surveys and cross-sectional studies. These are the methods used in the study as per each layer of the research onion.

This chapter addresses RQ$_4$ which asks, "*What are the current Internet Management practices at Higher Education Institutions in South Africa?*" and RQ$_5$ which asks, *"What are the national best practices adopted for Internet management at South African Higher Education Institutions?*". The research objective of this chapter is to identify the national best practices adopted for Internet management at South African Higher Education Institutions. In order to achieve this objective, an empirical evaluation of Internet management practices in the form of the business model canvas was conducted at all 26 universities in South Africa (SA). This identifies the full extent of the currently implemented Internet management practices at the HEIs. From these findings, the most commonly adopted Internet management practices were extracted, synthesised and combined, and will form the basis of the proposed national best practices adopted for Internet management at South African Higher Education Institutions. Figure 5.1 illustrates an overview of the research objectives for this chapter.

Chapter 5 identifies and discusses the participants' biographical information, the Universities' general information, ICT governance practices and each of the nine building blocks that institute the business model canvas. The chapter concludes by identifying the most commonly adopted Internet management practices, which constitute the national best practices adopted for Internet management at South African Higher Education Institutions. See Figure 5.2 for a Structural overview of Chapter 5.
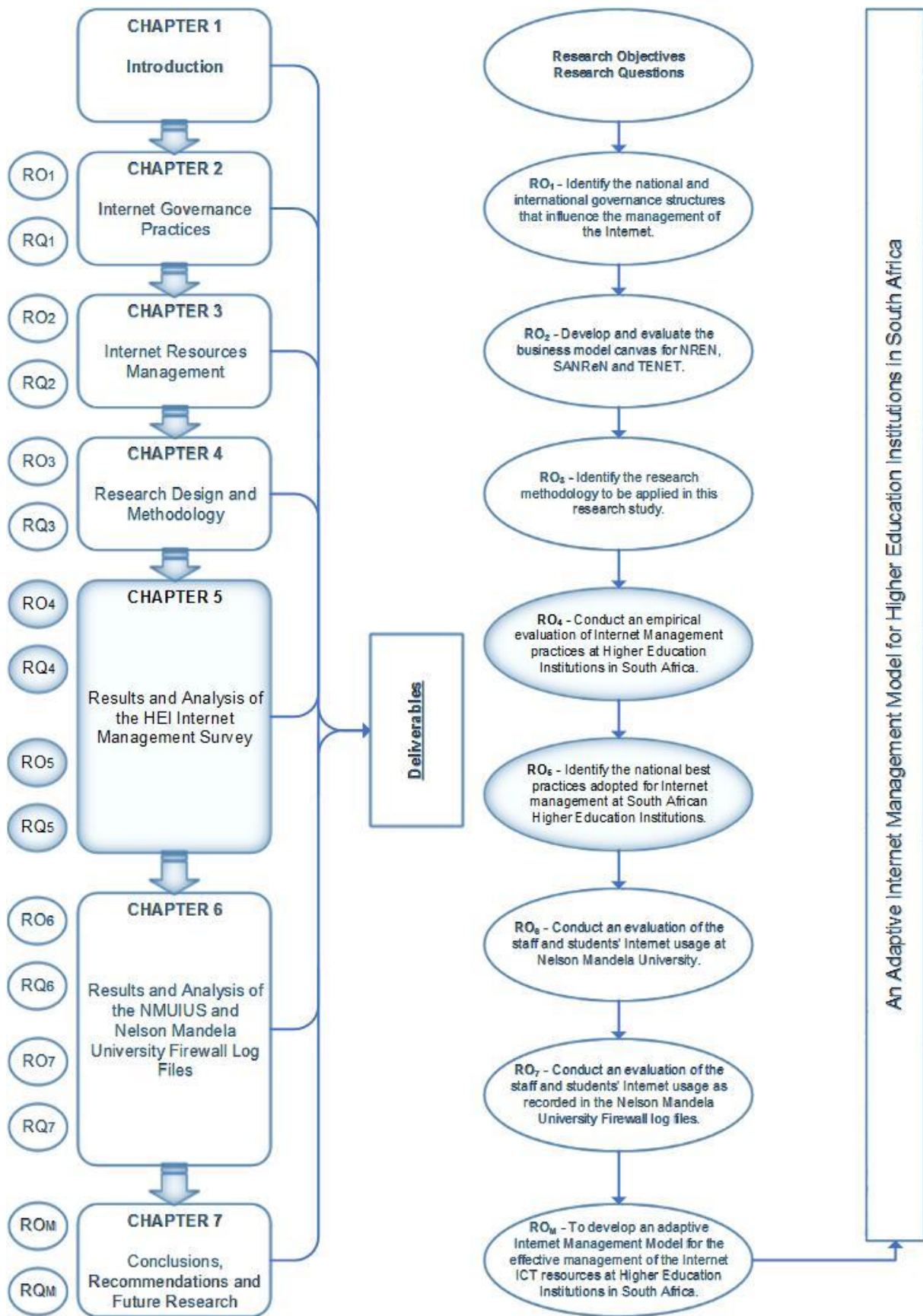
Figure 5.1: Chapter 5 Overview of the Research Objectives.

Chapter 1: Introduction

Chapter 2: Internet Governance Practices

Chapter 3: Internet Resources Management

Chapter 4: Research Design and Methodology

Chapter 5: Results and Analysis of the HEI Internet Management Survey

5.1. Introduction
5.2. Analysis of Empirical Results of the HEIIMS
5.3. Biographical Information and General University Information
5.4. ICT Governance
5.5. Internet Management Business Model
5.6. Best Practices HEIs Internet Management Business Model
5.7. Summary

Chapter 6: Results and Analysis of the NMUIUS and Nelson Mandela University Firewall Log Files

Chapter 7: Conclusions, Recommendations and Future Research

Figure 5.2: Structural Overview of Chapter 5.

5.2. Analysis of Empirical Results of the HEIIMS

The participants in this research study were all managers in charge of Internet Management at their respective South African Higher Education Institutions. The managers were any ICT individuals in the position of CIO, ICT: Director, ICT Deputy Director or ICT Manager, with Internet Management as a KPIs (Key Performance Indicators) in their job portfolio. In many cases, the ICT Deputy Director or ICT Manager who participated in this study requested guidance from their direct line managers, being their CIO or ICT: Director in completing the survey. All participants were provided with the same HEIIMS, which guided them in capturing their respective Internet Management Business Model as adopted by their university. The HEIIMS included biographical information, general university information and ICT governance. These were followed by the nine basic building blocks of the business model canvas, which are the Customer Segments, Value Proposition, Distribution Channels, Customer Relationships, Revenue Streams, Key Resources, Key Activities, Key Partnerships and Cost Structure. These nine basic building blocks all relate to the Internet Management Business Model of their HEIs' Internet. These findings were combine to provide a universal view of Internet management environments, structures and practices in South African Higher Education Institutions.

Each question in the HEIIMS was analysed and discussed individually, however, only the most significant and relevant findings required for the Best Practice Internet Management Business Model Canvas (BMC) and proposed adaptive Internet Management Model are presented in this chapter. The additional findings obtained from the survey are presented in some of the discussions and are included on the CD. Secondly, since some respondents opted not to respond to some questions and indicated that they did not know the answer, the response rate is indicated as n = 9. If no response rate is indicated, it should be accepted that all respondents completed the question.

5.2.1. HEIIMS Response Rate

The HEIIMS was drafted and went through multiple changes before it was finally approved. As part of the reliability and validity process, a pilot study was conducted to determine its effectiveness. The pilot study was completed in-house by the Nelson Mandela University Deputy Director: Service Delivery, with input from the Nelson Mandela University Director: ICT Services Delivery and Operations.

The HEIIMS was distributed via the ASAUDIT gatekeeper, Ms Val Theron, to 26 of the potential HEI respondents via email. It should, however, be noted that the researcher had little control over this distribution channel but was assured all 26 HEIs received the HEIIMS. The researcher was also invited to the first General Institutional ASAUDIT committee meeting for 2017 at the North-West University, Potchefstroom on 19 - 20 April. The email was further distributed to all ASAUDIT members who attended the meeting, being University ICT Directors or their representatives. The email included a message saying that the researcher would be at the General Institutional ASAUDIT committee meeting for consultation and additional assistance in completing the HEIIMS. Eighteen HEIs were represented at the General Institutional ASAUDIT committee meeting. One completed HEIIMS was collected and returned to the researcher via email before the General Institutional ASAUDIT committee meeting and five completed HEIIMS were collected at the General Institutional ASAUDIT committee meeting. All completed HEIIMS thus far were part of the 18 HEIs that were represented at the General Institutional ASAUDIT committee meeting.

The researcher and promoters regrouped and discussed the 7 completed HEIIMS. It was determined that this did not meet the required response rate and additional methods of distribution should be investigated. The researcher then contacted the ASAUDIT gatekeeper and asked for direct access to the 18 General Institutional ASAUDIT committee meeting

participants. The ASAUDIT gatekeeper composed a list of the 18 General Institutional ASAUDIT committee-meeting participants, who were those who agreed that their contact information may be shared with suppliers and vendors. The researcher then drafted an email template and distributed it with the HEIIMS to these General Institutional ASAUDIT committee-meeting participants. In addition, the researcher contacted his HEI peers directly via email, telephone calls, skype and Whatsapp and requested participation on a more personal level. The peers formed part of the 18 General Institutional ASAUDIT committee-meeting participants. Multiple follow-up sessions and reminders were sent following the original distribution. An additional 3 completed HEIIMS were collected using this distribution channel.

Through all communication channels, a total of 10 HEIs responded. All responses were adequately completed and met the preconditions that were set for this study. This equates to a response rate of 56 percent, if the 18 General Institutional ASAUDIT committee meeting participants are included. Alternatively, a response rate of 38 percent can be adopted if (one deemed it adequate to use) the 26 HEI are counted as the population. Both Statisticians, Dr Danie Venter and Dr Jan du Plessis deemed these response rates to be acceptable for statistical analysis.

5.2.2. Main Study HEIIMS

The HEIIMS used for this thesis consisted of twelve sections. See Appendix D – HEIIMS. These sections were:

- Section 1 - Biographical Information;
- Section 2 - General University Information;
- Section 3 - ICT Governance;
- Section 4 - Customer Segments;
- Section 5 - Value Proposition (what makes us different);
- Section 6 - Distribution Channel;
- Section 7 - Customer Relationships;
- Section 8 - Revenue Sources/Streams;
- Section 9 - Key Activities;
- Section 10 - Key Resources;
- Section 11 - Key Partnerships; and
- Section 12 - Cost Structure.

Section 1: Biographical Information captured the respondent's biographical information which included, 'Title', 'Name and Surname', 'Email Address', 'Job Title', 'Faculty/Department' and

'Duration in this position'. Additional questions included, 'Would you like to receive feedback on the findings of the survey?' and 'Would you like to receive feedback on the findings of the study titled 'An adaptive Internet Management Model for Higher Education Institutions in South Africa'?'

Section 2: General University Information, captured the University's personal identifiable information. The purpose of the two sections was to gain insight into the representation and distribution of the participants. In addition, the findings also served as a screening method to ensure that only appropriate and qualified individuals completed the HEIIMS. The design of the questions was based on short, open-ended questions and multiple choice tick boxes, which allowed the respondents to complete his/her biographical information and general university information quickly and easily.

Section 3: ICT Governance captured how the universities aligned their ICT strategy with the institutional strategy to ensure the effective and efficient use of ICT in enabling the HEI to achieve its business goals. The design of the questions was based on the 5 point Likert Scale and multiple choice tick boxes with an added box for 'Other' a short, open-ended question.

Section 4: Customer Segments to Section 12: Cost Structure, raised probing questions regarding the HEI's Internet Management Business Model Canvas. These included Customer Segments, Value Proposition, Distribution Channel, Customer Relationships, Revenue Sources/Streams, Key Activities, Key Resources, Key Partnerships and Cost Structure. The majority of the questions were in the form of structured questions such as multiple choice tick boxes and 5 point Likert Scale type questions. Open-ended questions were kept to a minimum and only adopted HEI unique answers were expected. All respondents were specifically requested to answer all open-ended questions in a bullet point format. The following section elaborates on the findings for Section 1: Biographical Information and Section 2: General University Information.

5.3. Biographical Information and General University Information

The first two sections in the HEIIMS were focused on capturing the respondent's biographical information and the University's personal identifiable information. The combined findings provide the reader with a general representation of the respondents and the participating Universities. The following sub-sections analyse and describe the findings for these two sections.

5.3.1. Analysis of Results for Section 1: Biographical Information and Section 2: General University Information

The HEIIMS data collection process commenced by collecting biographical information from the respondents, which served to gain a deeper understand of the representation and distribution of the participants. The collected information also served a second purpose; being the screening of the participants to ensure only appropriate and qualified individuals participated in the study. The data collected fields in this section included:

- Title;
- Name and Surname;
- Email Address;
- Job Title;
- Faculty/Department; and
- Duration in this position.

Due to the sensitive nature of the questions in the HEIIMS, it was emphasised and confirmed that the collected Personal Identifiable Information (PII) would not be documented or discussed within this study. Therefore, the respondent's title, name and surname and email address will not be included in the discussion. The confidentiality of the information will therefore be adhered to.

As previously discussed, a total of 10 HEIs responded to the survey. All HEIIMSs were completed by senior ICT staff personnel who are employed in the HEI's ICT Services Department or Division. Amongst these participants were two CIOs, one ICT Senior Director, five ICT Directors, 1 ICT Deputy Director and 1 ICT Manager. It should be acknowledged that the ICT Deputy Director and ICT Manager were guided by their seniors in completing the HEIIMS. Furthermore, the researcher also assisted them to understand the intricacies of the business model canvas framework. The respondents (n = 10) had an average of 8 years length of service in their positions. The minimum duration in the positions was 3 months and the maximum duration in this position was 30 years. All participants therefore met the requirement to participate in this research study. Moreover, due to the researcher's continuous involvement with special-interest groups, workshops, conferences, etc. in industry the researcher already was familiar with all participants. The validation of each respondent's credibility was therefore easily accomplished.

The second section, General University Information, the HEIIMS data collection process focused on collecting biographical information on the HEI itself. The information gathered from this section was used to gain a deeper understanding of the representation and

distribution of the participating HEIs as well as their Internet resource allocation strategies. The fields in this section included:

- Name of University;
- Number of Registered Students;
- Differentiate between full time and part time students;
- Differentiate between undergraduate and postgraduate students;
- Number of Academic Staff;
- Differentiate between permanent and contract academic staff;
- Number of Administrative Staff;
- Differentiate between permanent and contract administrative staff; and
- Differentiate between academic and administrative staff.

The participating 10 HEIs are classified as:

- Three Universities of Technology;
- Three Traditional universities; and
- Four Comprehensive Universities.

From the information given, the average number of students was 32 121 and staff was 3 202 (academic staff were 1 757 and administrative staff were 1 445) of these universities. The minimum number of students was 1 050 and staff was 135 (academic staff were 65 and administrative staff were 70) which was from a University of Technology. The maximum number of students was 64 070 and staff was 7 000 (academic staff were 4 000 and administrative staff were 3 000) which was from a Traditional University of Technology.

The findings indicate that all HEIs have a relatively large customer base. The academic staff portfolio is in all cases larger that the administrative staff portfolio. The registered student numbers, as expected, is much larger that the staff portfolio. HEIs vary significantly both in the numbers of registered students and staff portfolios. This could be due to the respective sizes, locations, type of Institution, offerings, brand, funding, etc. Furthermore, a diverse range of HEIs in types, sizes and locations are represented in this research study. Still, it was apparent that a one size fits all approach was adopted by most HEIs when allocating the Internet management resources to the respective Internet user groups. This approach should be visible throughout the business model canvas identification process that will follow, meaning the resources should be allocated between staff and students (as per the HEIIMS structure).

In answering questions asked regarding differentiation between the staff and student groups (profile groups), almost all HEIs indicated that they do not differentiate between different identified profile groups. Only one HEI differentiates its Internet management resources and then only between undergraduate and postgraduate students. This means that all Internet management resources are currently undivided between full time and part time students, undergraduate and postgraduate students, permanent and contract academic staff, permanent and contract administrative staff and academic and administrative staff. This means that no additional Internet priority, privileges and/or schedules are given to specific profile groups, even if their respective Internet-related requirements and business purposes differ.

It is imperative that the Internet resources be adequately allocated between the registered students, academic and administrative staff representation, taking into account their Internet requirements, peak- and off-peak periods, generational status, etc. It is vital that the Internet resource should not be over- or under-used and that a balance is maintained at all times, whilst feeding into the ICT strategic plan and consequently the Institutional strategic plan. In addition, the priority, privileges and/or schedule requirements will differ between the user groups and may introduce issues if not balanced correctly. The business models of each HEI should be aligned with the one size fits all strategy being implemented across the majority of HEIs. The following section elaborates on the findings for Section 3: ICT Governance.

5.4. ICT Governance

Section 3: ICT Governance is geared towards identifying and describing the ICT governance maturity levels of the HEIs. As was covered in Chapter 3, HEIs are expected to prove to NREN that they follow good Internet governance practices and implement adequate Internet management practices, with a key prerequisite being a sound ICT Policy. This is to ensure that the advance services offered by the institutions are not jeopardised by the internal ICT services practices and ICT support systems. The findings from this section will therefore assist in determining the HEI ICT Governance status.

5.4.1. Analysis of Results of Section 3: ICT Governance

Figure 5.3 depicts all responses received for the statement, 'The ICT strategy is aligned with your Institutional strategy'. It is apparent that six respondents indicated that they made a positive response, three respondents indicated that they made a neutral response and one respondent indicated that he/she made a negative response and that their ICT strategy was aligned with the Institutional strategy. The majority responded positively to the statement.
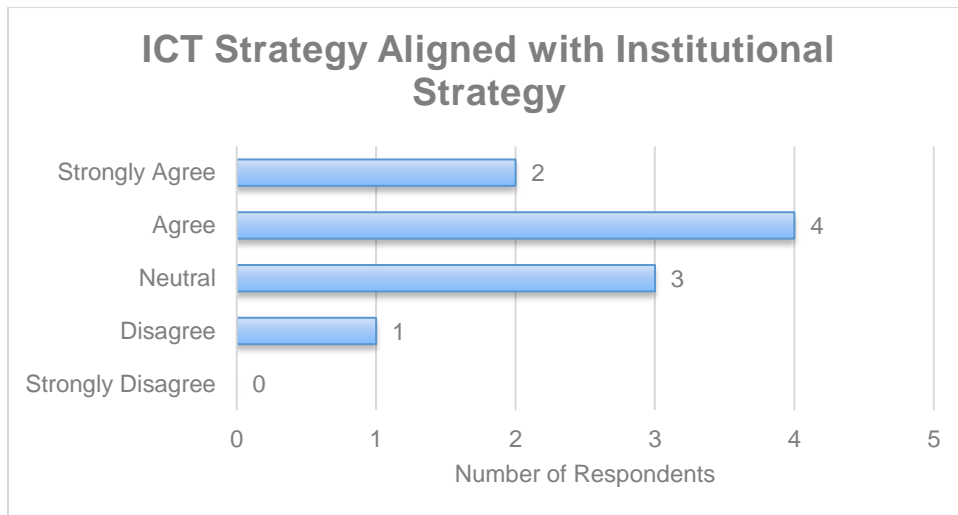
Figure 5.3: ICT Strategy Aligned with Institutional Strategy.

The findings indicate that most HEI's ICT strategies are aligned with the Institutional strategy. The minority indicated that they are neutral to the HEI's ICT strategy being aligned with the Institutional strategy and one HEI indicating that their HEI's ICT strategy is not aligned with the Institutional strategy. It is imperative that the HEIs ensure that their ICT strategy is aligned with the Institutional strategy. Proper ICT governance will assist, ICT Services to assist in realising institutional vision and goals, increase ICT value, improve communications, provide better agility in response to institutional growth, development and diversification, improve ICT cost control, enable greater sharing of resources and knowledge across the HEI and help to improve the overall experiences of students, staff and partners with greater HEI capability. The HEIs that are neutral or disagree with the question must review their ICT strategy and realign it to the Institutional strategy as a matter of urgency.
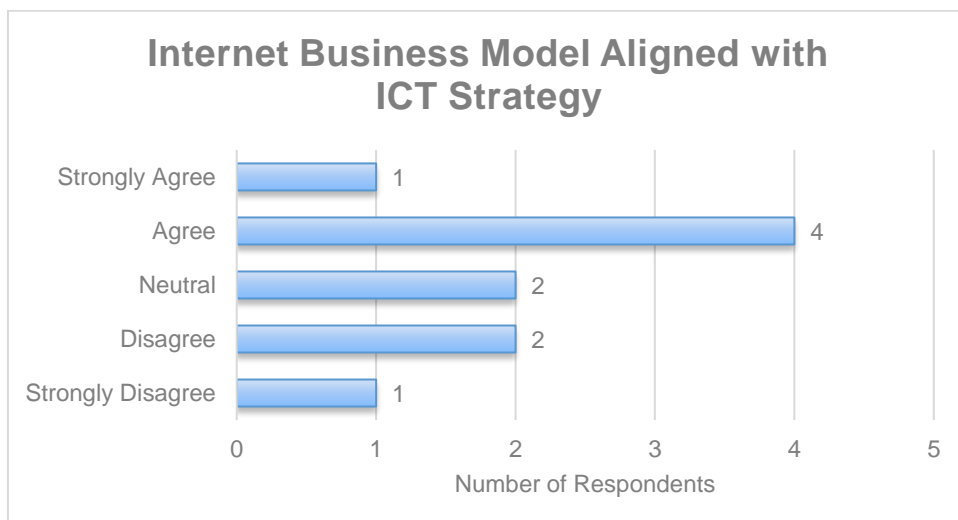
Figure 5.4: Internet Business Model Aligned with ICT Strategy.

Figure 5.4 depicts all the responses received for the statement, 'The Internet Business Model is aligned with the ICT strategy'. It is apparent that five respondents indicated that they made a positive response, two respondents indicated that they made a neutral response and three respondent indicated that they made a negative response, to their Internet Business Model being aligned with the ICT strategy.

The findings indicated that there are five HEIs whose Internet Business Model is aligned with the ICT strategy with three HEIs whose Internet Business Model is not aligned with the ICT strategy. Two HEIs indicated that they are neutral to the statement. The Internet is globally identified as an indispensable product and service to almost all Internet enabled organisations (Almeida, 2014). It is therefore imperative that the Internet's business model be aligned with the ICT strategy to ensure that it is being used to its full potential and to best serve the Institution and its identified vision and goals. As it currently stands, five of the respondents agreed with the statement while the other five are neutral or disagree. Effort should be made to revisit the Internet Business Model and to realign it to the ICT strategy for those who have not done so. Alignment is key if optimal value is to be extracted from this critical product and service.
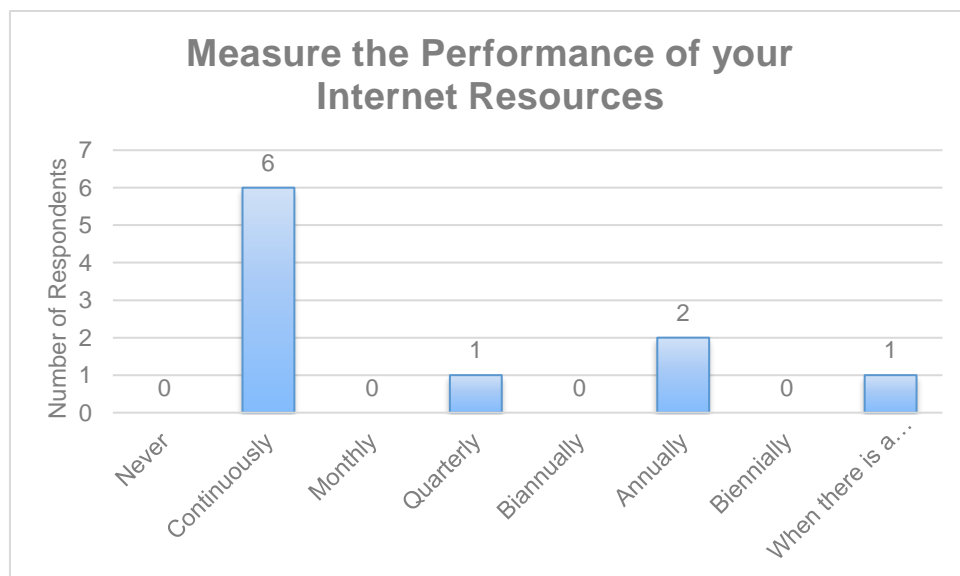
Figure 5.5: Internet Business Model Aligned with ICT Strategy.

Figure 5.5 depicts all responses received for the question, 'How often do you measure the performance of your Internet resources to ensure you are still moving towards meeting the overall objectives?'. The findings indicated that five of HEIs continuously measure the performance of their Internet resources to ensure they are still moving towards meeting the overall objectives. Two HEIs indicated that they annually measure the performance of their

Internet resources to ensure they are is still moving towards meeting the overall objectives followed by one HEI who indicated quarterly and one HEI indicated when there was a need to review. No responses were received for the remaining options. The objectives and strategy must be defined and feed into with the ICT strategy as well as the Institutional strategy. From the previous finding, it was captured that more HEIs are following this method, however, not all are. Continuously measuring of the performance of Internet resources is vital in an ever-changing environment. It guarantees that the resources are all geared towards achieving the set objectives and goals. If any negative measurements are detected, a quick review of the resources can be completed, which will again ensure that the Internet resources work towards the overall objectives and goals. Continuously measuring performance is ideal as mismanagement of critical resources can have a devastating impact on the Institution and implemented strategies if not detected and remedied quickly. It would be advantageous to include an annual audit which would include a comparison with industry best practices. These actions are, however, dependent on the availability of key resources e.g. time, money and staff.
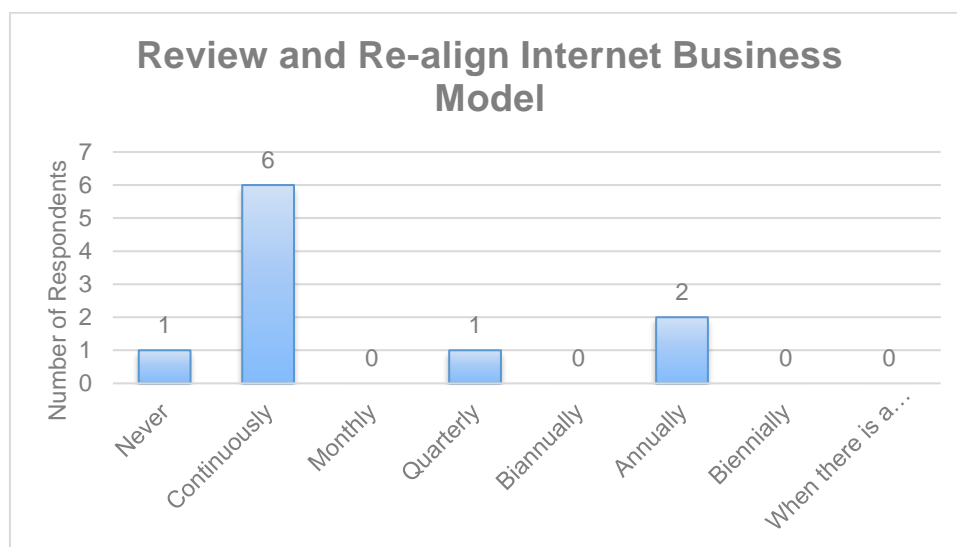
Figure 5.6: Review and Re-align Internet Business Model.

Figure 5.6 depicts all responses received for the question 'How often do you review and re-align your Internet Business Model (or Internet resources) to ensure they are still relevant?'. The findings indicated that six HEIs continuously view and re-align the Internet Business Model (or Internet resources) to ensure it is still relevant. Two HEIs indicated that they annually view and re-align the Internet Business Model (or Internet resources) to ensure it is still relevant, followed by one HEI indicating never and one HEI indicating quarterly. No responses were received for 'Monthly', 'Biannually', 'Biennially' and 'When there is a requirement'. As

discussed previously, the objectives and strategy must be defined and fed into the ICT strategy as well as into the Institutional strategy.

Continuously reviewing the Internet Business Model or Internet resources is advantageous, however, the responses do give the impression that tasks are performed on an ad hoc basis and according to set objectives and goals. Caution should be taken when following this approach. This last statement is, however, an assumption as the researcher only has insight into his own Internet management practices. The optimal combination would be to review the situation annually in collaboration with the ICT strategy and Institutional strategy and when there is a requirement such as an environmental or legal change. The following section elaborates on the findings for Section 4: Customer Segments - Section 12: Cost Structure.

5.5. Internet Management Business Model

The remainder of the HEIIMS focused on identifying the nine basic building blocks, which are the Customer Segments, Value Proposition, Distribution Channels, Customer Relationships, Revenue Streams, Key Resources, Key Activities, Key Partnerships and Cost Structure. The combination of these building blocks is a strategic tool in the form of an Internet Management Business Model that serves as a shared language used to describe, visualise, assess and change business models (França, Broman, Robert, Basile & Trygg, 2017; Osterwalder & Pigneur, 2010). The following two sub-sections elaborate on the findings for Section 4: Customer Segments.

5.5.1. Analysis of Results for Section 4: Customer Segments

Section 4: Customer Segments focused on identifying and describing the different groups of people who will be using the Higher Education Institution (HEI)'s Internet. It is important for the HEIs to identify their target market, what influences them and make sure that their habits are related to the Internet product and service.

Figure 5.7 depicts all responses received for the statement, 'Who are your HEI Internet users?'. Ten respondents identified 'Academic Staff', 'Admin Staff' and 'Students' as their Internet users and eight identified 'Contractors' as their Internet users. Nine identified 'Visitors' and 'On Campus Residences' as their Internet users while no respondents identified 'Others' as their Internet users. 'Visitors' are people who visit the HEI for a specific event. This could be to attend a conference, classes, workshops etc. The term 'Contractors' are external third party people or systems that are paid to deliver a product or service to the HEI, some for extended periods of time. The term 'Others' refers to any person, party or system who falls

outside the user profiles listed above. 'Others' include High School students, parents, consultants etc. Both user groups are not seen as regulars in the HEI environment.
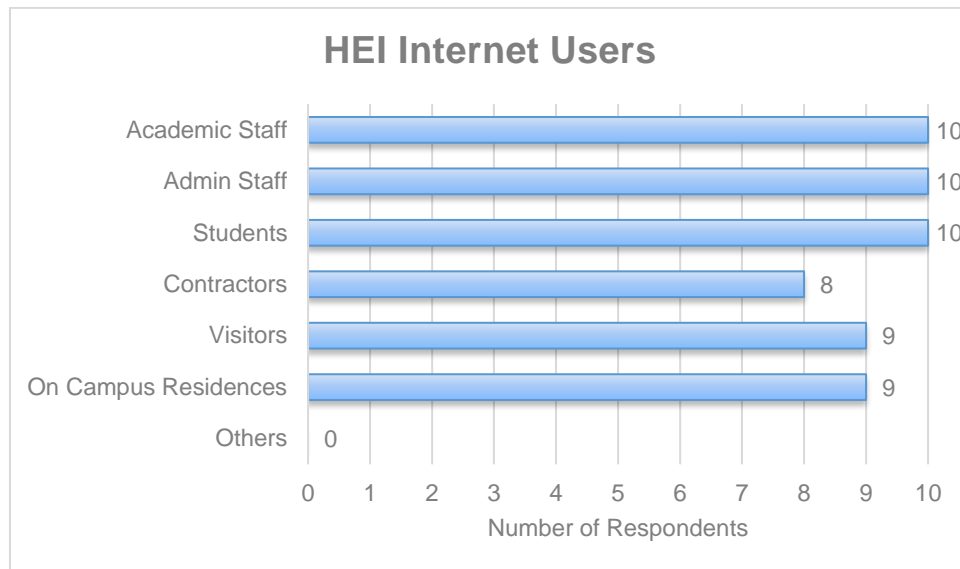
Figure 5.7: HEI Internet Users.

The findings indicate that all HEIs consider academic staff, administrative staff and students to be their core Internet users. This is followed by nine respondents indicating visitors and on-campus residences. Eight respondents identified contractors as their Internet users. It can therefore be argued that 'Academic Staff', 'Admin Staff', 'Students', 'Contractors', 'Visitors' and 'On Campus Residences' are the HEIs Internet users, the only difference being priority. These findings are in line with both HEI Internet users segment strategies, being mass market or niche market, depending on the approach taken and environmental analysis.

Table 5.1: Top Six Factors that Influence Staff and Students.

	Staff	Students
Factor 1	Culture and societal environment	Culture and societal environment
Factor 2	Age and way of life	Age and way of life
Factor 3	Lifestyle	Lifestyle
Factor 4	Learning	Learning
Factor 5	Reference groups and membership groups	Reference groups and membership groups
Factor 6	Beliefs and attitudes	Social roles and status

For the question, 'What influences your Internet users most?', a detailed analysis was conducted and is included on the CD. From the findings, the top six factors that influence staff and students were extracted and are presented in Table 5.1. Eight respondents identified the 'Culture and societal environment' to influence staff while seven respondents identified the 'Culture and societal environment' to influence students. Seven respondents identified 'Age and way of life' to influence staff, while seven respondents identified 'Age and way of life' to influence students. Six respondents identified 'Learning' to influence staff while seven respondents identified 'Learning' to influence students. Six respondents identified 'Lifestyle' to influence staff while seven respondents identified 'Lifestyle' to influence students. For the social factors consumer behaviour category, five respondents identified 'Reference groups and membership groups' to influence staff while six respondents identified 'Reference groups and membership groups' to influence students. Five respondents identified 'Beliefs and attitudes' to influence staff while four respondents identified 'Beliefs and attitudes' to influence students. Four respondents identified 'Social roles and status' to influence staff while five respondents identified 'Social roles and status' to influence students.

It is clear that staff and students have the same factors influencing their consumer behaviour, however, with different priorities. Consumer behaviour does however differ in the sixth factor, where HEIs consider 'Beliefs and attitudes' to be an important consumer behaviour factor for staff and 'Social roles and status' for students. In light of these findings, HEIs should take into account their consumer behaviour and align the Internet products and services accordingly. Considerations that stem from these factors are work, lifestyle, activities, values, age, hobbies, social origin, experiences, place of residence, leisure, beliefs, attitude or behaviour, role and social status and cultural environment or society.

Table 5.2: Top Seven Internet Users' Most Important Internet Usage Habits.

	Staff	**Students**
Habit 1	Research	Personal emails
Habit 2	Business emails	Education
Habit 3	Education	Social networking
Habit 4	Search engines and portals	Research
Habit 5	News and media	Entertainment
Habit 6	Social networking	Search engines and portals
Habit 7	Instant messaging	Instant messaging

For the question, 'What are your Internet users most important Internet usage habits?', a detailed analysis was conducted and is included on the CD. From the findings, the top seven Internet usage habits for staff and students were extracted and are presented in Table 5.2. Eight respondents identified 'Research' to be an important Internet usage habit for staff while seven respondents identified the 'Research' to be an important Internet usage habit for students. Three respondents identified 'Personal emails' to be an important Internet usage habit for staff while nine respondents identified the 'Personal emails' to be an important Internet usage habit for students. Seven respondents identified 'Business emails' to be an important Internet usage habit for staff while no respondents identified the 'Business emails' to be an important Internet usage habit for students.

Seven respondents identified 'Education' to be an important Internet usage habit for staff while eight respondents identified 'Education' to be an important Internet usage habit for students. Five respondents identified 'Social networking' to be an important Internet usage habit for staff while eight respondents identified the 'Social networking' to be an important Internet usage habit for students. Six respondents identified 'Search engines and portals' to be an important Internet usage habit for staff while four respondents identified the 'Search engines and portals' to be an important Internet usage habit for students. Five respondents identified 'News and media' to be an important Internet usage habit for staff while two respondents identified the 'News and media' to be an important Internet usage habit for students. One respondent identified 'Entertainment' to be an important Internet usage habit for staff while five respondents identified the 'Entertainment' to be an important Internet usage habit for students. Five respondents identified 'Instant messaging' to be an important Internet usage habit for staff while four respondents identified the 'Instant messaging' to be an important Internet usage habit for students.

It is clear from the findings that staff and students have different habits when it comes to Internet usage. There are, however, some common habits present in the combined list, these are, however, not at the same priority. The staff Internet usage habits tend to be focused on work, business and social whereas students Internet usage habits are focused on personal, studies and social. It is important for the HEI to align their Internet management resources, specifically Internet traffic controls according to these habits to ensure an adequate balance is maintained between work/academic and personal habits. The following sub-section elaborates on the findings for Section 5: Value Proposition.

5.5.2. Analysis of Results for Section 5: Value Proposition (what makes us different)

Section 5: Value Proposition focuses on identifying and describing the bundles of Internet-related products and services that create value for each specific Internet user segment. It is important that the HEI identify the core Internet values, list the users' Internet problems and needs and combine these to solve the users' problems through the Internet products and services offerings.

Figure 5.8 depicts all responses received for the question, 'What Core Internet values does your HEI aim to deliver to its Internet users?'. Five respondents identified 'Privacy' to be a core Internet value to deliver for staff while six respondents identified 'Privacy' to be a core Internet value to deliver for students. Ten respondents identified 'Security' to be a core Internet value to deliver for staff while six respondents identified 'Security' to be a core Internet value to deliver for students. Four respondents identified 'Trust' to be a core Internet value to deliver for staff while three respondents identified 'Trust' to be a core Internet value to deliver for students. Three respondents identified 'Freedom of Expression' to be a core Internet value to deliver for staff while six respondents identified 'Freedom of Expression' to be a core Internet value to deliver for students. No respondents identified 'Other' to be a core Internet value to deliver for staff while one respondent identified 'Other' to be a core Internet value to deliver for students.
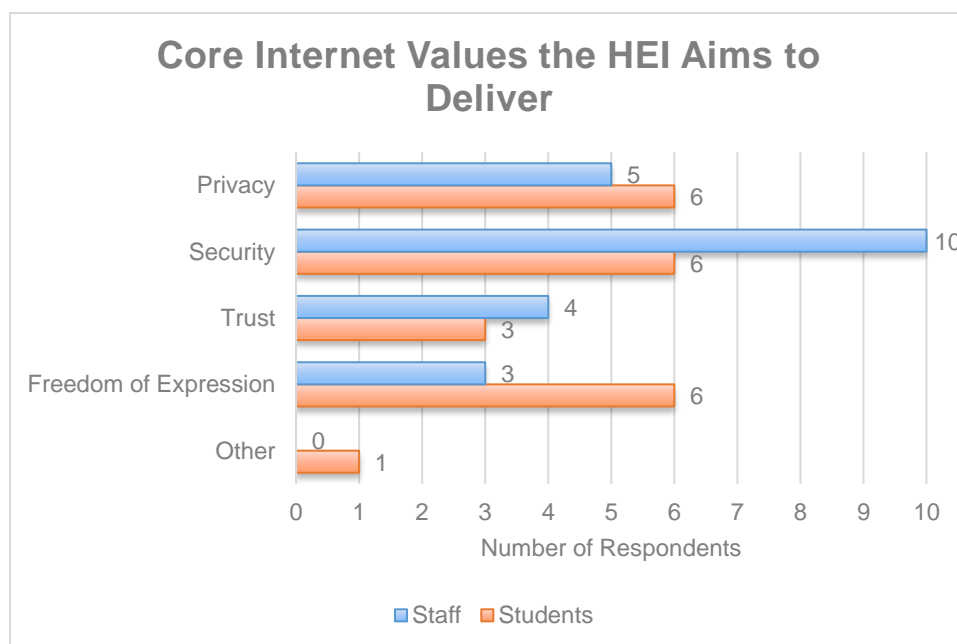
Figure 5.8: Core Internet Values the HEI Aims to Deliver.

The findings indicated that all HEIs consider security to be a core Internet value for staff. This is followed by more HEIs considering privacy to be a core Internet value for staff. A small number of HEIs consider trust to be core Internet value for staff with less considering freedom of expression to be a core Internet value for staff. On the contrary, HEIs consider privacy, security and freedom of expression to be of equal importance as a core Internet value for students. For both strategies to be achieved, the HEIs must review their Internet management resources and practices to guarantee that these values are achieved for each customer segment. These findings do not agree with a mass market strategy but do support a niche market strategy. HEIs are requested to review their respective customer segment strategies to make sure they are in line with the entire Internet Management Business Model.

Table 5.3: Top Five Internet Users' Problems that the HEIs are Addressing.

	Staff	Students
Problem 1	Slow connection	Slow connection
Problem 2	Unavailability of connection	Unavailability of connection
Problem 3	Expensive connection	Expensive connection
Problem 4	Unreliability connection	Inconsistent connection
Problem 5	Unsafe and unsecure connection	Unsafe and unsecure connection

For the question, 'Which Internet users' problems are the HEI helping to solve?', a detailed analysis was conducted and is included on the CD. From the findings, the top five Internet users' problems for the HEIs staff and students were extracted and are presented in Table 5.3. Nine respondents identified 'Slow connection' to be an Internet users' problem that the HEIs are addressing for both staff and student equally. Seven respondents identified 'Unavailability of connection' to be a problem for Internet users' that the HEIs are addressing for staff. Six respondents identified 'Unavailability of connection' to be an Internet users' problem that the HEIs are addressing for students. Six respondents identified 'Expensive connection' to be an Internet users' problem that the HEIs are addressing for both staff and students equally.

Five respondents identified 'Unreliability connection' to be an Internet users' problem that the HEIs are addressing for staff and four respondents identified 'Unreliability connection' to be an Internet users' problem that the HEIs are addressing for students. Five respondents identified 'Unsafe and unsecure connection' to be an Internet users' problem that the HEIs are addressing for both staff and students equally. Four respondents identified 'Inconsistent connection' to be an Internet users' problem that the HEIs are addressing for staff and five

respondents identified 'Inconsistent connection' to be an Internet users' problem that the HEIs are for students. Five respondents identified 'Unsafe and unsecure connection' to be an Internet users' problem that the HEIs are addressing for both staff and students equally.

It is clear from the findings that staff and students identify similar problems when it comes to Internet problems. There is, however, one different problem present in the combined list, which can be found at problem 4, being unreliable connection for staff and inconsistent connection for students. It is important for the HEIs to leverage on the core Internet values to address these problems for the Internet users. Furthermore, the Internet management resources must be focused on addressing these identified problems.

Table 5.4: Top Five Internet Users' Problems that the HEIs are Satisfying.

	Staff	Students
Solved 1	Slow connection	Unavailability of connection
Solved 2	Unavailability of connection	Slow connection
Solved 3	Unreliability connection	Inconsistent connection
Solved 4	Inconsistent connection	Unreliability connection
Solved 5	Expensive connection	Expensive connection

For the question, 'Which Internet users' needs are the HEI satisfying?', a detailed analysis was conducted and is included on the CD. From the findings above, the top five Internet needs of users the HEIs are satisfying for staff and students were extracted and are presented in Table 5.4. Nine respondents identified 'Slow connection' to be an Internet users' need that the HEIs are satisfying for staff and eight respondents identified 'Slow connection' connection' to be an Internet users' need that the HEIs are satisfying for students. Nine respondents identified 'Unavailability of connection' to be an Internet users' need that the HEIs are satisfying for staff and ten respondents identified 'Unavailability of connection' to be an Internet users' need that the HEI are satisfying for students.

Six respondents identified 'Unreliability connection' to be an Internet users' needs that the HEI are satisfying for staff and seven respondents identified 'Unreliability connection' to be an Internet users' need that the HEIs are satisfying for students. Five respondents identified 'Inconsistent connection' to be an Internet users' need that the HEIs are satisfying for staff and seven respondents identified 'Inconsistent connection' to be an Internet users' need that the HEIs are satisfying for students. Five respondents identified 'Expensive connection' to be an Internet users' need that the HEIs are satisfying for both staff and students equally.

It is clear from the findings that HEIs are addressing similar Internet users' needs for both staff and students. The top five are, however, just in a different order. It is imperative that the HEIs solve the problems of Internet users. According to the combined findings, it seems that this is the case.

Table 5.5: Top Five Bundles of Internet-Related Products and Services Offered to Each Internet User Segment.

	Staff	Students
Offered 1	Reliability	Availability (connectivity)
Offered 2	Speed	Reliability
Offered 3	Availability (connectivity)	Speed
Offered 4	Consistency	Consistency
Offered 5	Price	Price

For the question 'What bundles of Internet-related products and services is your HEI offering to each Internet user segment?', a detailed analysis was conducted and is included on the CD. From the findings, the top five bundles of Internet-related products and services being offered by the HEIs for the Internet user segment, staff and students were extracted and are presented in Table 5.5. Ten respondents identified 'Reliability' as an Internet-related product or service being offered to both staff and students equally. Nine respondents identified 'Availability (connectivity)' as an Internet-related product or service being offered to staff and ten respondents identified 'Availability (connectivity)' as an Internet-related product or service being offered to students.

Nine respondents identified 'Speed' as an Internet-related product or service being offered to both staff and students equally. Seven respondents identified 'Consistency' as an Internet-related product or service being offered to staff and nine respondents identified 'Consistency' as an Internet-related product or service being offered to students. Seven respondents identified 'Price' as an Internet-related product or service being offered to staff and six respondents identified 'Price' as an Internet-related product or service being offered to students.

It is clear from the findings that HEIs offer the same bundles of Internet-related products and services, however, there is different priority for each group. These bundles of Internet-related products and services must be focused on addressing the problems and needs of particular the Internet users. From the enquiry, they are to a large extent, being fulfilled.

Tables 5.6 and 5.7 provide a combined summary of the top 5 listings covered in this section. The listings should be viewed in together. In this context, the Core Internet values that the HEI seeks must be emphasised and be clearly visible in the Internet products and services being offered, which stem from the customer segments' problems and needs. As can be seen in both tables, this is the case to a large extent. The only glaring core Internet value and problem that is not reflecting in the Internet products and services offerings is Security or a safe and secure Internet offering. As discussed in the literature, cybercrime and cybersecurity are a prevalent topic within the Internet community and IG structures. Furthermore, data breaches have been listed as one of the top 5 global risks by the World Economic Forum in 2017 (World Economic Forum, 2017). HEIs have listed security as a core Internet value as well as identified it as an Internet users' problem, but have failed to incorporate it into the Internet products and services offering. This must be completed as a matter of urgency.

Table 5.6: Top Five Staff Value Proposition Listings.

Staff			
Core Internet Values	**Problems being addressed**	**Needs being solved**	**Products and services offered**
Security Privacy Trust	Slow connection Unavailability of connection Expensive connection Unreliability connection Unsafe and unsecure connection	Slow connection Unavailability of connection Unreliability connection Inconsistent connection Expensive connection	Reliability Speed Availability (connectivity) Consistency Price

Table 5.7: Top Five Students Value Proposition Listings.

Students			
Core Internet Values	**Problems being addressed**	**Needs being solved**	**Products and services offered**
Privacy Security Freedom of Expression	Slow connection Unavailability of connection Expensive connection Inconsistent connection Unsafe and unsecure connection	Unavailability of connection Slow connection Inconsistent connection Unreliability connection Expensive connection	Availability (connectivity) Reliability Speed Consistency Price

The following sub-section will elaborate on the findings for Section 6: Distribution Channel.

5.5.3. Analysis of Results for Section 6: Distribution Channel

Section 6: Distribution Channel describes how the HEIs communicate with and reach their Internet user segments to deliver the Value Proposition. It is important for the HEIs to identify the delivery method, how awareness is raised regarding the Internet products and services, purchasing methods and how Internet support is provided to the Internet user segments.
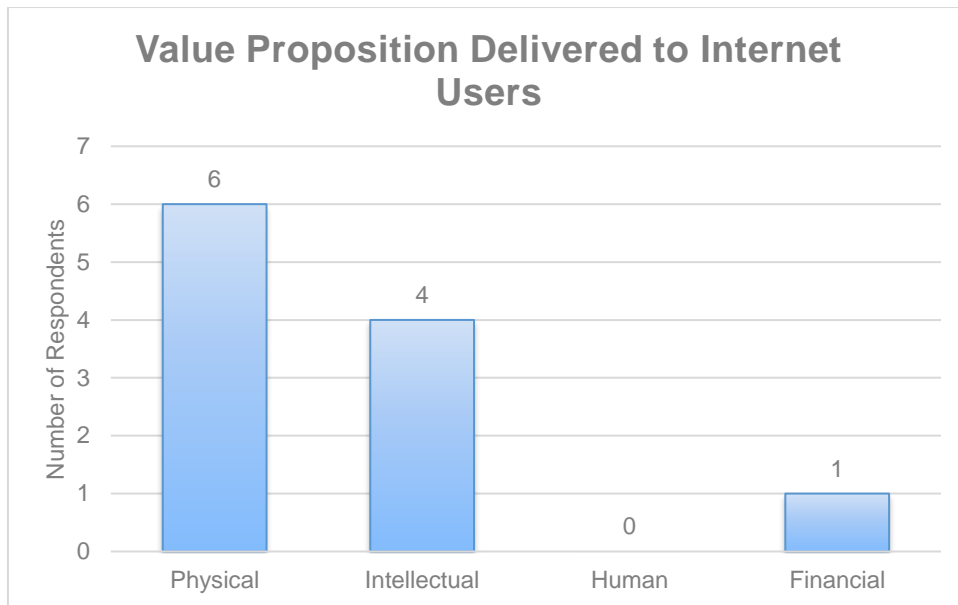
Figure 5.9: Value Proposition Delivered to Internet Users.

Figure 5.9 depicts all responses received for the question 'How does your HEI deliver a Value Proposition to Internet users?'. One HEI identified two delivery methods. Six respondents indicated that they deliver the value proposition to Internet users by means of the 'Physical Resources'. Four respondents indicated that they deliver the value proposition to Internet users by means of the 'Intellectual Resources'. No respondents indicated that they deliver the value proposition to Internet users by means of the 'Human Resources'. One respondent indicated that they deliver the value proposition to Internet users by means of 'Financial Resources'.

The findings indicate that the majority of HEIs deliver the Internet value proposition to the Internet users via physical resources. This is followed by some HEIs delivering the Internet value proposition to the Internet users via Intellectual resources. A limited number or no HEI deliver their Internet value proposition to the Internet users via financial- and human resources. As indicated in the literature chapters, the Internet is a physical product composed of cables, hardware, software and is regulated by technical controls (Chapter 2, Section 2.4.3). It therefore makes sense that HEIs deliver value through physical resources (cables, hardware, software) and some by intellectual resources (technical controls).

For the question 'How does your HEI raise awareness about your HEI's Internet products and services?', a detailed analysis was conducted and is included on the CD. Table 5.8 provides a combined summary of the top six methods adopted by HEIs to raise awareness about the Internet products and services for staff and students. Ten respondents indicated that they

raise awareness about their HEI's Internet products and services through 'Email' and Intranet for staff and eight respondents indicated that they raise awareness about their HEI's Internet products and services through 'Email' and 'Intranet' for students. Seven respondents indicated that they raise awareness about their HEI's Internet products and services through 'Social Media' for staff and eight respondents indicated that they raise awareness about their HEI's Internet products and services through 'Social Media' for students.

Six respondents indicated that they raise awareness about their HEI's Internet products and services through 'Induction' 'for both staff and students equally. Five respondents indicated that they raise awareness about their HEI's Internet products and services through 'Posters/Banners' for staff and six respondents indicated that they raise awareness about their HEI's Internet products and services through 'Posters/Banners' for students. Five respondents indicated that they raise awareness about their HEI's Internet products and services through 'Newsletters/Magazines' for both staff and students.

Table 5.8 provides a combined summary of the top six methods adopted by HEIs to raise awareness about the Internet products and services for staff and students. Method 1, 2, 3 and 6 are similar in ordering whilst method 4 and 5 are differently ranked. It is therefore clear that the same methods and approaches are adopted for both customer segments, with a difference on priorities. It is extremely important to align these methods with the top six factors that influence staff and students. Characteristics such as work, lifestyle, activities, values, age, hobbies, social origin, experiences, place of residence, leisure, beliefs, attitude or behaviour, role and social status and cultural environment or society should therefore be considered to ensure that the awareness methods speak directly to the targeted audience.

Table 5.8: Top Six Methods How HEIs Raise Awareness About the Internet Products and Services for Staff and Students.

	Staff	Students
Method 1	Email	Email
Method 2	Intranet	Intranet
Method 3	Social Media	Social Media
Method 4	Inductions	Posters/Banners
Method 5	Posters/Banners	Inductions
Method 6	Newsletters/Magazines	Newsletters/Magazines
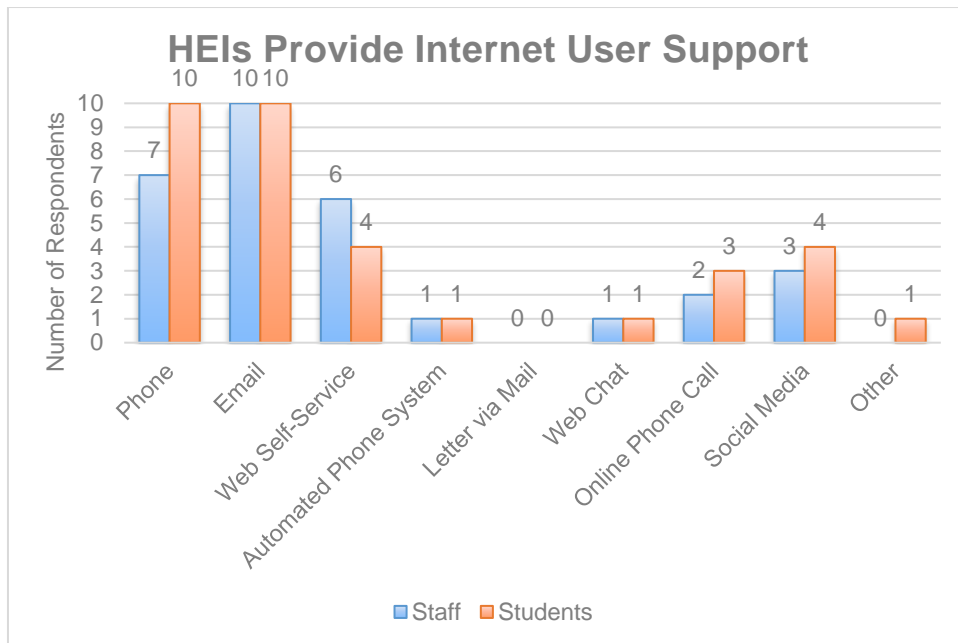
Figure 5.10: HEIs Provide Internet User Support.

Figure 5.10 depicts all responses received for the question 'How does your HEI provide Internet user support?'. Seven respondents indicated that they provide Internet user support by 'Phone' for staff and ten respondents indicated that they provide Internet user support by 'Phone' for students. Ten respondents indicated that they provide Internet user support via 'Email' for both staff and students equally. Six respondents indicated that they provide Internet user support using 'Web Self-Service' for staff and four respondents indicated that they provide Internet user support using 'Web Self-Service' for students. One respondent indicated that they provide Internet user support via an 'Automated Phone System' and 'Web Chat' for both staff and students equally.

No respondents indicated that they provide Internet user support via 'Letter via Mail' for both staff and students equally. Two respondents indicated that they provide Internet user support via 'Online Phone Call' for staff and three respondents indicated that they provide Internet user support via 'Online Phone Call' for students. Three respondents indicated that they provide Internet user support using 'Social Media' for staff and four respondents indicated that they provide Internet user support using 'Social Media' for students. No respondents indicated that they provide Internet user support via 'Other' methods for staff and one respondent indicated that they provide Internet user support via 'Other' methods for students.

The findings indicated that email is the preferred method to provide Internet user support for both staff and students by all HEI. All HEI providing Internet user support for students via

phone while the majority of HEI provide Internet user support for staff via phone. Lastly, web self-service is also identified as a method to provide Internet user support for staff by some HEIs while web self-service and social media are identified as a method to provide Internet user support for students by some HEIs. The findings do, however, identify email and phone to be the prevailing method, which are also still the preferred method of support by many call centres in South Africa. Alternative methods such as web self-service, web chat and social media are becoming mainstream and must be investigated as alternative Internet user support systems. It is clear that some HEIs are in the process of adopting these new methods for staff and students. In addition, characteristics such as work, lifestyle, activities, values, age, hobbies, social origin, experiences, place of residence, leisure, beliefs, attitude or behaviour, role and social status and cultural environment or society should be considered to ensure the support methods speak directly to the targeted audience. The following sub-section elaborates on the findings for Section 7: Customer Relationships.

5.5.4. Analysis of Results for Section 7: Customer Relationships

Section 7: The Customer Relationships section identifies and describes the types of relationships a HEI establishes with specific Internet user segments. It is important for the HEIs to identify the type of relationship Internet users expect, the type of relationship established, how the relationship is integrated with the rest of Internet Management Business Model and the costs associated with managing the relationship.

Table 5.9: Top Three Types of Relationships that Staff and Students Expect from the HEIs.

	Staff	Students
Type 1	Personal Assistance	Personal Assistance
Type 2	Self-Service	Self-Service
Type 3	Automated Services	Automated Services

For the question, 'What type of relationship does each of your Internet users expect your HEI to establish and maintain with them?', a detailed analysis was conducted and is included on the CD. Table 5.9 provides a combined summary of the top three types of relationships that staff and students expect from the HEI. Nine respondents indicated that a 'Personal Assistance' type of relationship is what both staff and student Internet users expect from the HEI. Seven respondents indicated that a 'Self-Service' type of relationship is what staff Internet users expect from the HEI and eight respondents indicated that a 'Self-Service' type of relationship is what student Internet users expect from the HEI. Four respondents indicated that an 'Automated Services' type of relationship is what staff Internet users expect from the

HEI and five respondents indicated that an 'Automated Services' type of relationship is what student Internet users expect from the HEI.

As can be seen, the type of relationships are 'Personal Assistance', 'Self-Service' and 'Automated Services' in that order, for both staff and student. These are, however, on different priority levels. Personal assistance is based on human interaction, which allows the Internet user to communicate directly with the HEI Internet management representatives. Communication takes place in the form of in person, by email, through call centres, etc. Human resources are therefore critical in this type of relationship. Self-Service focuses on providing the Internet users the necessary means to help themselves. Limited human interaction is therefore required in this type of relationship. Automated services is a mixture of customer self-service with automated processes. With both self-service and automated services, fewer human resources are required, which in most cases saves costs. The findings do, however, still identify personal assistance as the top choice by almost all HEIs which is combined with a mixture of self-service and automated services. These findings are in alignment with how an HEI provides Internet user support as discussed earlier.

For the question, 'What type of relationship has your HEI established? (Currently implemented)', a detailed analysis was conducted and is included on the CD. Table 5.10 provides a combined summary of the top three types of relationships that are established in the HEIs. Eight respondents indicated that a 'Personal Assistance' type of relationship is what is established in the HEI for both staff and student equally. Six respondents indicated that a 'Self-Service' type of relationship is what is established in the HEI for both staff and student equally. Three respondents indicated that an 'Automated Services' type of relationship is what is established in the HEI for both staff and students equally.

Table 5.10: Top Three Types of Relationships Established in the HEIs.

	Staff	Students
Type 1	Personal Assistance	Personal Assistance
Type 2	Self-Service	Self-Service
Type 3	Automated Services	Automated Services

As can be seen, the types of relationships are 'Personal Assistance', 'Self-Service' and 'Automated Services' in that order, for both staff and students, equally. It therefore appears that a standard type of relationship combination is supplied to all Internet users. These findings are in line with the three types of relationships that staff and students expect from the HEIs.
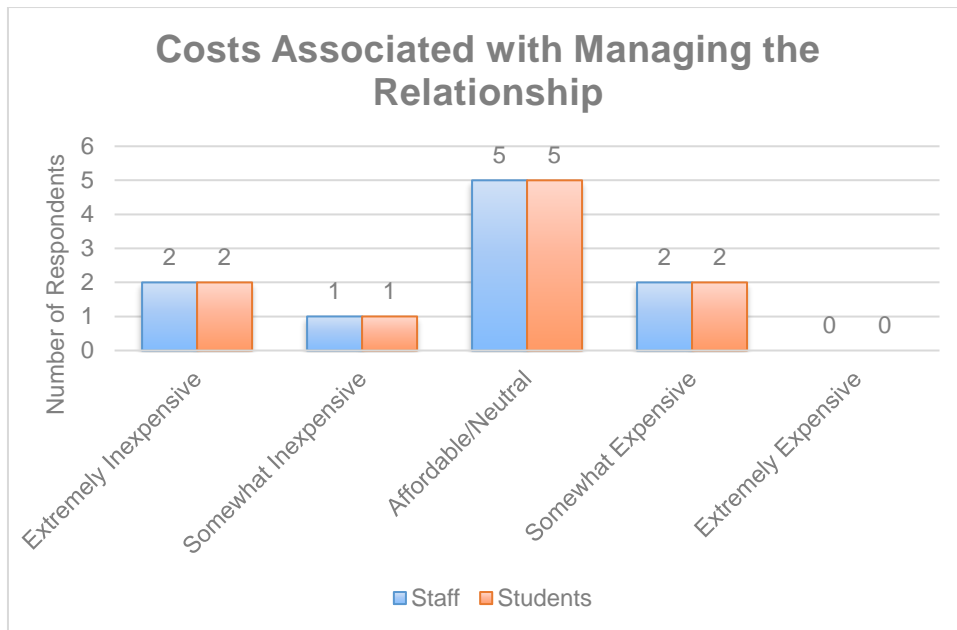
Figure 5.11: Costs Associated with Managing the Relationship.

Figure 5.11 depicts all responses received for the question, 'How costly are the relationships to manage?'. Two respondents indicated that the costs associated with managing the relationship are 'Extremely Inexpensive' for both staff and students equally. One respondent indicated that the costs associated with managing the relationship are 'Somewhat Inexpensive' for both staff and students equally. Five respondents indicated that the costs associated with managing the relationship is 'Affordable/Neutral' for both staff and students equally. Two respondents indicated that the costs associated with managing the relationship are 'Somewhat Expensive' for both staff and students equally. No respondent indicated that the costs associated with managing the relationship are 'Extremely Expensive' for both staff and students equally.

The findings indicate that the majority of HEIs identify the costs associated with managing the relationship as affordable/neutral for both staff and students equally. Fewer HEIs indicate that the costs associated with managing the relationship as extremely inexpensive and somewhat expensive for both staff and students equally. It is therefore argued that the cost funding towards managing the relationship is well managed in line with the required Internet management resources. The following sub-section elaborates on the findings for Section 8: Revenue Sources/Streams.

5.5.5. Analysis of Results for Section 8: Revenue Sources/Streams

Section 8: Their revenue Sources/Streams section aims to identify and describe the method used to generate cash from each Internet user segment to fund the Internet Management Business Model. It is important for the HEIs to identify the different types of Internet revenue sources, current pricing model(s) for each of the Internet user segments, how much are Internet users willing to pay and the contribution of each revenue stream to the overall Internet revenues.
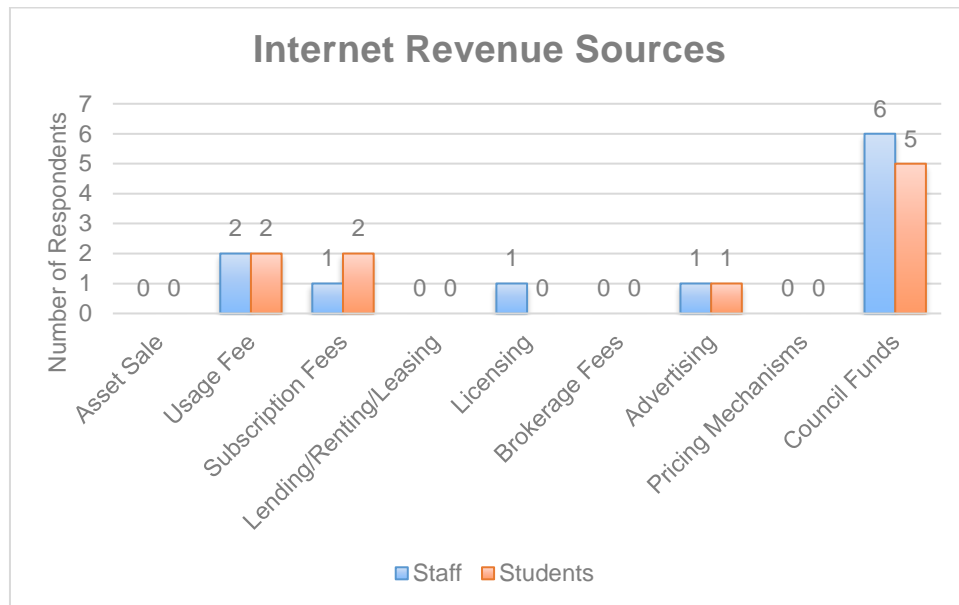
Figure 5.12: Internet Revenue Sources.

Figure 5.12 depicts all responses received for the question, 'What are the different types of Internet revenue sources?'. No respondents indicated that they use 'Asset Sale', 'Lending/Renting/Leasing', 'Brokerage Fees' and 'Pricing Mechanisms' as an Internet revenue source for both staff and students equally. Two respondents indicated that they use 'Usage Fee' as an Internet revenue source for both staff and students equally. One respondent indicated that they use 'Subscription Fees' as an Internet revenue source for staff and two respondents indicated that they use 'Subscription Fees' as an Internet revenue source for staff students. One respondent indicated that they use 'Licensing' as an Internet revenue source for staff and no respondents indicated that they use 'Licensing' as an Internet revenue source for staff students. One respondent indicated that they use 'Advertising' as an Internet revenue source for both staff and students equally. Seven respondents indicated that they use 'Council Funds' as an Internet revenue source for staff and six respondents indicated that they use 'Council Funds' as an Internet revenue source for staff and students.

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The findings indicate that the majority of HEIs use Council funds as an Internet revenue source for both staff and students. This could be due to the fact that the Internet products and services are offered for free by the majority of HEIs. This is in line with the Internet users' problems and needs of expensive connection as discussed earlier. A minority of HEIs use usage fee, subscription fees and advertising as an Internet revenue source for both staff and students. These are, however, on different priority levels.
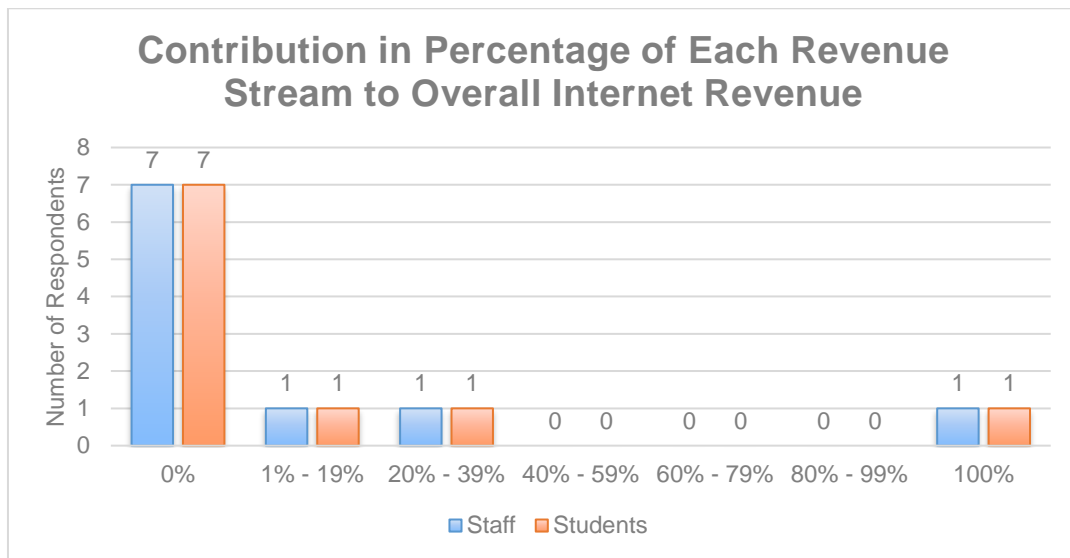
Figure 5.13: Contribution in Percentage of Each Revenue Stream to Overall Internet Revenue.

Figure 5.13 depicts the responses received for the question 'How much does each Revenue Stream contribute to overall Internet revenues?'. Seven respondents identified that there is a '0%' contribution of each revenue stream to the overall Internet revenue for both staff and students equally. One respondent identified that there is a '1% - 19%' and '20% - 39%' contribution of each revenue stream to the overall Internet revenue for both staff and students equally. No respondents identified that there is a '40% - 59%', '60% - 79%' and '80% - 99%' contribution of each revenue stream to the overall Internet revenue for both staff and students equally. One respondent identified that there is a '100%' contribution of each revenue stream to the overall Internet revenue for both staff and students equally.

The findings indicate that the majority of HEIs contribute '0%' of each revenue stream to overall Internet revenue for both staff and students. This stems from the fact that the only revenue stream identified by the majority of HEIs is Council funded. This means that it is part of their annual budget and not sourced directly from the Internet user segment. A minority of HEIs contribution '1% - 19%', '20% - 39%' and '100%' of each revenue stream to overall Internet

revenue for both staff and students, equally. These funds could stem from hidden costs build into the Internet users' registration fees or alternative methods. Lastly, one HEI indicated that their revenue streams are fully funded (100%) by the Internet user segment, as per the current pricing model(s) identified in the previous question. Only having one source of income means that the business model must be aligned with this structure, depending on the size of the allocated funds. The following sub-section elaborates on the findings for Section 9: Key Activities.

5.5.6. Analysis of Results for Section 9: Key Activities

Section 9: The key activities section identifies and describes the most important things the HEIs must do to make their Internet Management Business Model work. It is important for the HEIs to identify the critical characteristics of the HEI's Internet, key activities that the value propositions require, key activities that the distribution channels require, key activities that the customer relationships require, key activities that the revenue streams require and the activities that the HEIs must do once in a while to keep in touch with reality (Internet Management alignment with best practices, etc.).
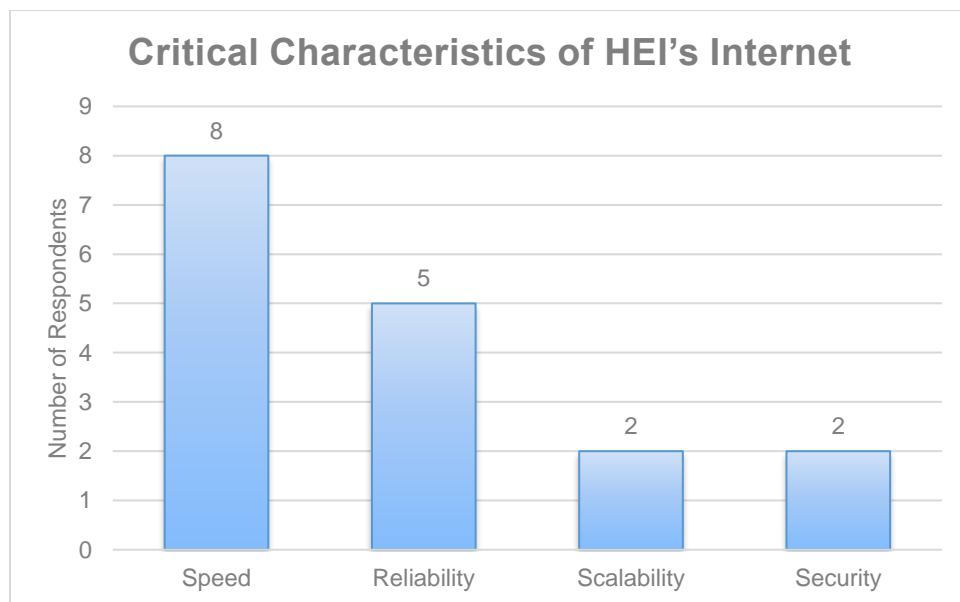
Figure 5.14: Critical Characteristics of HEI's Internet.

Figure 5.14 depicts all responses received for the question, 'What are the critical characteristics of your HEI's Internet?'. It should be noted that seven HEIs identified multiple critical HEI Internet resources. Eight respondents identified 'Speed' as the critical characteristics of the HEI's Internet. Five respondents identified 'Reliability' as the critical characteristics of the HEI's Internet. Two respondents identified 'Scalability' as the critical

characteristics of the HEI's Internet. Two respondents identified 'Security' as the critical characteristics of the HEI's Internet.

The majority of HEIs identified speed as a critical characteristics of the HEI's Internet with more HEIs identifying reliability as a critical characteristics of the HEI's Internet. These findings are in line with the list the users Internet problems and needs and Internet products and services offerings as covered in the value proposition section. Some HEIs identified scalability and security as critical characteristics of the HEI's Internet. The security characteristics are, however, more prevalent in the rest of the Internet Management Business Model and this low score is therefore not in line with the other findings.

For the question, 'What Key Activities do your Value Propositions require?' the following nine responses were received. The open-ended qualitative question was thematically analysed. The findings do indicate that some HEIs identified security controls in the form of physical, technical and operational controls as key activities required by the value propositions. In addition, speed is also common as a key activity required by the value propositions. Other less common findings include accounting, availability, bandwidth provisioning, dashboards and monitoring. The findings of security and speed are in line with the value propositions (core Internet values, users Internet problems and needs and Internet products and services offerings), however, not on the same priority levels.

For the question, 'What Key Activities does your Distribution Channel require?' the following nine responses were received. The open-ended qualitative question was also thematically analysed. The findings do indicate that more HEIs identified security, speed, network access, maintenance and proper procurement practises as key activities that the distribution channels require. Other less common findings include monitoring, funding, good relationship with service provides, enterprise solutions, cost effective solutions, reliability, availability and open communication. The findings of security, speed, network access, maintenance and proper procurement practices speed are in line with the identified physical- and intellectual resources as identified in the distribution channel section.

For the question, 'What Key Activities do your Customer Relationships require?' the following ten responses were received. As previously discussed, the open-ended qualitative question was thematically analysed. The findings do indicate that the majority of HEIs identified the availability of well-trained support staff to be a key activity that the customer relationships require. This is in line with the personal assistance type of relationship being implemented by

the majority of HEIs, which is covered in the customer relationships section. Other HEIs identified speed, security and customer relationship support software (Microsoft Customer Relationship Management (CRM) and Self-Serve system) to be key activities that the customer relationships require. Speed of customer support and customer relationship support software are in line with the customer relationships section. Security is not directly in line with the customer relationships section, however, is still identified as important here and in various other places in the Internet Management Business Models. Other less common findings include SLA, roadshows, departmental meetings and reliability.

For the question, 'What Key Activities do your Revenue streams require?' the following nine responses were received. The open-ended qualitative question was also thematically analysed. The findings do indicate that more HEIs identified management support and adequate funding structures key activities that the revenue streams require. These findings are in line with the council funds identified in the revenue sources section. Furthermore, these council funds are allocated to the department and additional funding must be motivated. Other less common findings include reduced costs, cost recovery, speed, reliability, security and availability.

For the question, 'Which activities should your HEI keep doing occasionally to keep in touch with reality?' the following ten responses were received. Thematically analysis was also applied to the open-ended qualitative question. The findings indicate that more HEIs identified market-related comparisons as activities the HEI must do once in a while to keep in touch with reality. Other common findings include peer meetings and customer-satisfaction surveys. Other less common findings include a strong relationship with vendors, strong relationship with business and community, attending conferences, hosting roadshows, total cost of ownership, ensure cost effectiveness, ensure positive experience, speed and security. The following sub-section elaborates on the findings for Section 10: Key Resources.

5.5.7.   Analysis of Results for Section 10: Key Resources

The Key Resources section identifies and described the most important resources required to make the Internet Management Business Model work. It is important for the HEIs to identify the critical HEI's Internet resources and how the HEIs commonly address Internet-related risks.
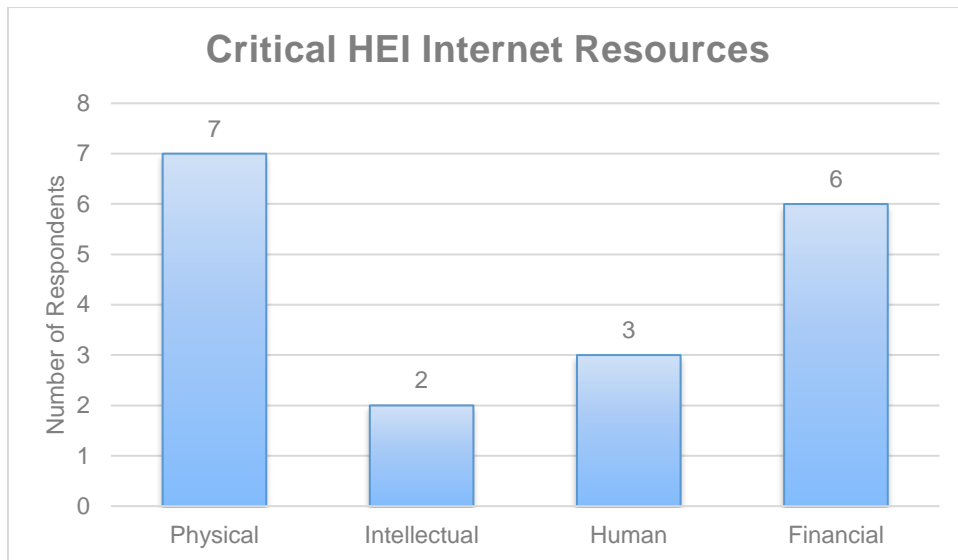
Figure 5.15: Critical HEI Internet Resources.

Figure 5.15 depicts all responses received for the question, 'What are your critical HEI's Internet resources?'. It should be noted that eight HEIs identified multiple critical HEI Internet resources. Seven respondents identified 'Physical Resources' to be a critical HEI's Internet resources. Two respondents identified 'Intellectual Resources' to be a critical HEI's Internet resources. Three respondents identified 'Human Resources' to be a critical HEI's Internet resources. Six respondents identified 'Financial Resources' to be a critical HEI's Internet resources.

There are more HEIs that identified physical resources as a critical HEI Internet resource and this is followed closely by multiple HEIs identifying financial resources as a critical HEI Internet resource. As previously discussed in the literature chapters, the Internet in its entirety is the interconnection of physical hardware, software etc. (Chapter 2, Section 2.3). If the physical resources fail, the connection with the specific area will be cut off with no access to the global Internet. The finding that physical resources is critical is therefore obvious. Additionally, to install and maintain the physical resources, the HEI must have the financial resources to support the installation and maintenance strategies. Adequate revenue streams must thus be available to support this critical resource. The findings are therefore aligned with the revenue sources/streams section.
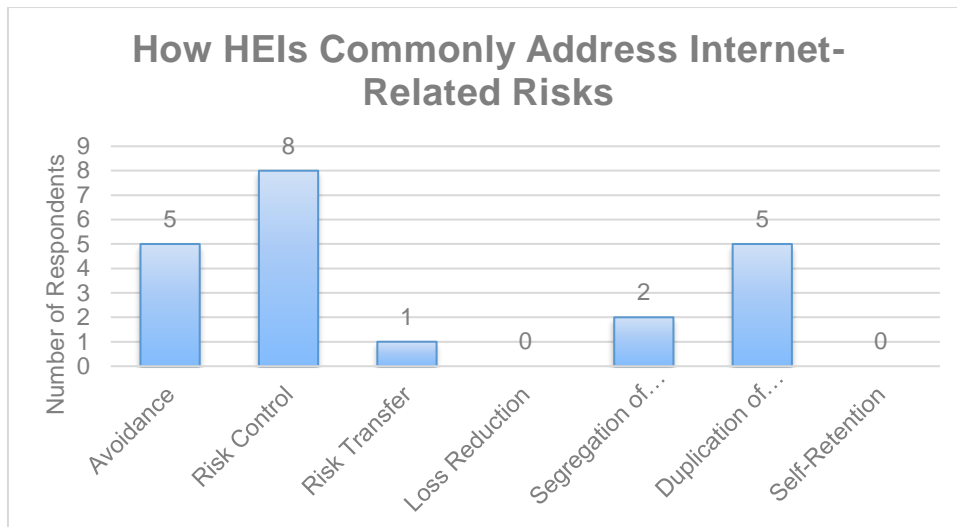
Figure 5.16: How HEIs Commonly Address Internet-Related Risks.

Figure 5.16 depicts all responses received for the question, 'How does your HEI commonly address Internet-related risks?'. It should be noted that all HEIs identified multiple methods adopted to address their HEI's Internet-related risks. Five respondents identified 'Avoidance' and 'Duplication of Resources' to be the preferred approach to address Internet-related risks. Eight respondents identified 'Risk Control' to be the preferred approach to address Internet-related risks. One respondent identified 'Risk Transfer' to be the preferred approach to address Internet-related risks. No respondents identified 'Loss Reduction' and 'Self-Retention' to be the preferred approach to address Internet-related risks. Two respondents identified 'Segregation of Exposures' to be the preferred approach to address Internet-related risks.

From the findings it is clear that the majority of HEIs have adopted a risk control method to address their HEI's Internet-related risks. This is followed by some HEIs adopting the avoidance and duplication of resources method to address their HEI's Internet-related risks. Risk control, is in general, a common method of evaluating potential losses and implementing actions to mitigate these risks. Risk control is also recommended as the preferred method of addressing risks by many standards such as ISO/SANS 27001, NIST, etc.

The key component of risk control is the focus on controlling the damage and financial consequences. Risk avoidance aims to eliminate the activities, hazards and exposures that can negatively affect the Internet resources while duplication of resources focuses on building redundancy or backup routes into the network. Both options are common methods adopted by HEIs to address their Internet-related risks. All risk controls do, however, require additional physical-, human- and financial resources to be present to adequately manage the identified

risk strategies. The following sub-section will elaborate on the findings for Section 11: Key Partnerships.

5.5.8. Analysis of Results for Section 11: Key Partnerships

Section 11: The key partnership's section identifies and describes the network of suppliers and partners that make the business model work. It is important for the HEI to identify the critical partners related to Internet management, critical suppliers related to Internet management, key resources acquired from suppliers and partners for Internet management, key activities that the partners perform and the kind of partnerships the HEIs maintain.

For the question, 'Who are your critical partners related to Internet Management?' the following ten responses were received. The open-ended qualitative question was thematically analysed. The findings do indicate that more HEIs identified TENET and SANReN as critical partners related to Internet management. These supporting services do appear in the NREN business models as discussed in a previous chapter. Furthermore, a minority of HEIs identified Dimension Data, BCX, NEOTEL, ISV and FortiNet as critical partners related to Internet management. It is therefore clear that a large number of HEIs have many critical partners with TENET and SANReN being the common industry-preferred critical partners. This is followed by supporting critical partners such as Dimension Data, BCX, NEOTEL, ISV and FortiNet who may be area specific, problem specific, technology specific etc. and therefore serve that HEI specifically.

For the question, 'Who are your critical suppliers related to Internet Management?' the following ten responses were received. As per the previous question, the open-ended qualitative question was also thematically analysed. The findings do indicate that more HEIs identified TENET as critical supplier related to Internet management. These supporting services do appear in the NREN business models as discussed in a previous chapter. Furthermore, a minority of HEIs identified Dimension Data, FortiNet, FixCan, DNI, BCX, NEOTEL, Internet Solutions, Bytes SANReN and own staff as critical suppliers related to Internet management. It is therefore clear that a bigger portion of HEIs have multiple critical suppliers with TENET being the common industry preferred critical supplier. This is followed by supporting critical partners such as Dimension Data, FortiNet, FixCan, DNI, BCX, NEOTEL, Internet Solutions, Bytes, SANReN and own staff who may be area specific, problem specific, technology specific etc. and therefore serve that HEI specifically.
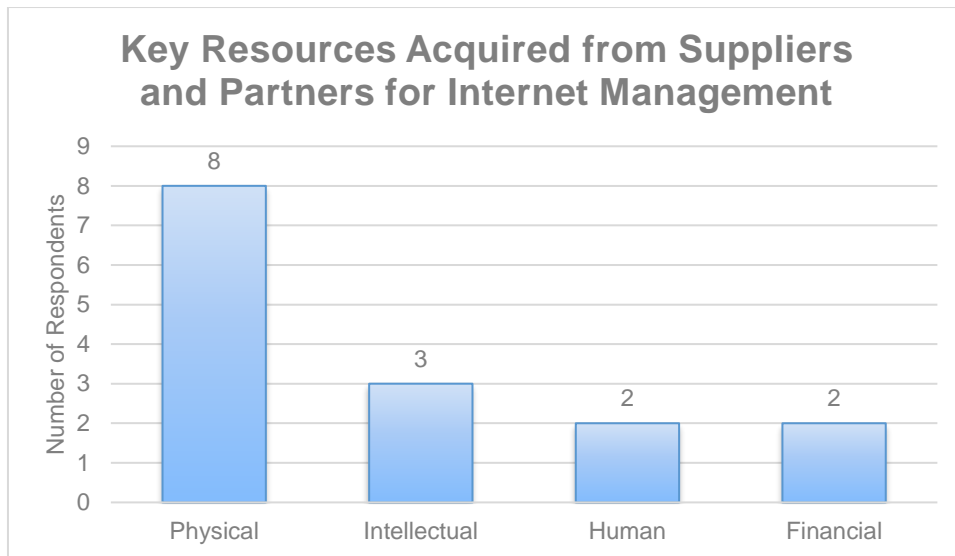
Figure 5.17: Key Resources Acquired from Suppliers and Partners for Internet Management.

Figure 5.17 depicts all responses received for the question, 'Which Key Resources does your HEI acquire from suppliers and partners for Internet Management?'. It should be noted that five HEIs identified multiple key resources acquired from suppliers and partners for Internet management. Eight respondents identified 'Physical Resources' to be a key resource that the HEIs acquire from suppliers and partners for Internet management. Three respondents identified 'Intellectual Resources' to be a key resource that the HEIs acquire from suppliers and partners for Internet management. Two respondents identified 'Human Resources' to be a key resource that the HEIs acquires from suppliers and partners for Internet management. Two respondents identified 'Financial Resources' to be a key resource that the HEIs acquire from suppliers and partners for Internet management.

The findings indicate that the majority of HEIs identified physical Internet management resources as a key resource that the HEIs acquire from suppliers and partners for Internet management. A few HEIs identified intellectual Internet management resources as a key resource that the HEIs acquire from suppliers and partners for Internet management. The minority of HEIs identified human- and financial Internet management resources as a key resource that the HEIs acquire from suppliers and partners for Internet management. If one is to follow a cost-driven business model it would be ideal to outsource the critical HEI Internet resources. The findings are reflected to some extent in the Cost Structure, Key Resources and Value Proposition section as they all focus on physical Internet management resources.

Table 5.11: Key Activities that the HEIs Partners Perform.

	Key Activities that the HEIs partners perform
Key Activity 1	Physical installation, infrastructure recommendations and maintenance
Key Activity 2	Network performance, security and BYOD
Key Activity 3	Manage infrastructure, provide bandwidth
Key Activity 4	Manage and purchase
Key Activity 5	Provisioning and fault investigation
Key Activity 6	Sell stuff and maintenance contract
Key Activity 7	Operate and maintain
Key Activity 8	Knowledge and bandwidth supply
Key Activity 9	Design, install and support
Key Activity 10	Support

Table 5.11 depicts all responses received for the question, 'Which Key Activities do your partners perform?'. The open-ended qualitative question was also thematically analysed. The findings indicate that more HEIs require the partners to perform network design, implementation and maintenance. These findings support an outsourcing structure as most HEIs do not have the required human and intellectual resources to perform these activities in-house. Also, the physical resources are key to the Internet and therefore must be designed, implemented and maintained adequately. These findings therefore support the rest of the Internet Management Business Model.
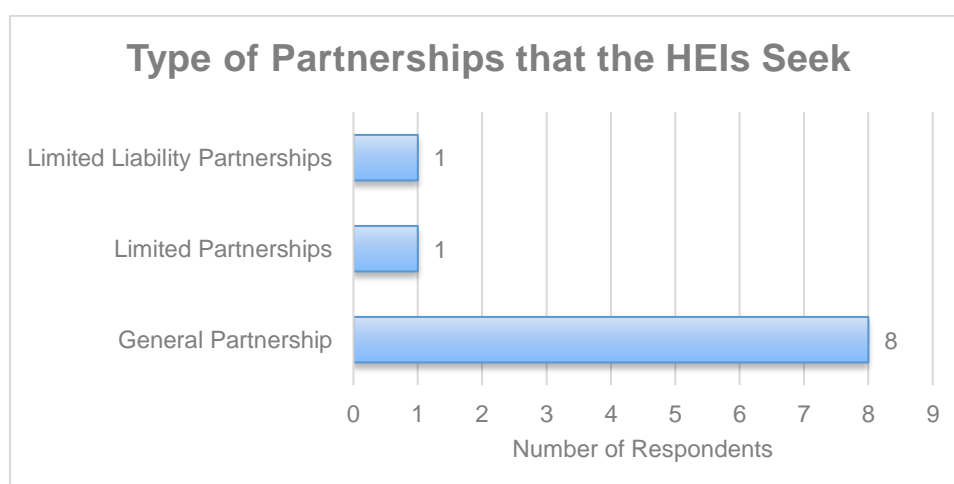
Figure 5.18: Type of Partnerships that the HEIs Seek.

Figure 5.18 depicts all responses received for the question, 'What kind of partnerships should your HEI seek?'. One respondent identified their HEI was seeking a 'Limited Liability

Partnership', one respondent identified its HEI was seeking a 'Limited Partnership' and eight respondents identified their HEI was seeking a 'General Partnership'. The majority of HEIs seek a 'General Partnership'. This could be because it is easy to create, low cost of operation and requiring only a few ongoing requirements. The following sub-section elaborates on the findings for Section 12: Cost Structure.

5.5.9. Analysis of Results for Section 12: Cost Structure

The Cost Structure section identifies and describes all costs incurred to operate an Internet Management Business Model. It is important for the HEIs to identify the most important costs inherent in the business model, the Internet management resources with most impact on the costs, most expensive key resources and most expensive key activities.
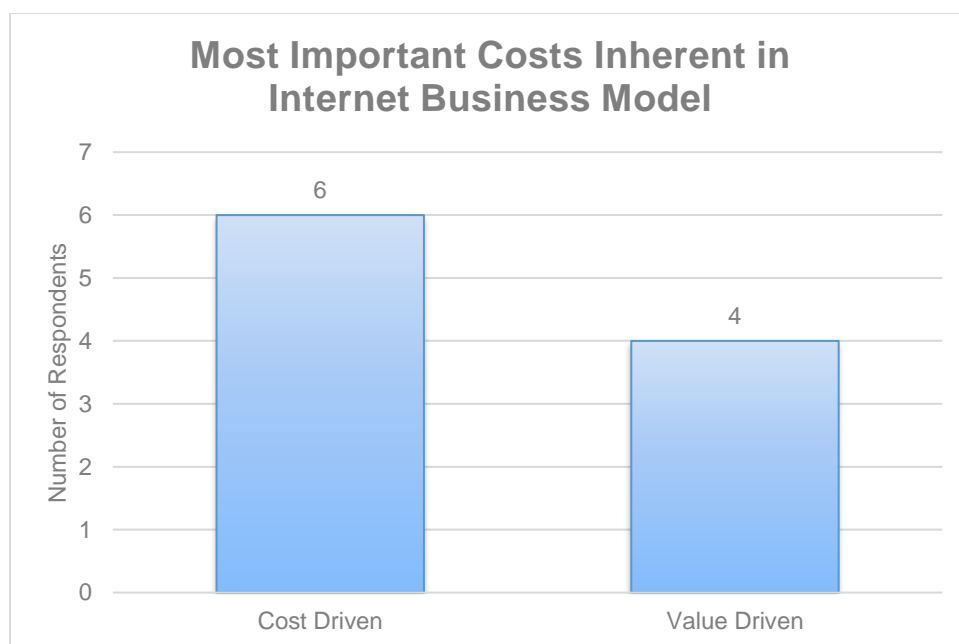
Figure 5.19: Most Important Costs Inherent in the Business Model.

Figure 5.19 depicts all responses received for the question, 'What are the most important costs inherent in your Internet Business Model?'. Six respondents identified 'Cost Driven' to be the most important costs inherent to their Internet Business Model while four respondents identified 'Value Driven' to be the most important costs inherent to their Internet Business Model.

The findings indicate that more HEIs use the cost-driven business model where some HEIs use the value-driven business models. The cost-driven business model is focused on minimising costs wherever possible. This model uses low price Value Propositions, extensive

outsourcing and maximum automation. The value-driven business model is focused less on cost and more on value creation. A high degree of personalised service and premium value propositions are always present in the value-driven business model. These characteristics must therefore be prevalent in the respective Value Propositions, Distribution Channels and Key Partnerships, which in most cases speak to the cost-driven business model. It could be that the smaller and less mature HEIs with fewer resources are focused on cost-driven business models whereas the bigger and more mature HEIs with more resources are focused on value-driven business models.
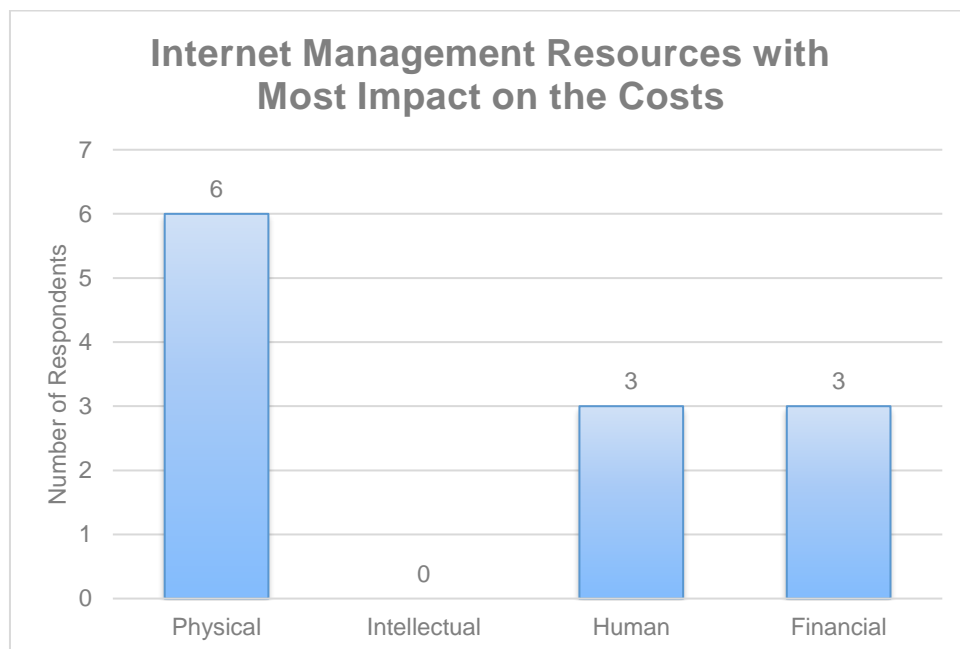
Figure 5.20: Internet Management Resources with Most Impact on the Costs.

Figure 5.20 depicts all responses received for the question, 'Which Internet management resources have the most impact on the costs?'. It should be noted that two HEIs identified multiple Internet management resources as having the greatest impact on the costs. Eight respondents identified 'Physical' Internet management resources as having the greatest impact on the costs. No respondents identified 'Intellectual' Internet management resources as having the greatest impact on the costs. Three respondents identified 'Human' Internet management resources as having the greatest impact on the costs. Three respondents identified 'Financial' Internet management resources as having the greatest impact on the costs.

The findings indicate that more HEIs identified physical Internet management resources as having the greatest impact on the costs. This is followed with some HEIs identifying human

and financial Internet management resources as having the greatest impact on the costs. The Internet backbone is by nature extremely expensive to implement and maintain as it requires hardware, software and civil work to be completed on a large scale. In most cases, suppliers will do the installations and maintenance, as identified in the Key Partnerships section. The HEIs that selected human Internet management resources as having the greatest impact on the costs may have their own internal staff assisting with the management of the Internet. The HEIs that selected financial Internet management resources as having the greatest impact on the costs may lack strong funding structures to support the management of the HEI Internet.
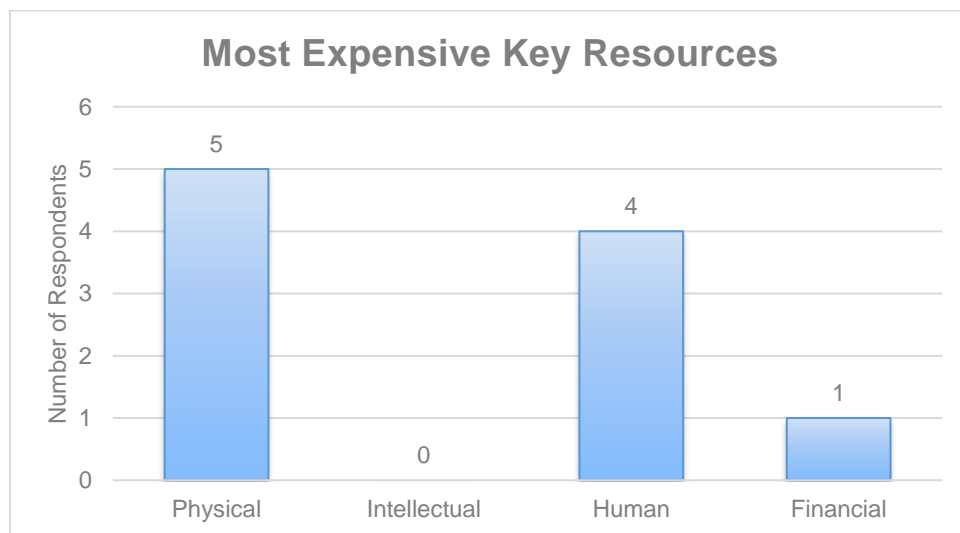
Figure 5.21: Most Expensive Key Resources.

Figure 5.21 depicts all responses received for the question, 'Which Key Resources are the most expensive?'. Five respondents identified 'Physical' Internet management resources to be the most expensive. No respondents identified 'Intellectual' Internet management resources to be the most expensive. Four respondents identified 'Human' Internet management resources to be the most expensive. One respondent identified 'Financial' Internet management resources to be the most expensive.

The findings indicate that more HEIs identified physical Internet management resources as the most expensive key resources, which is followed by fewer HEIs identifying human Internet management resources as the most expensive key resources. These two resources are linked to the physical installation of the Internet and supporting network and the humans that are required to manage and maintain the HEI Internet. The findings are therefore aligned with the Key Resources section.
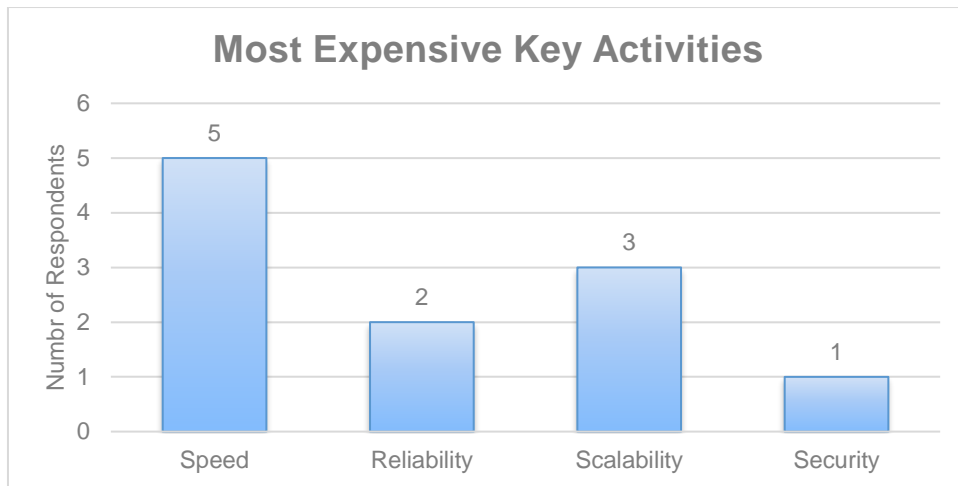
Figure 5.22: Most Expensive Key Activities.

Figure 5.22 depicts all responses received for the question, 'Which Key Activities are the most expensive?'. Five respondents identified 'Speed' as the most expensive key activity. Two respondents identified 'Reliability' as the most expensive key activity. Three respondents identified 'Scalability' as the most expensive key activity. One respondent identified 'Security' as the most expensive key activity.

The findings indicate that more HEIs identified speed as the most expensive key activity which is followed by scalability, reliability and security, in that order. Research has shown the South African Internet was the second highest cost amongst countries which include Brazil, China, India, Kenya, Australia and Russia (Van Zyl, 2016). Speed is therefore considered to be the most expensive key activity. In addition, the findings are therefore aligned with the Key Activates section as well as the value proposition listings. The following section presents and describes the best practices HEIs Internet Management Business Model.

5.6. Best Practices HEIs Internet Management Business Model

Figure 5.23 depicts the SA HEIs Internet Management Business Model Canvas as per the findings captured in the chapter. The core findings of each of the nine buildings blocks were therefore documented, processed, summarised, reviewed and captured into the BMC. It should be noted that due to the summarised nature of the BMC, only the core elements were captured. This does not mean that the remaining findings of this chapter are irrelevant. The findings play a pivotal role in the interconnected nature of the BMC and therefore guide its entire nature and consequently, its final form. Lastly, the synergy is clearly visible between the SANReN BMC and HEIs BMC, as well as the TENET BMC and HEIs BMC.

Key Partners	**Key Activities**	**Value Propositions**	**Customer Relationships**	**Customer Segments**
Critical partners: • TENET • SANREN Supporting partners: • Dimension Data • BCX • NEOTEL • ISV • FortiNet Critical suppliers: • TENET Supporting suppliers: • Dimension Data • FortiNet • FixCan • DNI • BCX • NEOTEL • Internet Solutions • Bytes • SANREN • Own (Internal) staff	• To provide fast and reliable Internet connectivity. • Security, speed, network access, maintenance and proper procurement practices. • Availability of well-trained support staff. • Management support and adequate funding structures. **Key Resources** • Physical resources. • Financial resources. • Proper Risk control strategy.	• Security, privacy and trust by including reliability, speed, availability (connectivity), consistency and low price in the Internet product and service offerings.	• Personal Assistance • Self-Service • Automated Services **Channels** • Internet resources are delivered through physical- and intellectual resources.	Internet user segments: • Academic staff • Administrative staff • Students • Contractors • Visitors • On Campus Residences

Cost Structure	**Revenue Streams**
• Cost-driven strategy with some value-driven strategy. • Physical Internet infrastructure. • Internet bandwidth (Speed).	• Council funded

Figure 5.23: SA HEIs Internet Management Business Model Canvas.

From the SA HEIs Internet Management BMC, it is clear that HEIs provide an Internet connection for academic staff, administrative staff, students, contractors, visitors and on campus residences, which focus on security, privacy and trust by including reliability, speed, availability (connectivity), consistency at a low price. HEIs delivers fast, secure and reliable Internet connectivity and provide for well-trained support staff through physical and intellectual resources. In addition, management support and adequate funding structures are key requirments for the Internet's successful implementation and maintenance. The HEIs Internet is funded via Council funds and tend towards the cost-driven strategy with some value-driven strategy, physical Internet infrastructure and Internet bandwidth (speed).

HEIs' key reources include physical resources, financial resources and proper risk control strategy. HEIs have formed partnerships with critical partners which include amongst other TENET and SANReN, supporting partners which include amongst other Dimension Data, BCX, NEOTEL, ISV and FortiNet, critical suppliers which include amongst other TENET and supporting supplier which include amongst other Dimension Data, FortiNet, FixCan, DNI, BCX, NEOTEL, Internet Solutions, Bytes, SANReN and own (Internal) staff. The following section summarises the chapter.

5.7. Summary

This chapter addressed RQ$_4$ which asks, "*What are the current Internet Management practices at Higher Education Institutions in South Africa?*" and RQ$_5$ which asks, "*What are the national best practices adopted for Internet management at South African Higher Education Institutions?*". The chapter completed the objectives which were to conduct an empirical evaluation of Internet management practices at Higher Education Institutions in South Africa and from this to identify the national best practices adopted for Internet management at South African Higher Education Institutions.

Chapter 5 focused on identifying and discussing the participants' biographical information, the Universities general information, ICT governance practices and each of the nine building blocks that institute the business model canvas. The findings indicated that the Internet and its relevant resources are extremely important to all HEIs. These findings are to a large extent aligned with the NRENs business models and the requirements of the Internet community.

The HEIs cater for a large Internet community but do not differentiate between the members, most HEIs follow good ICT governance practices, the Internet is provided at no cost and is funded via Council funds. The staff and student requirements are mostly similar with minor

priority differences to key content needs. Internet resources are aligned to support the physical infrastructure of the Internet. The types of relationship that are required and that staff and students expect and consequently are implemented are Personal Assistance, Self-Service and Automated Services in that order and most HEIs consider the NRENs as key partners and suppliers with additional local suppliers used as secondary support. Some interventions are required for those HEIs who do not comply with the Internet Management Business Model. The chapter concluded by identifying the most commonly adopted Internet management practices, which will constitute the national best practices adopted for Internet management at South African Higher Education Institutions presented in the form of the business model canvas.

Chapter 6 provides a comprehensive analysis of the collected empirical data of the NMUIUS and Nelson Mandela University Firewall Logs. The NMUIUS analysis will be compiled by analysing each research question and presenting these findings in a clear and logical manner while the Nelson Mandela University Firewall log Files will be analysed and the findings presented in a clear and logical manner. Therefore, the research objectives of this chapter are focused on RO_6, which is to conduct an evaluation of the staff and students' Internet usage at Nelson Mandela University and RO_7 which is to conduct an evaluation of the staff and students' Internet usage as recorded in the Nelson Mandela University Firewall Log files. These are achieved by asking RQ_6, which questions "*What are the staff and students within Nelson Mandela University using the Internet for?*" and RQ_7, which questions "*What are the staff and students within Nelson Mandela University using the Internet for, according to the Firewall log files?*".

6. RESULTS AND ANALYSIS OF THE NMUIUS AND NELSON MANDELA UNIVERSITY FIREWALL LOG FILES

6.1. Introduction

Chapter 5 presented and discussed the findings of the HEIIMS. The HEIIMS captured the participants' biographical information, the universities' general information, ICT governance practices and each of the nine building blocks that constitute the business model canvas. The most commonly adopted Internet management practices were identified and recorded in the BMC. The SA HEIs Internet Management Business Model Canvas constitutes the national best practices adopted for Internet management at South African Higher Education Institutions.

Chapter 6 addresses RQ$_6$ which asks, "*What are the staff and students within Nelson Mandela University using the Internet for?*" and RQ$_7$ which asks, "*What are the staff and students within Nelson Mandela University using the Internet for, according to the Firewall log files?*". The objective of the chapter is to conduct an evaluation of the staff and students' Internet usage at Nelson Mandela University and to conduct an evaluation into the Internet usage by staff and students' as recorded in the Nelson Mandela University Firewall log files. The NMUIUS was compiled and distributed to all Nelson Mandela University staff and students. The NMUIUS focused on determining what Nelson Mandela University's users are currently using the Internet for. To achieve this, the Nelson Mandela University firewall log files were collected and processed to determine what the Nelson Mandela University's users actually used the Internet for. The combined findings will be presented in this chapter. Figure 6.1 illustrates an overview of the research objectives for this chapter.

Chapter 6 provides a comprehensive analysis of the collected empirical data sections. To achieve this, an empirical evaluation of the Nelson Mandela University staff and students' Internet usage practices was conducted. In addition, an empirical evaluation of the actual Nelson Mandela University staff and students Internet usage practices as per the firewall log files data were conducted. The findings are presented and the anomalies between indicated Internet usage and actual Internet usage according to the log files are identified. A summary of the findings conclude the chapter. See Figure 6.2 for a Structural overview of Chapter 6.
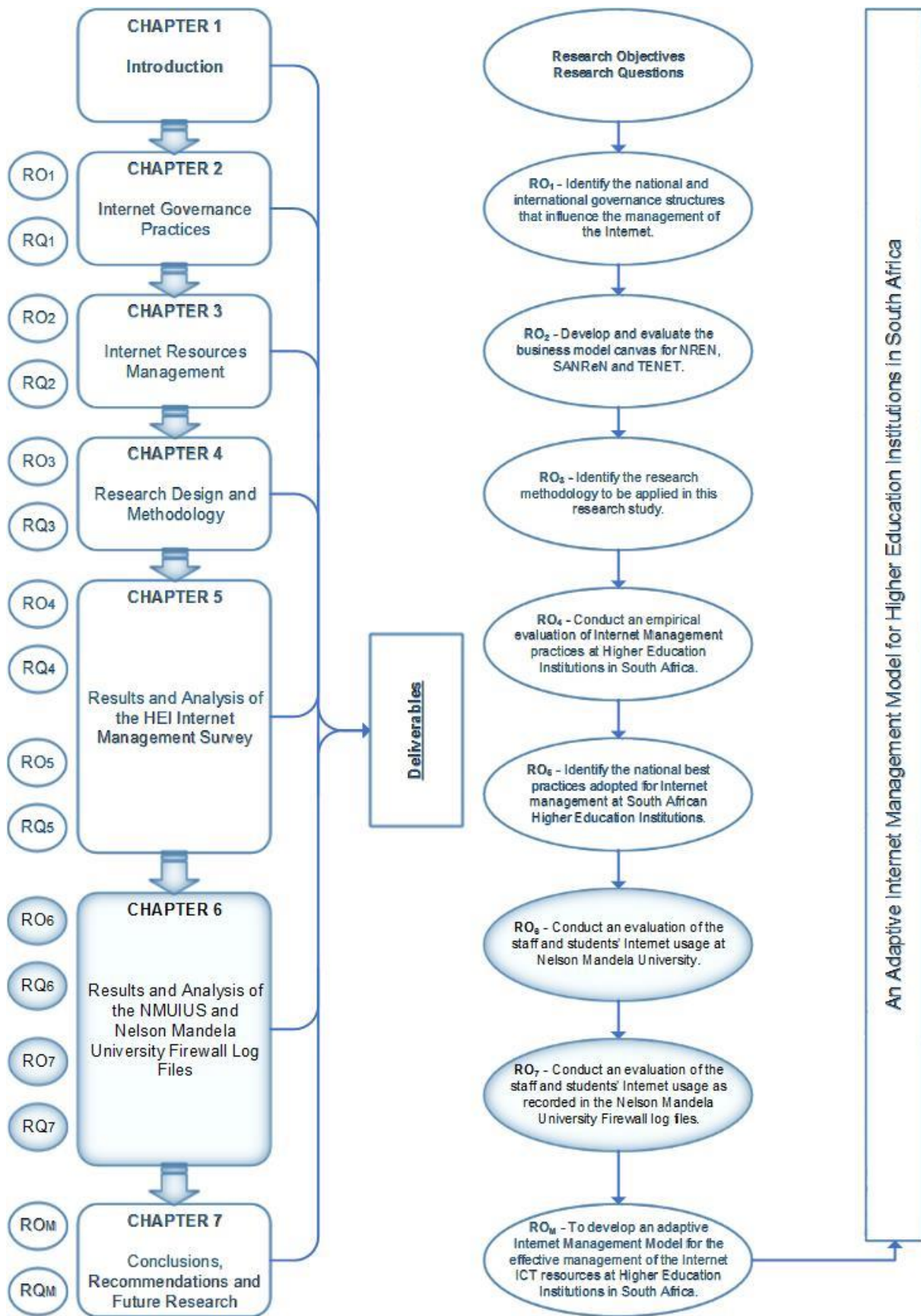
Figure 6.1: Chapter 6 Overview of the Research Objectives.

| Chapter 1: Introduction |
| Chapter 2: Internet Governance Practices |
| Chapter 3: Internet Resources Management |
| Chapter 4: Research Design and Methodology |
| Chapter 5: Results and Analysis of the HEI Internet Management Survey |

Chapter 6: Results and Analysis of the NMUIUS and Nelson Mandela University Firewall Log Files

6.1. Introduction
6.2. Analysis of Empirical Results of the NMUIUS and Nelson Mandela University Firewall Log Files
6.3. Section 1: Demographic Information
6.4. Section 2: Governance
6.5. Section 3: Usage and Access Duration
6.6. Section 4: Content
6.7. Section 5: Primary Purpose
6.8. Section 6: Management
6.9. Summary

| Chapter 7: Conclusions, Recommendations and Future Research |

Figure 6.2: Structural Overview of Chapter 6.

6.2. Analysis of Empirical Results of the NMUIUS and Nelson Mandela University Firewall Log Files

Nelson Mandela University is a comprehensive South African Higher Education Institute situated in Port Elizabeth, Eastern Cape and George, Western Cape, which formed the basis of this study. The NMUIUS was created and distributed within this environment, meaning that all the respondents who participated in this study were affiliated as current staff or students from Nelson Mandela University. The NMUIUS prompted the participants to provide their input on their Internet awareness, habits, usage and practices at the Nelson Mandela University. The NMUIUS obtained demographic information, user-governance awareness, their usage and access duration, content access, the primary purpose for using the Internet and general views of the management of the Nelson Mandela University Internet. These combined findings provide a holistic view of the Nelson Mandela University Internet users' awareness, habits, usage and actual practices.

The Nelson Mandela University firewall log files are recorded and stored by the Nelson Mandela University as part of its standard Internet management practices. The Nelson Mandela University firewall log files were imported into the Nelson Mandela University Sawmill universal log analysis software package for processing. The processing included the removal of any Personal Identifiable Information (PII), separating the data of staff and students and categorising it into the six main Fortigate web dimensions and subsequent seventy-nine Fortigate web filtering classifications. The six main Fortigate web dimensions include Security Risk, General Interest - Business, Adult/Mature Content, Bandwidth Consuming, Potentially Liable and General Interest - Personal with each having a multitude of assigned Fortigate web filtering classifications. The six main Fortigate web categories were linked to the cyberloafing approaches or constructs as created by Blanchard and Henle (2008) and reused by Kalayci (2010) and Yaşar and Yurdugül (2013). The Fortigate firewall categories are logically grouped by the cyberloafing approaches or constructs requirements. The results establish statistical data on the exact Internet content being accessed in the Nelson Mandela University Internet environment for staff and students.

These cyberloafing approaches or constructs are a grouping of similar levels of activities used to measure cyberloafing. Originally the groupings was into minor cyberloafing activities such as receiving, checking and sending personal email, surfing mainstream web sites including financial, news, auction, sports, stock sites and shopping online and serious cyberloafing activities such as personals and gambling sites, chatrooms, virtual communities, updating webpages, downloading music and reading blogs. This approach was adopted and aligned with the Fortigate firewall categories, which are already logically grouped according to the cyberloafing approaches or constructs requirements. See Appendix H for the 6 Web Filtering categories.

Each question in the NMUIUS was analysed and discussed individually, however, only the most significant and relevant findings as required for the proposed adaptive Internet Management Model are presented in this chapter. The remainder of the analysed and discussed findings have been placed on the attached CD.

6.2.1. NMUIUS Response Rate and Nelson Mandela University Firewall Log Files

The NMUIUS was distributed via the Nelson Mandela University Communication and Stakeholder Liaison Department in the form of an email. The email was then sent to the entire Nelson Mandela University population, which was a total of 28 974 Nelson Mandela University Internet users. The Nelson Mandela University population was made up of 3 730 Nelson

Mandela University staff members and 25 244 Nelson Mandela University students. The final number of responses received was 678, which comprised of 49 academic staff, 89 administrative staff (138 staff members in total) and 540 registered students.   The 678 responses were adequately completed and met all the preconditions identified for this study. This equates to a response rate of 2.34 percent. Both Statisticians, Dr Danie Venter and Dr Jan du Plessis deemed these response rates to be acceptable for statistical analysis.

The Firewall data were collected from all Internet traffic that travelled between the Nelson Mandela University network through the Nelson Mandela University Firewall and the Internet. All transactions were logged onto the log server and were used in this study.   The period included 01 January 2014 to 29 February 2016 and constituted a total of 1.4 petabytes (PB) of Internet traffic. From the total, 331.7 terabytes (TB) were allocated to staff Internet traffic and 1 PB to student Internet traffic. Unfortunately, due to the Edward Snowdon saga (Epstein, 2017), much Internet traffic has become mainly encrypted, meaning that the Nelson Mandela University Firewall was unable to read some of the traffic and therefore captured it in the category titled 'empty'. For staff, 83.2 TB or 25.08 percent of all traffic was classified as empty while for students, 524.1 TB or 25.82 percent of all traffic was classified as empty. Due to the abundance of Firewall data available to the researcher, no required response rate was stipulated by the Nelson Mandela University Ethics Committee.

6.2.2. Main Study NMUIUS

The NMUIUS consisted of six data gathering sections. See Appendix F - NMUIUS. These included:

- Section 1: Demographic Information;
- Section 2: Governance;
- Section 3: Usage and Access Duration;
- Section 4: Content;
- Section 5: Primary Purpose; and
- Section 6: Management.

Section 1: Demographic Information captured the participants' demographic information, for example, gender, age, affiliation, etc. The information was used to gain a deeper understanding of the representation and distribution of the participants as well as their current personal Internet ownership status (if they have Internet at home or on their mobile devices). Section 2: Governance was used to identify the level of policy awareness and its acceptance and support, which was followed by the device preferences and primary Internet value

requirements. Section 3: Usage and Access Duration was used to capture information regarding the duration of time spent on the Nelson Mandela University Internet during office hours, after office hours and over weekends, accessing work/academic and non-work/non-academic content. Section 4: Content was used to capture how frequently participants access specific content as per the Fortiguard Categorisation Criteria and therefore the captured Firewall data categories.

Section 5: The Primary Purpose was used to capture the participants' primary purpose for using the Nelson Mandela University Internet during office hours, after office hours and over weekends. Section 6: Management was used to capture the general views of participants on aspects of the Nelson Mandela University's Internet management practices and Internet value offerings. The following section presents and discusses the findings for Section 1: Demographical Information.

6.3. Section 1: Demographic Information

The NMUIUS demographic section captured the following:

- Gender;
- Age;
- Campus;
- Student, Academic Staff or Administrative Staff. This question is, however, not discussed below as the focus is on the differences between staff and students;
- Internet at Home; and
- Mobile Internet.

See Appendix I – NMUIUS's Demographic Information.

6.3.1. Analysis of Results for Section 1: Demographic Information

The detailed analysis of results for all questions covered in Section 1: Demographic Information be found on the attached CD. The distribution of all respondents (n = 678) is divided between staff (n = 138) and students (n = 540). The gender distribution of all respondents consisted of 57 percent (n = 79) females and 43 percent (n = 59) males. From all the registered students (n = 540) who participated in this study, 46 percent (n = 248) were females and 54 percent (n = 292) were males. The total number of female respondents was 48 percent (n = 327) and the total number of male respondents was 52 percent (n = 351). The combined gender distribution of all respondents is therefore considered as diverse and well-balanced and representative of the Nelson Mandela University Internet community population.

The majority of students are in the 'below 20' age group with 28 percent students (n = 152) and '21 - 29' age group with 63 percent students (n = 341). The majority of staff are represented in the '30 - 39' age group with 24 percent staff (n = 33), the '40 – 49' age group with 21 percent staff (n = 29) and '50 +' with 40 percent staff (n = 55). The findings indicate that a large portion of staff are aged '50 +' with the remaining staff participants being distributed between '21 - 49'. The staff complement is therefore well dispersed across the maturing population. The student population is primarily situated in '21 - 29' age group with a large representation also found in the 'below 20' age group. There is a minor and decreasing participation rate from '30 - 39' towards '50 +'.

All Internet resources should be created and managed by taking into account their target audience. For staff, the Internet resources should be aligned with the requirements of Generation Y, Xennials, Generation X and Baby Boomer Generation and for students the Internet resources should be aligned with the requirements of Generation Z and Generation Y (Robinson, 2017). Key considerations should include what influences them (cultural factors, social factors, personal factors and psychological factors), preferred communication methods, technology knowledge, device preferences, etc.

Regarding the use of the Internet at home, 72 percent (n = 99) of staff have a physical Internet connection at home while 28 percent (n = 39) have no connection. Forty-three percent (n = 231) of students have a physical Internet connection at home while 57 percent (n = 309) have no connection. The findings indicate that the majority of staff have an active Internet connection at home compared to a larger number of students who do not have an active Internet connection at home. Staff members are therefore able to use the Internet at office for work and it is therefore expected that they are more familiar with being connected to the Internet and would therefore use the Nelson Mandela University's Internet in an acceptable manner. The majority of students do not have an Internet connection at home and would therefore be bound to the Nelson Mandela University Internet to be able to fulfil their academic obligations. It is therefore expected that students would use the Internet extensively during office hours to ensure that work is completed before they leave to go home. Lastly, resources must be allocated to assist the students to in gain access to the Internet on campus, taking into consideration the number of students per campus.

Regarding mobile Internet access, 88 percent (n = 121) of staff have an active mobile Internet connection with 12 percent (n = 17) do not have Internet access. Eighty percent (n = 432) of students have an active mobile Internet connection while 20 percent (n = 108) do not have

Internet access. The findings indicate that the majority of staff and students have an active mobile Internet connection used to browse the Internet. Staff and students are therefore not always bound to use only the Nelson Mandela University Internet, however to use the university facility, would still be preferred as mobile data in South Africa is extremely expensive compared to other countries. Having a mobile Internet connection means that more devices will be connected to the network at the same time with continuous access to richer content. The physical network must therefore be setup to accommodate the mobile devices as well as keep unsecure devices off the network. Lastly, the Internet resources must be created and maintained to keep a balance between those who use the Internet for work/academic purposes and those who use the Internet for non-work/non-academic purposes. The following sub-section presents and discusses the findings for Section 2: Governance.

6.4. Section 2: Governance

Tables 6.1 - 6.2 depict selected findings captured from the staff (n = 138) and students (n = 540) regarding the Nelson Mandela University Internet governance. The Nelson Mandela University Internet governance covers the level of policy awareness and its acceptance and support, which was followed by the device preferences and primary Internet value requirements.

6.4.1. Analysis of Results for Section 2: Governance

From all responses (n = 678) received from staff (n = 138) and students (n = 540) for the question, 'Are you aware of the Nelson Mandela University General ICT Policy?', 79 percent (n = 109) of the staff respondents indicated 'Yes' while only 46 percent (n = 250) of the student respondents indicated 'Yes'. Based on the frequencies, the awareness of of staff and students of the General ICT Policy was found to be significantly different (Chi² (d.f. = 1, n = 678) = 47.14; p < .0005; V = 0.26 Small). Staff were more aware than the students of the General ICT Policy. For the staff (n = 109) and students (n = 250) respondents who indicated 'Yes, to the question, 'Are you aware of the Nelson Mandela University General ICT Policy?', 75 percent (n = 82) of the staff and 72 percent (n = 179) of the student respondents specified that they had read and understood the General ICT Policy. Based on the frequencies, the difference between those staff and students who had read and understood was found to be not statistically significant (Chi² (d.f. = 1, n = 359) = 0.50; p = .478). For the staff (n = 109) and students (n = 250) respondents who indicated 'Yes, to the question, 'Are you aware of the Nelson Mandela University General ICT Policy?', 83 percent (n = 91) of the staff and 81 percent (n = 202) of the student respondents specified that they agree with the General ICT Policy. Based on the frequencies, the difference between those staff and students who agree

with the General ICT Policy was found not to be statistically significant (Chi² (d.f. = 1, n = 359) = 0.37; p = .546).

The findings indicated that the majority of staff are aware of the Nelson Mandela University General ICT Policy compared to the number of students that are not aware of the Nelson Mandela University General ICT Policy. The Nelson Mandela University General ICT Policy, as with all institutional policies, is located on the internal staff and student websites under the category Official Stuff - Official Policies - Official University Policies. The Nelson Mandela University General ICT Policy is used by top management, with some elements stemming from NREN, to influence or help to stipulate the course of action that Nelson Mandela University takes regarding its ICT resources. The policies are well communicated via Internet email communication and with any new update, management is required to communicate the changes to the staff and students within their Department/Section/Faculty.

It is crucial that the Nelson Mandela University Internet community familiarise themselves with the Nelson Mandela University General ICT Policy as this is the preferred method of instilling the set norms and values around ICT Internet resources. The majority of staff and students are aware of the policy, have read and understood, as well as agree with its content and therefore its purpose. There is, however, still a small portion of each grouping that has not read and understood as well as agreed, with the Nelson Mandela University General ICT Policy. It is critical to determine the cause of this and address it immediately. Failure to abide by the policy will lead to unwanted Internet behaviour and misuse of the Internet resources.

From all responses (n = 678) received from staff (n = 138) and students (n = 540) for the question, 'Are you aware of the Acceptable Use Policy?', 62 percent (n = 85) of the staff respondents indicated 'Yes' while 47 percent (n = 255) of the student respondents indicated 'Yes'. Based on the frequencies, the awareness of staff and students of the Acceptable Use Policy was found to be significantly different (Chi² (d.f. = 1, n = 678) = 9.08; p = .003; V = 0.12 Small). Staff were more aware than the students of the Acceptable Use Policy. For the staff (n = 85) and students (n = 255) respondents who indicated 'Yes', to the question, 'Are you aware of the Acceptable Use Policy?', 82 percent (n = 70) of the staff respondents and 77 percent (n = 196) of the student respondents specified that they had read and understood the Acceptable Use Policy. Based on the frequencies, the difference between those staff and students who had read and understood was found to be not statistical significant (Chi² (d.f. = 1, n = 340) = 1.13; p = .288). For the staff (n = 85) and students (n = 255) respondents who indicated 'Yes', to the question, 'Are you aware of the Acceptable Use Policy?', 83 percent (n

= 91) of the staff respondents and 81 percent (n = 202) of the student respondents specified that they agree with the Acceptable Use Policy. Based on the frequencies, the difference between those staff and students who agree with the Acceptable Use Policy was found to be significantly different (Chi² (d.f. = 1, n = 340) = 8.28; p = .004; V = 0.16 Small). More staff were found to agree with the Acceptable Use Policy than students.

The findings indicated that the majority of staff are aware of the Nelson Mandela University Acceptable Use Policy as compared to students who not aware of the Nelson Mandela University Acceptable Use Policy. This is similar to the trend found in the Nelson Mandela University General ICT Policy awareness question. The Nelson Mandela University Acceptable Use Policy is the set of instructions which guides the proper use of the ICT Internet resources. The Acceptable Use Policy forms part of the Nelson Mandela University General ICT Policy and is therefore included as a subsection of it. It specifically covers general usage of ICT resources, with each main ICT policy focusing on specific acceptable use of that system. For example, the acceptable use of email accounts will be included in the Electronic Messaging Systems (Including Email) policy section. Furthermore, the Nelson Mandela University Acceptable Use Policy is displayed on all laboratory computers as part of the login page. Once a user logs into the system, he/she is prompted to read and accept the policy before displaying the Windows Welcome Screen. All logs are stored centrally as proof that the users did read and accept the Nelson Mandela University Acceptable Use Policy.

The majority of staff and students have read and understood the Nelson Mandela University Acceptable Use Policy and are in agreement with the policy. There is, however, a small portion of each grouping who have not read and understood nor agree with the Nelson Mandela University Acceptable Use Policy. It is essential to determine the cause of this and address it immediately. Failure to abide by the policy will lead to unacceptable Internet behaviour and misuse of the Internet resources.

From all responses (n = 678) received from staff (n = 138) and students (n = 540) for the question, 'How many devices do you use to connect to Nelson Mandela University's Internet on a day to day basis?', 22 percent (n = 30) of the staff respondents and 39 percent (n = 213) of the student respondents indicated 'One'. Fifty-one percent (n = 71) of the staff respondents and 53 percent (n = 286) of the student respondents indicated 'Two'. Twenty-one percent (n = 29) of the staff respondents and 6 percent (n = 31) of the student respondents indicated 'Three'. Based on the frequencies, the relationship between the number of devices used by staff and students connect to the Internet was found to be significantly different (Chi² (d.f. = 4,

n = 678) = 46.22; p < .0005; V = 0.26 Small). Students had more devices to connect to the Internet than staff.

The findings indicated that the majority of staff and students have two devices that they use to connect to the Nelson Mandela University's Internet. This is followed by a smaller number of staff having one device, followed closely with three devices. A smaller number of students use one device that they use to connect to the Nelson Mandela University's Internet. As can be seen in the following results, staff prefer laptops and desktops whilst the majority of students prefer smartphones. The majority of staff are allocated a device (laptop or desktop) which he/she can work on. Also, these staff devices are all allocated a fixed network connection, so in most cases they will not connect to the wireless network.

Students on the other hand are allocated PCs which are stationed in the General Computer Laboratories and connected via a fixed network connection. The PCs in the General Computer Laboratories are, however, shared computers and are not allocated to a specific student. This therefore means that if staff have indicated two devices, one is a work device and another a personal device e.g. work laptop and smartphone. Students would in most cases have their own devices e.g. personal laptop and smartphone as the majority of students are not given a device. It can therefore be argued that a large number of devices on the network consists of Nelson Mandela University Council-owned devices and are connected via a fixed network connection whilst the majority of devices (taking into account the student population) are BYOD, which are non-Council funded devices and are connected via a wireless connection to the Internet.

Figure 6.3 depicts the number of wireless connected devices for that week, dated 12 September 2016 - 18 September 2017. All uniquely associated wireless devices are collected in a period of a week (data collection period before being reset). Thereafter, the logs are refreshed and the data were collected for the next week period. The number of devices connected on a weekly basis can therefore be identified as non-Council funded devices, meaning they are BYOD. This action puts additional strain on the Nelson Mandela University Internet resources as there are now more devices connected than was originally planned. The findings indicate that, 1) there is a requirement for connectivity of all devices, 2) proper capacity planning is required, especially on the wireless networks side and 3) planning must be considered regarding the required Internet values (Speed, Availability (connectivity) and Safety and Security) as these are all directly affected by BYOD.
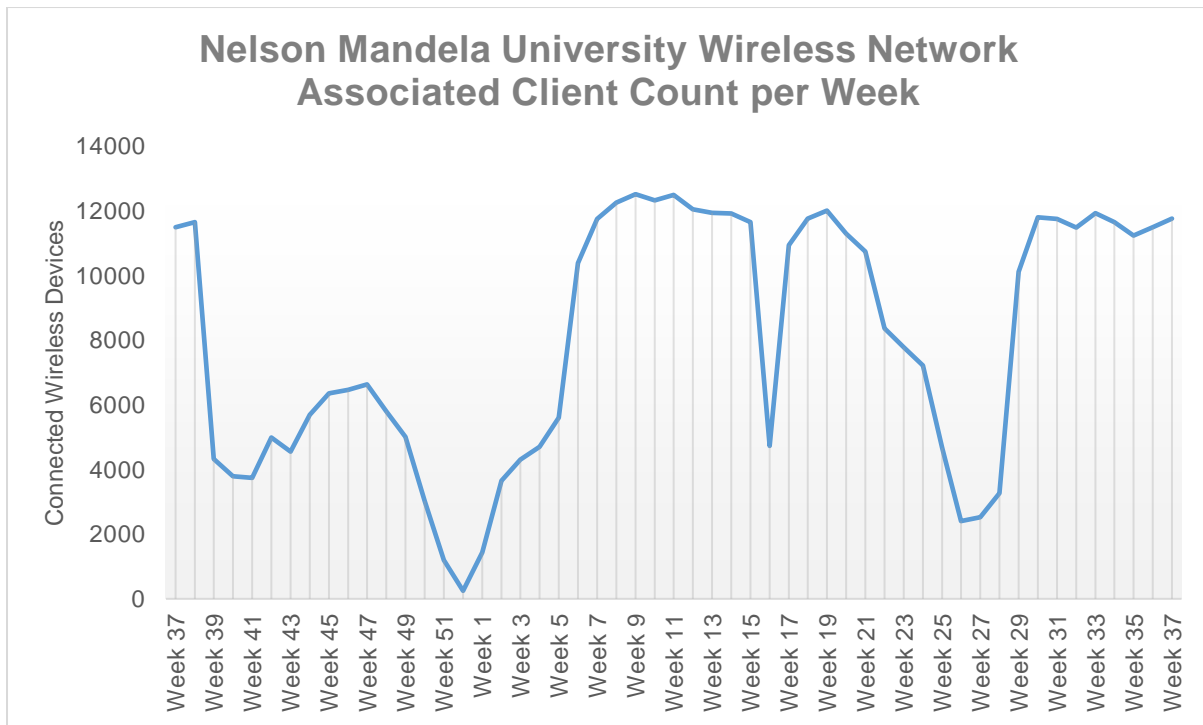
Figure 6.3: Nelson Mandela University Wireless Network Associated Client Count per Week.

The responses received from staff (n = 138) and students (n = 540) for the question, 'What type of device do you mainly use to connect to Nelson Mandela University's Internet?', 46 percent (n = 64) of the staff and 16 percent (n = 87) of the student respondents indicated 'Desktop Computer'. Twenty-two percent (n = 151) of all respondents indicated 'Desktop Computer'. Forty-six percent (n = 63) of the staff and 24 percent (n = 130) of the student respondents indicated 'Laptop'. Twenty-eight percent (n = 193) of all respondents indicated 'Laptop'. Seven percent (n = 10) of the staff respondents and 53 percent (n = 285) of the student respondents indicated 'Smartphone'. Forty-four percent (n = 295) of all respondents indicated 'Smartphone'. Based on the frequencies, the relationship between staff and students devices to connect to the Internet was found to be significantly different (Chi² (d.f. = 4, n = 678) = 116.93; p < .0005; V = 0.42 Medium). Staff use different devices than students to connect to the Internet.

The findings indicated that the majority of staff prefer desktop computers and laptops. The majority of students prefer smartphones with a small portion preferring laptops followed by desktop computers. It should be noted that the student desktop computer findings would in this case refer to the General Computer Laboratory computers provided by the University. The findings clearly identify a difference between the user groups. Internet resources must therefore be allocated according to the preferred devices. For example, staff would require a mixture of fixed network connections (most likely administrative staff) with some requiring

wireless network connections (most like academic staff) and students requiring wireless network connections.

A balance between wired network and wireless network must be kept, taking into account the preference of the target audience. Furthermore, academic resources such as e-learning platforms, surveys, websites, applications, etc. must be aligned to accommodate smartphones. It is therefore preferable that HEIs adopt a Mobile Device Management solution to manage these devices. The Internet value requirement of 'Safe and Secure' would be vital in this space to ensure that only authorised users are allowed to access the Nelson Mandela University Internet and ICT resources.

Table 6.1: Top Four Primary Internet Value Requirements for the Nelson Mandela University Internet.

	Staff	**Students**
Value 1	Speed	Speed
Value 2	Availability (connectivity)	Availability (connectivity)
Value 3	Safe and Secure	Safe and Secure
Value 4	Reliability	Reliability

For the question, 'What are your top four primary Internet value requirements for the Nelson Mandela University Internet?', a detailed analysis was conducted and is included on the CD. From the findings, the top four primary Internet value requirements for the Nelson Mandela University Internet were extracted and are presented in Table 6.1. Eighty-four percent (n = 116) of the staff and 84 percent (n = 455) of the student respondents indicated 'Speed' as one of the top four value requirements. Based on the frequencies, the relationship between staff and students was found to be not statistical significant (Chi² (d.f. = 4, n = 678) = 2.91; p = .406). Seventy-two percent (n = 100) of the staff and 76 percent (n = 411) of the student respondents indicated 'Availability (connectivity)' as one of the top four value requirements. Based on the frequencies, the relationship between staff and students was found not to be statistically significant (Chi² (d.f. = 4, n = 678) = 3.47; p = .325).

Fifty-nine percent (n = 81) of the staff and 50 percent (n = 269) of the student respondents indicated 'Safe and Secure' as one of the top four value requirements. Based on the frequencies, the relationship between staff and students was found not to be statistically significant (Chi² (d.f. = 4, n = 678) = 3.71; p = .294). Forty-eight percent (n = 66) of the staff and 37 percent (n = 202) of the student respondents indicated 'Reliability' as one of the top

four value requirements. Based on the frequencies, the relationship between staff and students was found not to be statistically significant (Chi² (d.f. = 4, n = 678) = 5.83; p = .120). Staff and students therefore have similar Internet value requirements.

The findings indicated that the majority of staff and students identified 'Speed' as the most important Internet value requirement. This is followed by 'Availability (connectivity)' as the second most important Internet value requirement and lastly, staff and students identified 'Safe and Secure' as the third most important Internet value requirement. It is clear from the findings that the Internet value requirements for the Nelson Mandela University Internet are very similar even though they use different methods (fixed vs wireless) to access the Internet and different devices (desktops computers and laptops vs smartphones). In order to address these Internet value requirements, Nelson Mandela University must have the correct funding structures to support the costs associated with 'Speed' (bandwidth costs) and 'Availability (connectivity)' (physical infrastructure costs) and the correct security controls (with supporting ICT governance structures) to secure the Internet threat landscape.

Table 6.2: Preferred Method of Communication when Receiving Internet User Support.

	Staff	Students
Method 1	Email	Email
Method 2	Phone	Phone
Method 3	Web Service	Web Service
Method 4	Web Chat	Web Chat

For the question, 'What method of communication would you prefer when receiving Internet user support?', a detailed analysis was conducted and is included on the CD. From the findings, the top four methods of communication when receiving Internet user support were extracted and are presented in Table 6.2. Fifty-one percent (n = 71) of the staff and 71 percent (n = 381) of the student respondents indicated 'Email'. Thirty percent (n = 42) of the staff and 16 percent (n = 87) of the student respondents indicated 'Phone'. Seven percent (n = 9) of the staff and 4 percent (n = 24) of the student respondents indicated 'Web Self-Service'. Seven percent (n = 9) of the staff and 3 percent (n = 16) of the student respondents indicated 'Web Chat'. Based on the frequencies, the relationship between preferred method of communication of staff and students was found to be significantly different ((Chi² (d.f. = 8, n = 678) = 38.84; p < .0005; V = 0.24 Small). Although the method order is the same, it was found internally (percentage) that staff prefer 'Phone', 'Web Self-Service' and 'Web Chat' more than students while students prefer 'Email' more than staff.

The findings indicated that the majority of staff identified 'Email' as the preferred method of communication when receiving Internet user support and more students identified 'Email' as the preferred method of communication when receiving Internet user support. A small number of staff identified 'Phone' as the preferred method of communication when receiving Internet user support while a large number of students identified 'Phone' as the preferred method of communication when receiving Internet user support. It is clear that the majority of staff prefer 'Email' while the students prefer 'Email' with some preferring 'Phone' as the method of communication when receiving Internet user support. These findings are in line with the preferred type of relationships that staff and students expect from the HEIs and the first type of relationships established in the HEIs, being 'Personal Assistance'. There are, however, differences as staff and students do not prefer Self-Service' and 'Automated Services' as a method of communication when receiving Internet user support. The following section presents and discusses the findings for Section 3: Usage and Access Duration.

6.5. Section 3: Usage and Access Duration

Figures 6.4 - 6.9 depicts the findings captured from the staff (n = 138) and students (n = 540) regarding the Nelson Mandela University Internet usage and access duration. The Nelson Mandela University Internet usage and access duration was used to capture information regarding the duration of time spent on the Nelson Mandela University Internet during office hours, after office hours and over weekends accessing work/academic and non-work/non-academic content.

6.5.1. Analysis of Results for Section 3: Usage and Access Duration

Figure 6.4 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the question, 'How many hours per day on average do you use Nelson Mandela University's Internet for work/academic purposes during office hours on weekdays?'. Nineteen percent (n = 26) of the staff and 38 percent (n = 205) of the student respondents indicated '1 - 3 hours'. Twenty-two percent (n = 31) of the staff and 23 percent (n = 123) of the student respondents indicated '4 - 5 hours'. Fifty-four percent (n = 74) of the staff and 22 percent (n = 118) of the student respondents indicated 'More than 5 hours'. Based on the frequencies, the relationship between staff and students use during office hours was found to be significantly different (Chi² (d.f. = 4, n = 678) = 62.26; p < .0005; V = 0.30 Medium). The staff Internet usage for work/academic purposes is higher that student Internet usage.

Work/Academic Purposes During Office Hours on Weekdays
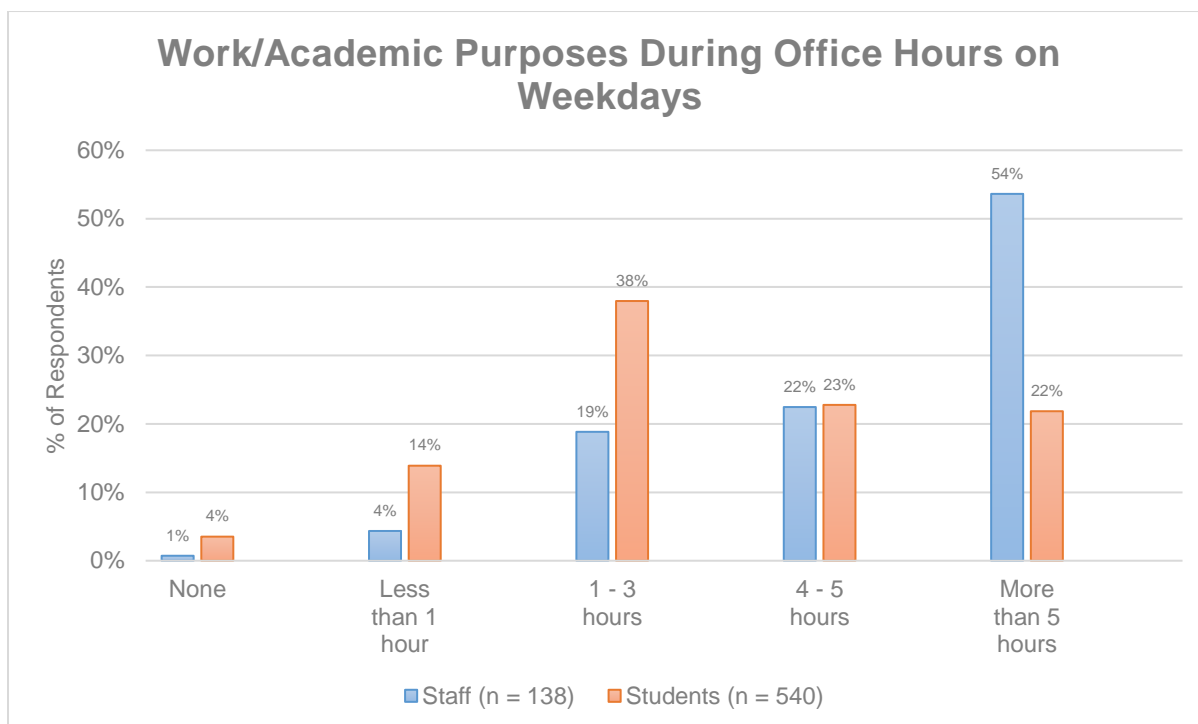
Figure 6.4: Work/Academic Purposes During Office Hours on Weekdays.

The findings indicated that during the day the majority of staff use the Internet for work/academic purposes more than 5 hours per day, with some staff using it for '4 - 5 hours' followed by '1 - 3 hours'. Students on the other hand use the Internet for work/academic purposes for '1 - 3 hours', followed by some using it for '4 - 5 hours', with a small percentage who use it more than 5 hours and some for 1 hour. As previously mentioned, the majority of staff are office bound and have a fixed Internet connection for their Council funded device. The latter is done on purpose as they are expected to use the Internet for work/academic purposes. Staff generally work an 8 hour day and administrative staff can in most cases be found in their offices with academic staff being bound to the office or lecture venue. Students on the other hand are in most cases only bound to the Campus. They attend classes at various venues and can use any of the General Computer Laboratories across all campuses. Furthermore, they have course specific laboratories which are dedicated to their field of study or module codes only. Students therefore spend most of their time attending lectures and use the time between lectures or during laboratories to access the Internet for work/academic purposes. It is expected that those students that use the Internet for longer periods either have a day off, have extended gaps between classes or are postgraduate students. The students that have no Internet at home, as supported in the Internet at home question, must therefore stay on campus to be able to complete their academic obligations.
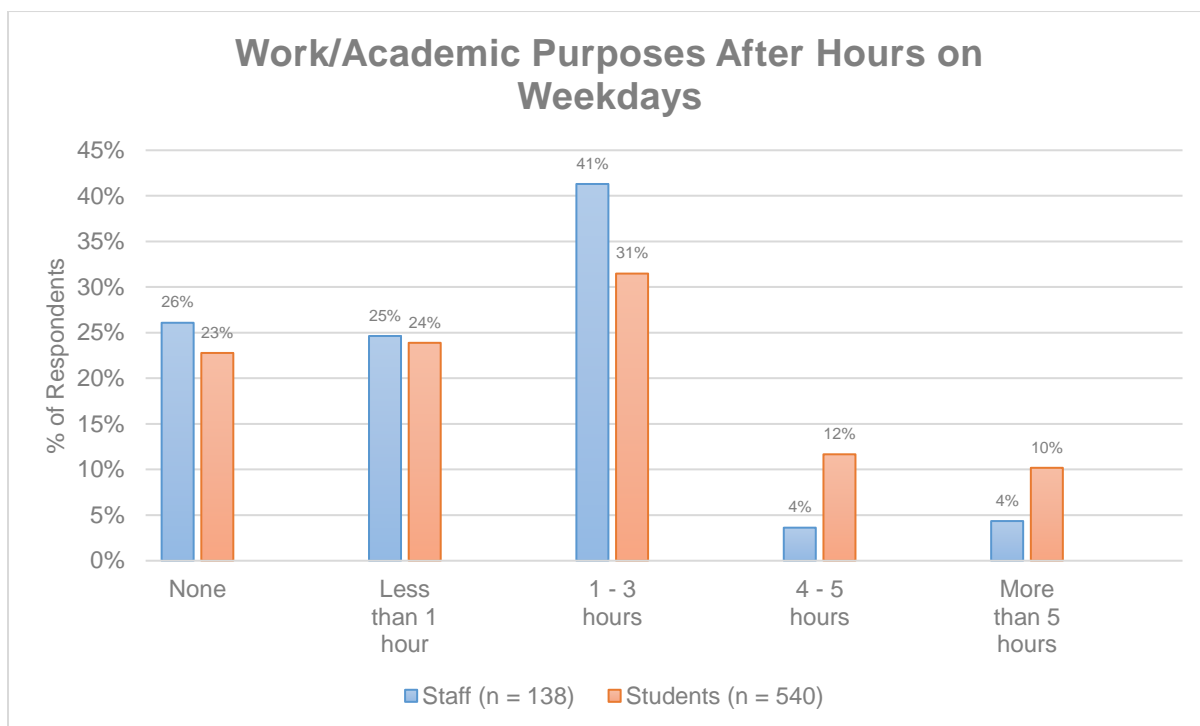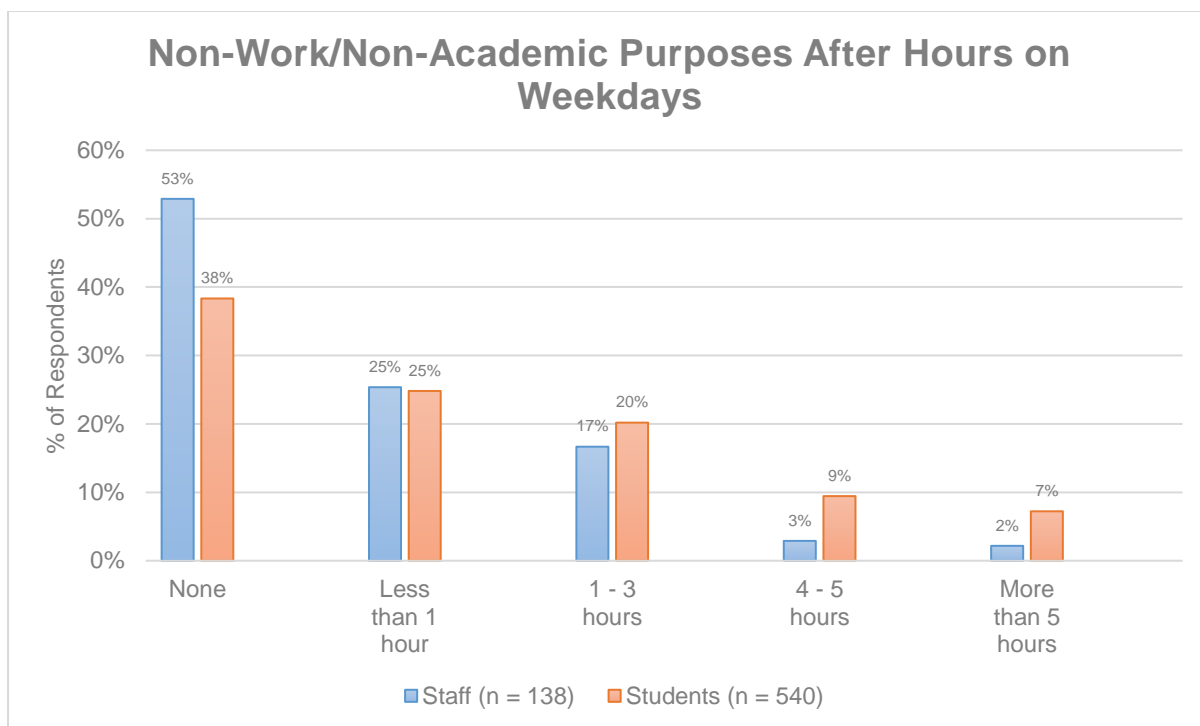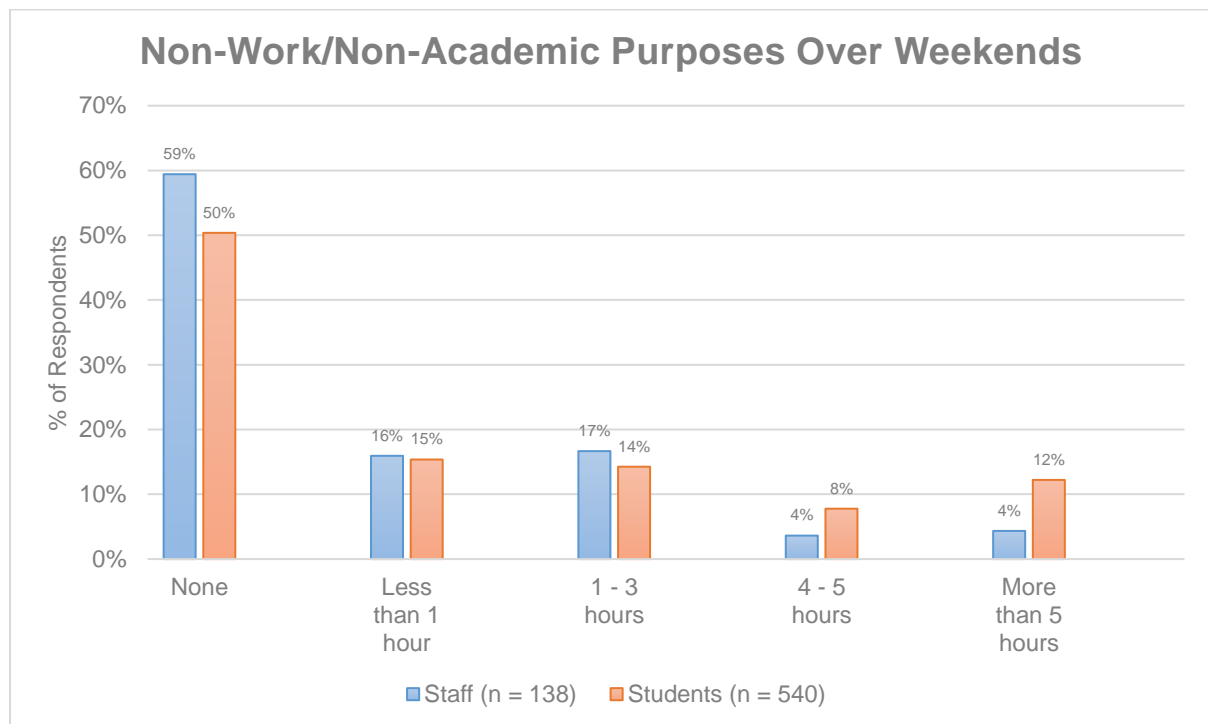
Figure 6.5: Work/Academic Purposes After Hours on Weekdays.

Figure 6.5 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the question, 'How many hours per day on average do you use Nelson Mandela University's Internet for work/academic purposes after hours on weekdays?'. Twenty-six percent (n = 36) of the staff and 23 percent (n = 123) of the student respondents indicated 'None'. Twenty-five percent (n = 34) of the staff and 24 percent (n = 129) of the student respondents indicated 'Less than 1 hour'. Forty-one percent (n = 57) of the staff and 31 percent (n = 170) of the student respondents indicated '1 - 3 hours'. Based on the frequencies, the relationship between use by staff and students after hours on weekdays was found to be significantly different (Chi² (d.f. = 4, n = 678) = 14.96; p = .005; V = 0.15 Small). Staff use the Internet more than students after hours on weekdays for work/academic purposes.

The findings indicated that after office hours on weekdays the majority of staff use the Internet for work/academic purposes 1 - 3 hours per day, but some staff do not use it at all followed by less than 1 hour. Students on the other hand use the Internet for work/academic purposes for 1 - 3 hours after hours on weekdays, followed by some who use it for less than 1 hour and some do not use it at all. After hours, the majority of administrative staff would leave as they are not required to access the University Internet for work after hours. Some academic staff and students still have to give/attend classes until 20:30 pm for some courses. It should, however, be noted that the number of Internet users will drop substantially during this period

which mean less Internet traffic is being generated. The staff component that uses the Internet after hours can therefore be identified as some administrative staff working late from their offices and the academic staff having to work until their classes are completed. The late use of computers could be students who are attending classes, those that reside in residences and those that are staying after hours to work on academic assignments, preparing for tests, etc. as they do not have Internet connections at home. It is, however, clear that the Internet is still being used by both staff and students for work or academic purposes, only for a reduced time period as with during office hours on weekdays.
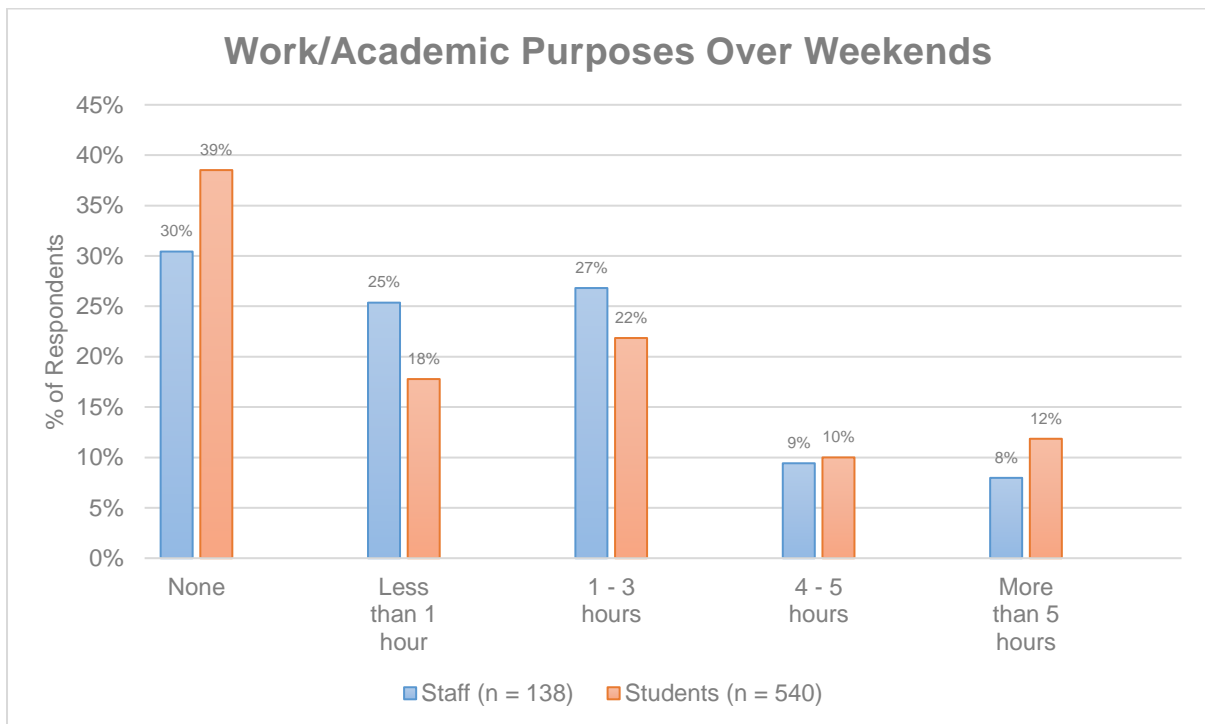
Figure 6.6: Work/Academic Purposes Over Weekends.

Figure 6.6 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the question, 'How many hours per day on average do you use Nelson Mandela University's Internet for work/academic purposes over weekends?'. Thirty percent (n = 42) of the staff and 39 percent (n = 208) of the student respondents indicated 'None'. Twenty-five percent (n = 35) of the staff and 18 percent (n = 96) of the student respondents indicated 'Less than 1 hour'. Twenty-seven percent (n = 37) of the staff and 22 percent (n = 118) of the student respondents indicated '1 - 3 hours'. Based on the frequencies, the relationship between staff and students Internet usage over weekends was found not to be statistically significant (Chi² (d.f. = 4, n = 678) = 7.94; p = .094). Staff and students have similar periods of access to the Internet over weekends for work/academic purposes.

The findings indicated that over weekends there are more staff who do not make use of the Internet for work/academic purposes, followed closely with some who use it for 1 - 3 hours and less than 1 hour. Students follow the same trend, but have a slightly higher rating for not using the Internet over weekends. Over weekends, the majority of administrative staff would not be on site, unless they access the Nelson Mandela University Internet via VPN to gain access to some ICT resources or when they have to come in to complete some work. Some academic staff and students still have to give/attend classes on Saturdays for some courses. The staff component that uses the Internet after hours can therefore be identified as some administrative staff working to finalise work and the academic staff having to work until their classes are done for the day. The students could comprise those who are attending classes, those that reside in residences and come to campus over the weekend to work on academic assignments, preparing for tests, etc. as they do not have Internet connections at home. It is, however, clear that the Internet is still being used by both groups for work/academic purposes, but for a reduced time period as with after hours on weekdays.
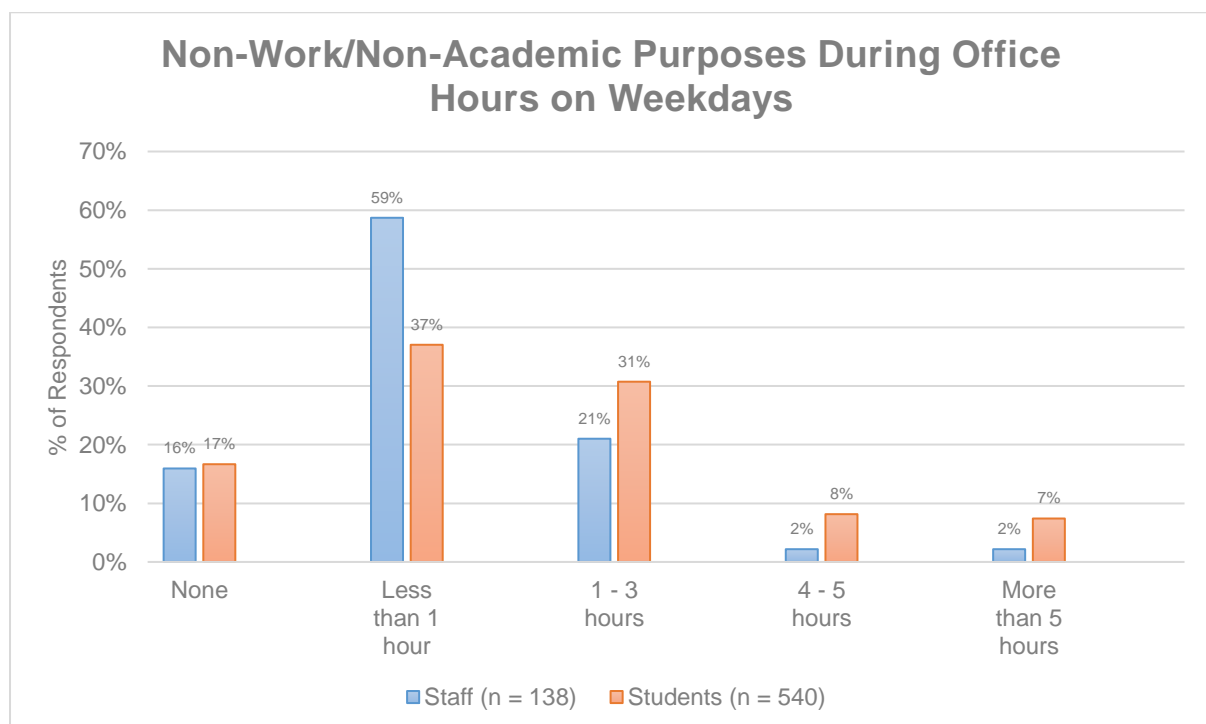
Figure 6.7: Non-Work/Non-Academic Purposes During Office Hours on Weekdays.

Figure 6.7 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the question, 'How many hours per day on average do you use Nelson Mandela University's Internet for non-work/non-academic purposes during office hours on weekdays?'. Sixteen percent (n = 22) of the staff and 17 percent (n = 90) of the student respondents

indicated 'None'. Fifty-nine percent (n = 81) of the staff and 37 percent (n = 200) of the student respondents indicated 'Less than 1 hour'. Twenty-one percent (n = 29) of the staff and 31 percent (n = 166) of the student respondents indicated '1 - 3 hours'. Based on the frequencies, the relationship between staff and students Internet used during office hours on weekdays was found to be significantly different (Chi² (d.f. = 4, n = 678) = 26.50; p < .0005; V = 0.20 Small). Staff use the Internet for shorter periods of time for non-work/non-academic purposes during office hours on weekdays while students use the Internet for longer periods of time for non-work/non-academic purposes during office hours on weekdays.

The findings indicated that during the day, the majority of staff use the Internet for non-work/non-academic purposes for less than 1 hour, with some staff using it for 1 - 3 hours followed by some staff not using it at all. Students on the other hand use the Internet for non-work/non-academic purposes for less than 1 hour, with some students using it for 1 - 3 hours followed by students not using it at all. The students' responses regarding less than 1 hour and 1 - 3 hour are however more balanced whereas the majority of staff selected less than 1 hour. Administrative staff are given a 45 minute lunch break and it is expected that those that are office-bound stay in the office and play around on the Internet. Administrative staff use the Internet for more than the 45 minute lunch break are therefore using it during 'company time' and this will hinder the productivity of the employee.

A balanced approached must be followed to ensure that staff use the Internet only during breaks or when it is necessary to relax without abusing Internet privileges. This is not against the Nelson Mandela University ICT General Policy and Nelson Mandela University Acceptable Use Policy as some controlled non-work/non-academic Internet use is allowed. It is, however, stated that the traffic may be monitored and abuse will not be tolerated.

Student Internet usage tends to be more open as they do not have a fixed 9 - 5 work/academic schedule compared to the staff work environment. They are allowed to use the Internet during free time as well as, in some cases, during classes. The use of the Internet for non-work/non-academic purposes during classes has been proven to be distracting to the student and those around them. This action negatively affects the student, surrounding students and degrades the quality of the lecture (Baturay & Toker, 2015). The balanced approach of less than 1 hour and 1 - 3 hours is therefore expected. It must, however, be considered that not all students have Internet access and the General Laboratories computers must therefore be only allocated to those who want to use them for work/academic purposes.

Figure 6.8: Non-Work/Non-Academic Purposes After Hours on Weekdays.

Figure 6.8 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the question, 'How many hours per day on average do you use Nelson Mandela University's Internet for non-work/non-academic purposes after hours on weekdays?'. Fifty-three percent (n = 73) of the staff and 38 percent (n = 207) of the student respondents indicated 'None'. Twenty-five percent (n = 35) of the staff and 25 percent (n = 134) of the student respondents indicated 'Less than 1 hour'. Seventeen percent (n = 23) of the staff and 20 percent (n = 109) of the student respondents indicated '1 - 3 hours'. Based on the frequencies, the relationship between staff and students Internet usage after hours on weekdays was found to be significantly different (Chi² (d.f. = 4, n = 678) = 16.69; p = .002; V = 0.16 Small). Students use the University Internet for longer periods of time for non-work/non-academic purposes after hours on weekdays as compared to staff.

The findings indicated that the majority of staff do not use the Internet for non-work/non-academic after hours on weekdays. This is followed with some using it for less than 1 hour and fewer using it for 1 - 3 hours. Most of them do not use the Internet for non-work/non-academic after hours on weekdays, using it for less than 1 hour and less using it for 1 - 3 hours. The staff feedback, however, leans towards not using it at all where the student feedback follows a more divided approach between their responses. It is expected that those who use the Nelson Mandela University Internet after hours for non-work/non-academic purposes for a shorter period are doing so to waste time e.g. waiting for a lift or waiting for

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class to start. Those who are using it for longer periods of time are expected to either stay in residences or do not have an Internet connection at home. Support must be given to these individuals on an individual basis as to ensure it does not interfere with their work/academic obligations. Lastly, it is clear that the Internet is still being used by both parties for non-work/non-academic purposes, only for a reduced time period as with during office hours on weekdays.

Figure 6.9: Non-Work/Non-Academic Purposes Over Weekends.

Figure 6.9 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the question, 'How many hours per day on average do you use Nelson Mandela University's Internet for non-work/non-academic purposes over weekends?'. Fifty-nine percent (n = 82) of the staff and 50 percent (n = 272) of the student respondents indicated 'None'. Sixteen percent (n = 22) of the staff and 15 percent (n = 83) of the student respondents indicated 'Less than 1 hour'. Seventeen percent (n = 23) of the staff and 14 percent (n = 77) of the student respondents indicated '1 - 3 hours'. Based on the frequencies, the relationship between staff and students Internet usage over weekends was found to be significantly different (Chi² (d.f. = 4, n = 678) = 11.33; p = .023; V = 0.13 Small). Staff use the Internet less for non-work/non-academic purposes over weekends while students use the Internet more.

The findings indicated that the majority of staff and students do not use the Internet for non-work/non-academic over weekends. This is followed by small groupings of staff and students using it at various frequencies over the weekend. The non-work/non-academic activities being captured should not affect the small number of staff and students that are still using the Nelson Mandela University Internet for work/ academic activities as the previous findings already indicated that the majority will not be using Nelson Mandela University Internet during this period. This means that an abundance of Nelson Mandela University Internet resources (especially bandwidth/speed) will be available to use. Controls must nevertheless be in place to ensure that a handful of users do not cause a bottleneck by using up 90 percent of the Internet traffic.

The summated scores analysis of results for Section 3: Usage and Access Duration according to the demographic group can be found on the attached CD. The following section presents and discusses the findings for Section 4: Content.

6.6. Section 4: Content

Figures 6.10 - 6.39 and Table 6.3 depicts the findings captured from the staff (n = 138) and students (n = 540) regarding the frequency with which the participants use the Internet to access specific content as per the Fortiguard Categorisation Criteria and therefore the captured Firewall data categories. See Appendix H for the Fortiguard Categorisation Criteria with a description of each category. Figures 6.10 - 6.18 focuses on the category 'General Interest Business', Figures 6.19 - 6.33 focuses on the category 'General Interest Personal', Figures 6.34 - 6.36 focuses on the category 'Bandwidth Consuming', Figure 6.37 focuses on the category 'Security Risk', Figure 6.38 focuses on the category 'Adult/Mature Content' and Figure 6.39 focuses on the category 'Unrated'. Only the findings with a statistical, significant relationship and which form part of the firewall which staff and student top 20 use will be covered. The top 30 is covered and placed on the CD. The NMUIUS's Content analysis can be found in Appendix K and the staff and student top 30 Internet use as per the Firewall data can be found in Appendix L.

6.6.1. Analysis of Results for Section 4: Content

'Finance and Banking' is a website that offers news and quotations on bonds, stocks, and other investment advice and investment vehicles. Furthermore, it includes credit unions, banks, insurance and credit cards. Examples include paypal.com, fnb.co.za and absa.co.za (Fortinet, 2017). Figure 6.10 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'Finance and Banking'. Thirty-two percent (n = 44) of

the staff respondents access 'Finance and Banking' content 'Weekly' followed by 26 percent (n = 36) of the staff respondents indicated 'Monthly'. Forty-nine percent (n = 266) of the student respondents indicated that they 'Never' access 'Finance and Banking' content with 25 percent (n = 137) of the student respondents indicating 'Less Often'. Based on the frequencies, the relationship between staff and students 'Finance and Banking' access was found to be significantly different (Chi² (d.f. = 4, n = 678) = 83.59; p < .0005; V = 0.35 Medium). Staff access 'Finance and Banking' content more frequently than students do.

The analysis of the Firewall data indicated that staff accessed 'Finance and Banking' content 0.15 percent (518.9GB) of the time while students accessed 'Finance and Banking' content 0.04 percent (382.9GB) of the time. 'Finance and Banking' was not in the staff and student top 20 Internet uses as per the Firewall data list. These findings correspond to the responses received from staff and students.
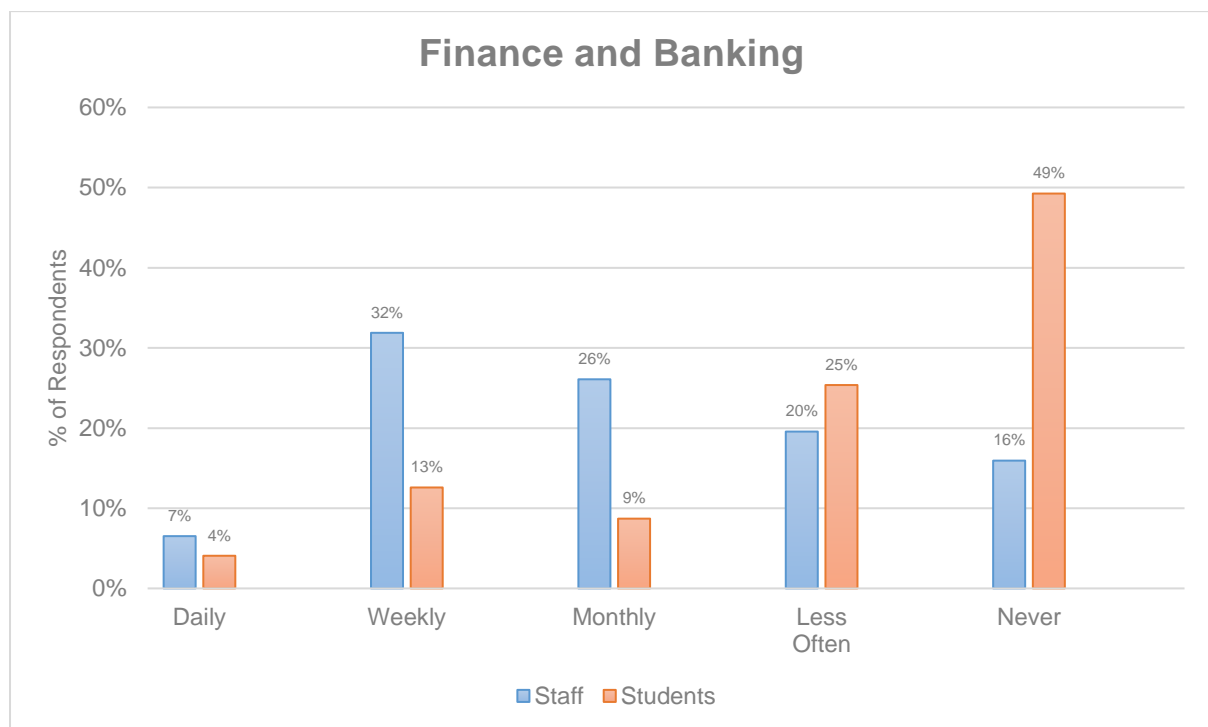
Figure 6.10: Finance and Banking.

'Search Engines and Portals' sites are websites that support searching indices/directories, the news groups and the web. Examples includes google.com and yahoo.com (Fortinet, 2017). Figure 6.11 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'Search Engines and Portals'. Seventy-five percent (n = 104) of the staff respondents and 72 percent (n = 388) of the student respondents indicated 'Daily'. Based on the frequencies, the relationship between staff and students 'Search Engines and Portals'

access was found not to be statistically significant (Chi² (d.f. = 4, n = 678) = 3.71; p = .447). Staff and students are found to access 'Search Engines and Portals' content in a similar way.
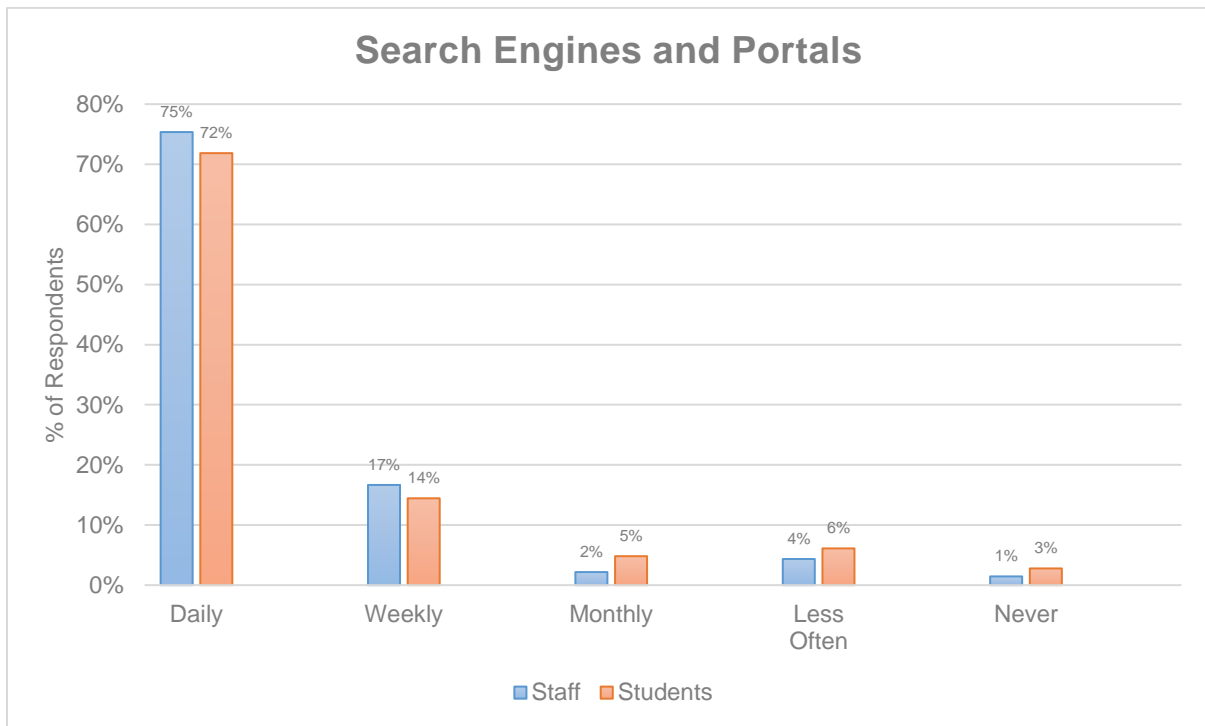
Figure 6.11: Search Engines and Portals.

According to the Firewall data, staff accessed 'Search Engines and Portals' content 4.95 percent (16.4TB) of the time while students accessed 'Search Engines and Portals' content 3.67 percent (39TB) of the time. 'Search Engines and Portals' was identified by Higher Education Institutions (HEIs) as habit number 4 for staff and habit number 6 for students. Furthermore, 'Search Engines and Portals' was listed as priority number 5 for staff and priority number 3 for students as per the staff and student top 20 Internet uses according to the Firewall data list. 'Search Engines and Portals' was not identified as the 'Top four primary uses for Nelson Mandela University Internet' in all periods by students. The popularity of 'Search Engines and Portals' is in line with the responses received from staff and students above but are not in line with the primary uses findings as covered in the next section. In addition, it is clear that students use 'Search Engines and Portals' to a greater extent compared to staff. Nevertheless, 'Search Engines and Portals' is used extensively by both groups according to the Firewall data.
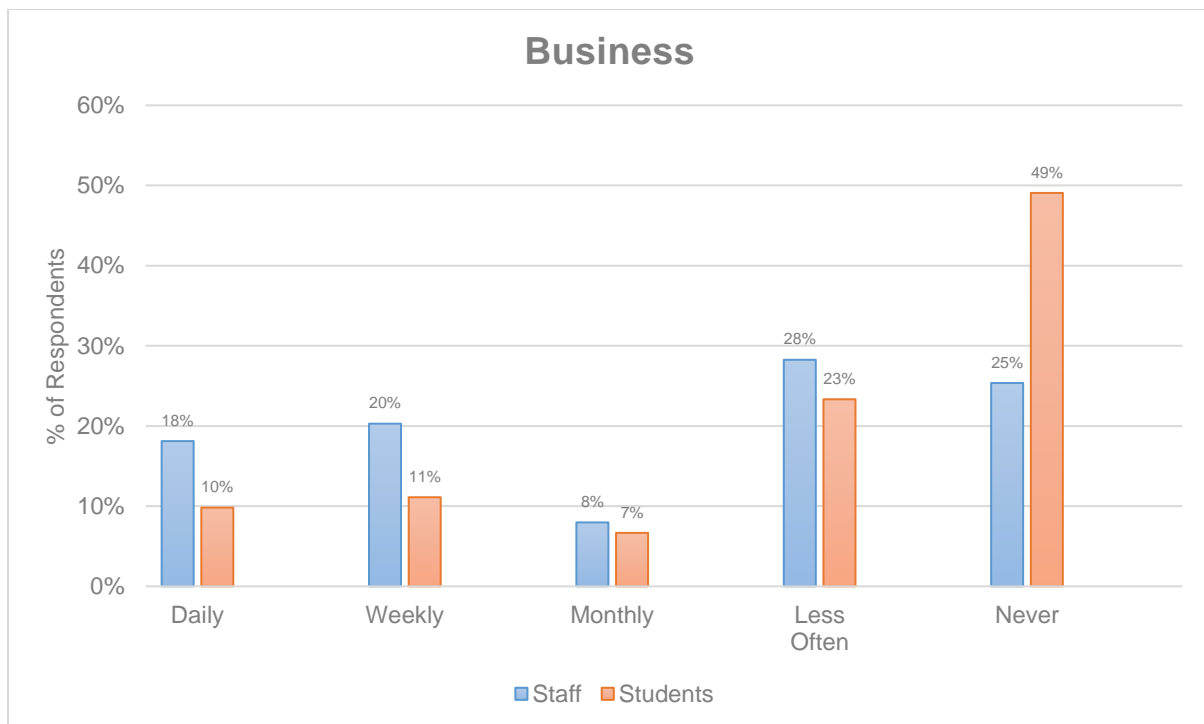
Figure 6.12: Business.

'Business' is a website that are devoted to or sponsored by business firms, industry groups, business associations, or business in general. Examples include hootsuite.com, linkedin.com, m2newmedia.com and alibaba.com (Fortinet, 2017). Figure 6.12 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'Business'. Twenty-eight percent (n = 39) of the staff respondents indicated that they access 'Business' content 'Less Often' with 20 percent (n = 28) indicating 'Weekly' and 18 percent (n = 25) indicating 'Daily'. Forty-nine percent (n = 265) of the student respondents indicated that they 'Never' access 'Business' content with 23 percent (n = 126) indicating 'Less Often'. Based on the frequencies, the relationship between staff and students 'Business' access was found to be significantly different (Chi² (d.f. = 4, n = 678) = 29.05; p < .0005; V = 0.21 Small). Staff access **'**Business' more than students do.

According to the Firewall data, staff accessed 'Business' content 2.56 percent (8.5TB) of the time while students accessed 'Business' content 1.42 percent (15.1TB) of the time. 'Business' was listed as priority number 7 for staff and priority number 8 for students as per the staff and student top 20 Internet uses as per the Firewall data list. 'Business' was identified by HEIs as an almost non-existing, unimportant Internet usage habit for staff and students. 'Work (Job specific content search)' (also known as 'Business') was identified as purpose number 2 in the 'Top four primary uses for Nelson Mandela University Internet during office hours' and purpose number 4 in the 'Top four primary uses for Nelson Mandela University Internet after hours' by

staff and none for students. The Firewall data does indicate that 'Business' content is accessed more frequently than is being identified by HEIs and the Internet community. This is especially true for the student user group as they use it to a great extent. A review of the HEI Internet Management Business Models in this area and implemented Internet resources must be conducted to verify these findings.
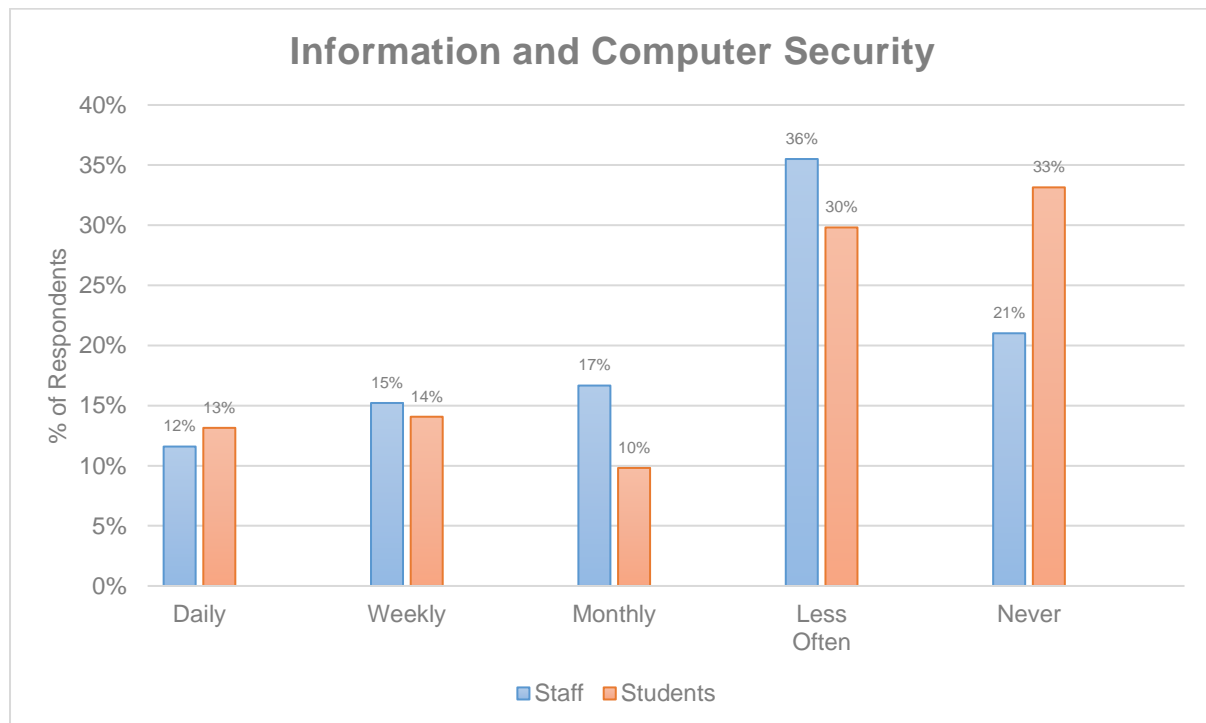
Figure 6.13: Information and Computer Security.

'Information and Computer Security' is a website that provides free downloadable tools or information about computer security, which are not ordinary Freeware and Software downloading. Examples include avast.com, siteadvisor.com, avira.com and norton.com (Fortinet, 2017). Figure 6.13 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'Information and Computer Security'. Thirty-six percent (n = 49) of the staff respondents indicated that they access 'Information and Computer Security' content 'Less Often' with 21 percent (n = 29) indicating 'Never'. Thirty percent (n = 161) of the student respondents indicated that they access 'Information and Computer Security' content 'Less Often' with 33 percent (n = 179) indicating 'Never'. Based on the frequencies, the relationship between staff and students 'Information and Computer Security' access was found to be significantly different (Chi² (d.f. = 4, n = 678) = 11.34; p = .023; V = 0.13 Small). Staff access 'Information and Computer Security' more than students.

According to the Firewall data, staff accessed 'Information and Computer Security' content 2.11 percent (7TB) of the time while students accessed 'Information and Computer Security' content 0.35 percent (3.7TB) of the time. 'Information and Computer Security' was listed as priority number 9 for staff and priority number 18 for students as per the staff and student top 20 Internet uses as per the Firewall data list. 'Information and Computer Security' content was not included in previous questions directly but will form part of 'Safe and Secure' which is a critical component of all aspects of the Internet. The Firewall data indicated that staff access 'Information and Computer Security' content more frequently than they indicated while students' access it as indicated in their responses. Staff could therefore be using these sites to enhance their security for their devices while only a small number of students follow this route. As staff have Council-funded devices, it is expected that they do not install these third party security tools onto these devices. Students are guided to many of these sites by Nelson Mandela University ICT Services to increase the security posture of their personal devices. A review is required to ensure that the roles are reversed.
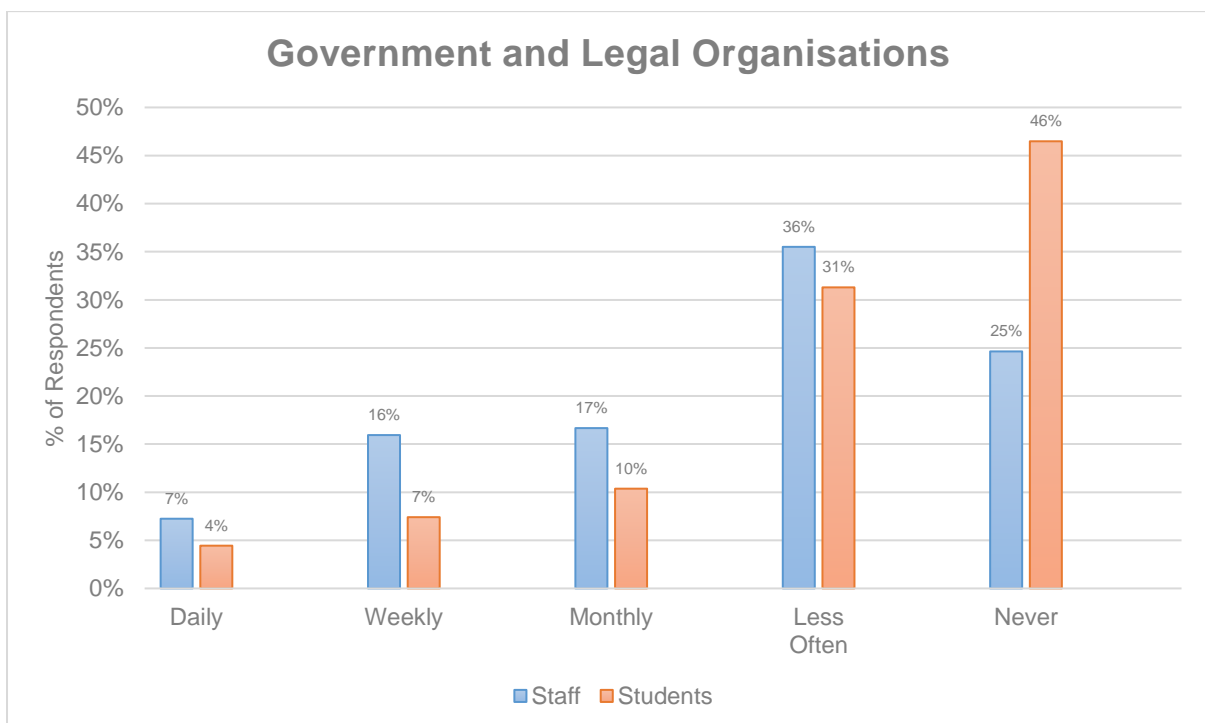
Figure 6.14: Government and Legal Organisations.

'Government' is a website sponsored by bureaus, branches, or agencies at any level of government while 'Legal organisations' is a website that explain or discuss laws of various government entities. Examples include irs.gov, nih.gov, gc.ca and rednet.cn (Fortinet, 2017). Figure 6.14 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'Government and Legal Organisations'. Twenty-five percent (n =

34) of the staff respondents indicated that they 'Never' access 'Government and Legal Organisations' content with 36 percent (n = 49) indicating 'Less Often'. Forty-six percent (n = 251) of the student respondents indicated that they 'Never' access 'Government and Legal Organisations' content with 31 percent (n = 169) indicating 'Less Often'. Based on the frequencies, the relationship between staff and students 'Government and Legal Organisations' access was found to be significantly different (Chi² (d.f. = 4, n = 678) = 27.30; p < .0005; V = 0.20 Small). Staff access 'Government and Legal Organisations' more than students.

According to the Firewall data, staff accessed 'Government and Legal Organisations' content 0.13 percent (433.8GB) of the time while students accessed 'Government and Legal Organisations' content 0.08 percent (910.4GB) of the time. 'Government and Legal Organisations' was not listed in the staff and student top 20 Internet uses as per the Firewall data list. 'Government and Legal Organisations' content was not included in previous questions. The Firewall data and findings correspond with the responses received by staff and students.
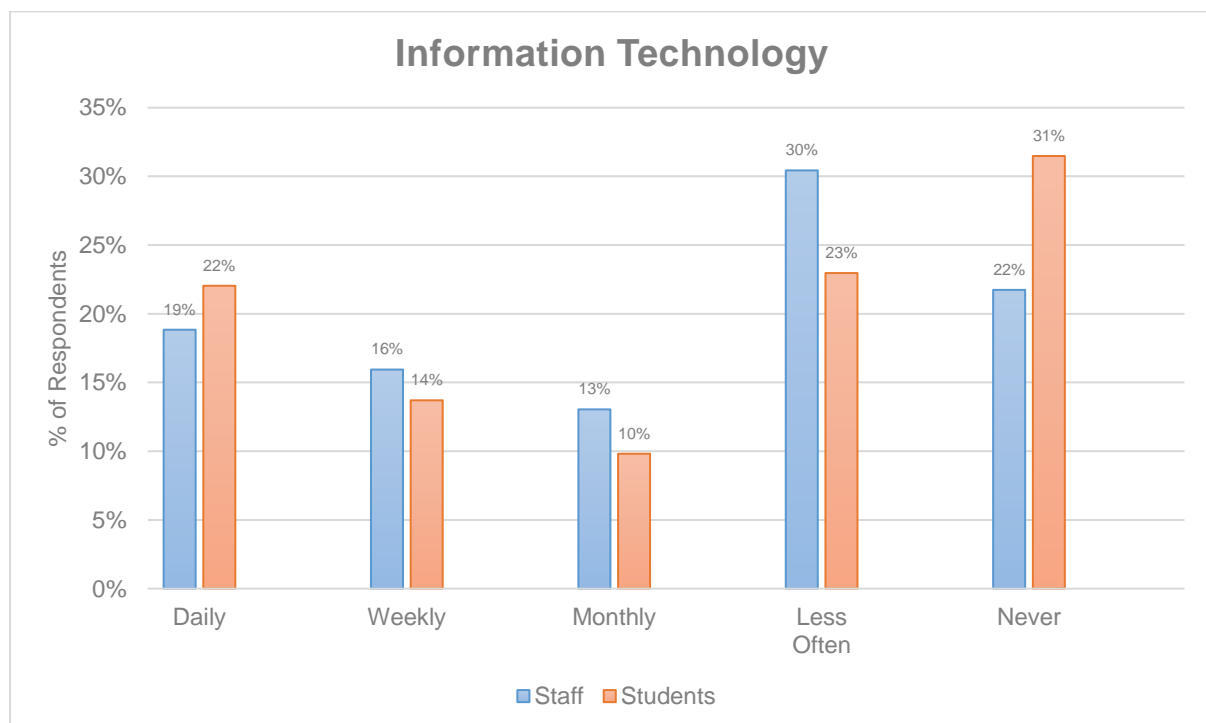
Figure 6.15: Information Technology.

'Information Technology' is a website dedicated to peripherals and services, cable TV/Internet suppliers, and cell phone services. Examples include 360.cn, apple.com, microsoft.com and stackoverflow.com (Fortinet, 2017). Figure 6.15 depicts all responses (n = 678) received from

staff (n = 138) and students (n = 540) for the content group 'Information Technology'. Thirty percent (n = 42) of the staff respondents indicated that they access 'Information Technology' content 'Less Often' with 19 percent (n = 26) indicating 'Daily' and 26 percent (n = 22) indicating 'Weekly'. Thirty-one percent (n = 170) of the student respondents indicated that they 'Never' access 'Information Technology' content with 23 percent (n = 124) indicating 'Less Often' and 22 percent (n = 119) indicating 'Daily'. Based on the frequencies, the relationship between staff and students 'Information Technology' access was found not to be statistically significant (Chi² (d.f. = 4, n = 678) = 8.05; p = .090). Staff and students access 'Information Technology' content similarly.

According to the Firewall data, staff accessed 'Information Technology' content 33.09 percent (109.8TB) of the time while students accessed 'Information Technology' content 25.82 percent (274.4TB) of the time. 'Information Technology' was listed as priority number 1 for staff and priority number 2 for students as per the staff and student top 20 Internet uses as per the Firewall data list. 'Information Technology' content was not included in previous questions directly but forms part of the 'Safe and Secure' category which is a critical component of all aspects of the Internet. The Firewall data indicates that 'Information Technology' content is accessed extensively and is not reflected accurately in the survey findings listed above. This could be because the users do not know that operating system updates are classified as Internet usage and the fact that some devices automatically update the software without the user's knowledge. The amount of 'Information Technology' content being accessed by the Internet community must not go unnoticed and the HEIs must therefore realign the Internet resource management accordingly.

'Secure Websites' is a website that institute security measures such as registration, passwords, authentication, etc. Examples include adm918.com, fhserve.com, cpmterra.com, and huffingtonpost.de (Fortinet, 2017). Figure 6.16 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'Secure Websites'. Thirty-three percent (n = 45) of the staff respondents indicated that they access 'Secure Websites' content 'Daily' with 22 percent (n = 31) indicating 'Weekly' and 20 percent (n = 27) indicating 'Less Often'. Thirty-five percent (n = 188) of the student respondents indicated at they access 'Secure Websites' content 'Daily' with 20 percent (n = 108) indicating 'Less Often', 19 percent (n = 100) indicating 'Never' and 18 percent (n = 96) indicating 'Weekly'. Based on the frequencies, the relationship between staff and students 'Secure Websites' access was found to be significantly different (Chi² (d.f. = 4, n = 678) = 12.21; p = .016; V = 0.13 Small). Students access 'Secure Websites' more often than staff.

According to the Firewall data, staff accessed 'Secure Websites' content 0.05 percent (160.8GB) of the time while students accessed 'Secure Websites' content 0.01 percent (63.1GB) of the time. 'Secure Websites' was given a low priority for staff and students by the HEI as an important Internet usage habit. Furthermore, 'Secure Websites' did not feature on the staff and student top 20 Internet uses as per the Firewall data list. The Firewall data and other HEI Internet resources indicate a low usage whilst the findings as listed above indicate a high usage. Internet users therefore think they are access 'Secure Websites' content whereas they are in fact, not. Therefore, the 'Secure Websites' content that they are accessing are being categorised by the Fortigate firewall into other firewall categories.
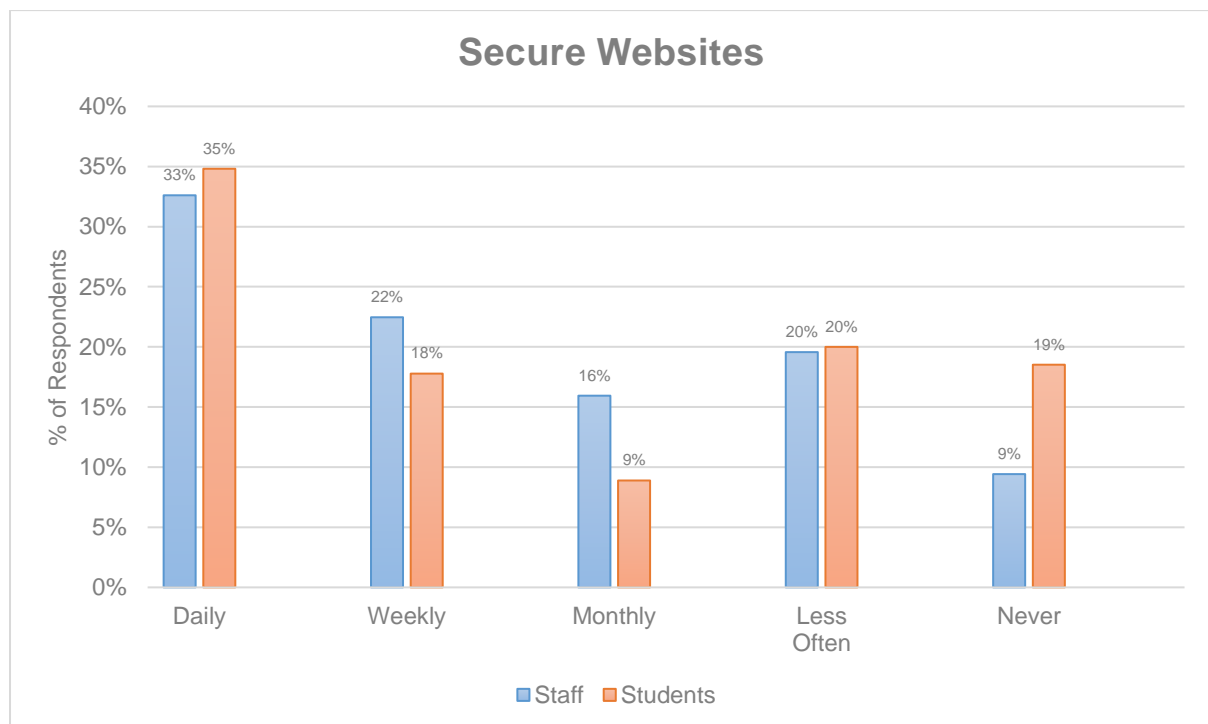
Figure 6.16: Secure Websites.

'Web-Based Applications' is a website that mimics desktop applications such as slide-show presentations, spreadsheets and word processing. Examples include befunky.com, evernote.com, listchallenges.com and appstorm.net (Fortinet, 2017). Figure 6.17 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'Web-Based Applications'. Twenty-nine percent (n = 40) of the staff respondents indicated that they access 'Web-Based Applications' content 'Daily' while 28 percent (n = 39) indicating 'Less Often' and 20 percent (n = 27) indicating 'Weekly'. Twenty-five percent (n = 136) of the student respondents indicated that they access 'Web-Based Applications' content 'Daily' while 22 percent (n = 121) indicating 'Never' and 21 percent (n = 113) indicating 'Weekly' and 'Less Often'. Based on the frequencies, the relationship between staff and students 'Web-Based

Applications' access was found not to be statistically significant (Chi² (d.f. = 4, n = 678) = 8.07; p = .089). Staff and students access 'Web-Based Applications' content similarly.
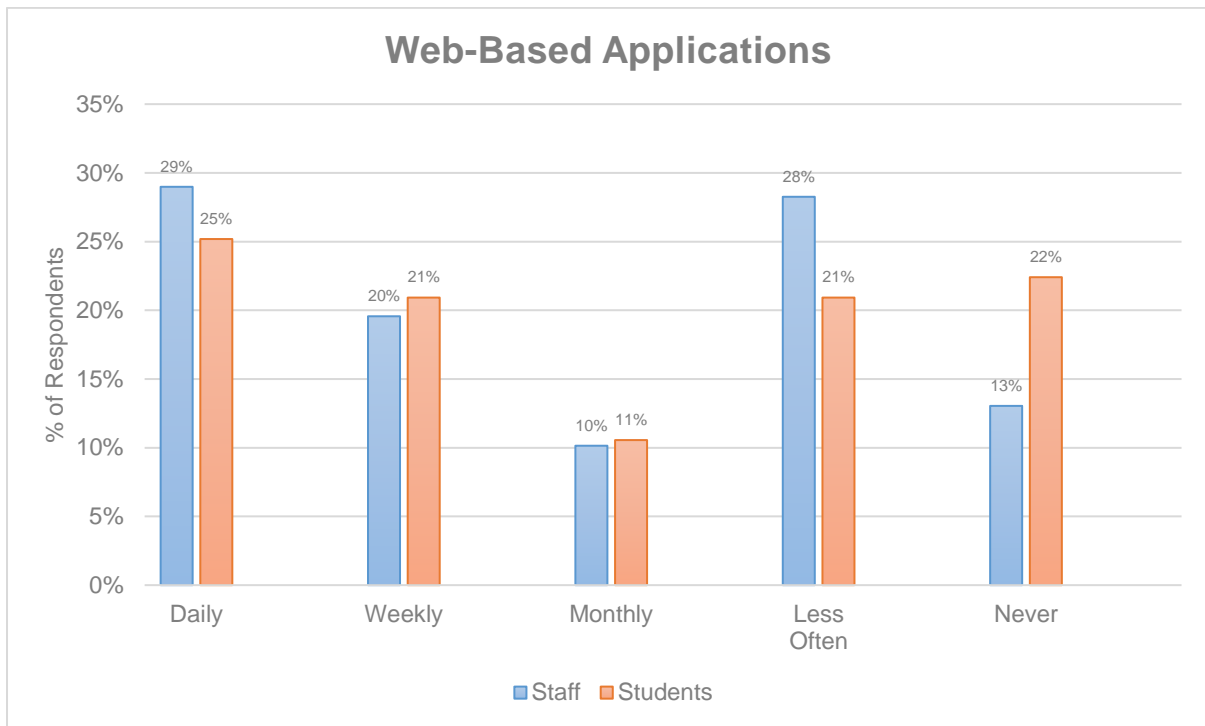
Figure 6.17: Web-Based Applications.

According to the Firewall data, staff accessed 'Web-Based Applications' content 0.08 percent (277.2GB) of the time while students accessed 'Web-Based Applications' content 0.06 percent (623.2GB) of the time. 'Web-Based Applications' was given a low priority for staff and students by HEIs as an important Internet usage habit. Furthermore, 'Web-Based Applications' did not feature on the staff and student top 20 Internet uses as per the Firewall data list. The Firewall data and other HEI Internet resources indicate a low usage whilst the findings as listed above indicate a high usage. Internet users therefore think they are accessing 'Web-Based Applications' content whereas they are in fact, not. In most of these case the application would be housed internally (such as the Enterprise Resource Planning system) and therefore does not require an external Internet connection and the traffic would consequently not traverse the Firewall to be categorised.
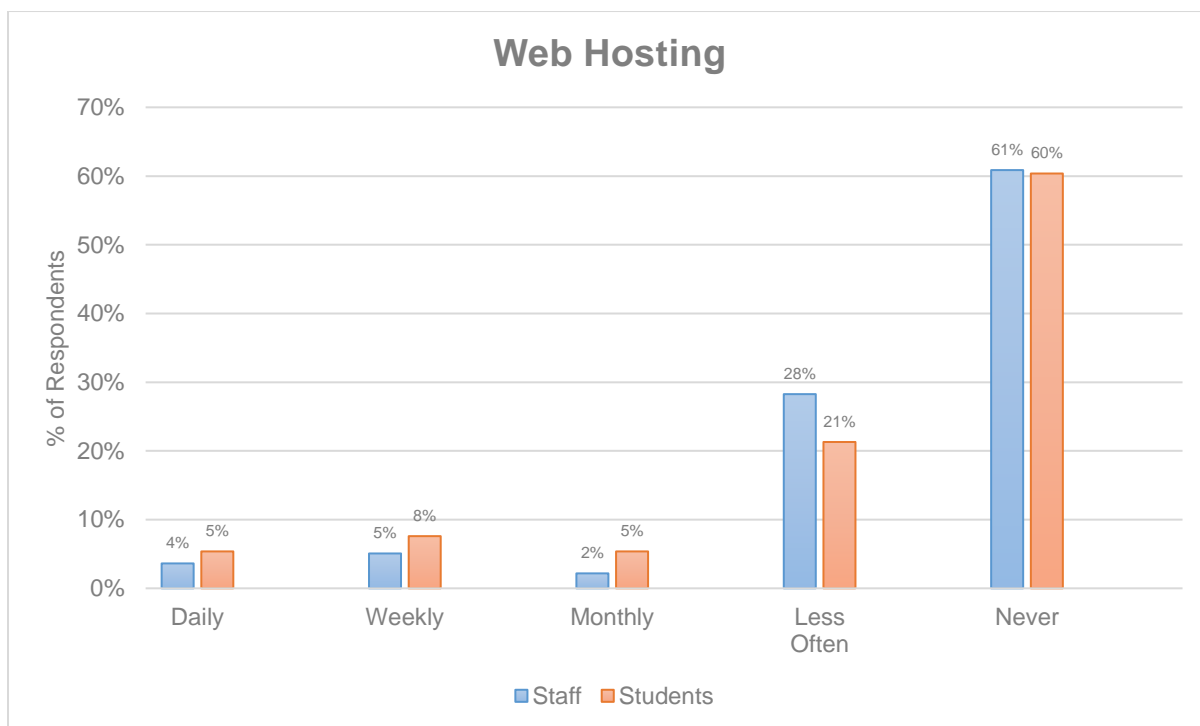
Figure 6.18: Web Hosting.

'Web Hosting' is a website for organisations that provide top-level domain pages or hosting services of web communities. Examples include godaddy.com, hostgator.com, bluehost.com and weebly.com (Fortinet, 2017). Figure 6.18 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'Web Hosting'. Sixty-one percent (n = 84) of the staff respondents indicated that they 'Never' access 'Web Hosting' content while 28 percent (n = 39) indicating 'Less Often'. Sixty percent (n = 326) of the student respondents indicated that they 'Never' access 'Web Hosting' content while 21 percent (n = 115) indicating 'Less Often'. Based on the frequencies, the relationship between staff and students 'Web Hosting' access was found not to be statistically significant (Chi² (d.f. = 4, n = 678) = 6.39; p = .172). Staff and students seldom access 'Web Hosting' content.

According to the Firewall data, staff accessed 'Web Hosting' content 0.87 percent (2.9TB) of the time while students accessed 'Web Hosting' content 0.81 percent (8.6TB) of the time. 'Web Hosting' was listed as priority number 17 for staff and priority number 11 for students as per the staff and student top 20 Internet uses as per the Firewall data list. 'Web Hosting' content was not included in previous questions. The Firewall data does indicate that 'Web Hosting' content is being accessed more frequently than expected and should be taken note of. The findings as listed above do not support this statement and are therefore not in line with the Firewall data. Provision must be made to include 'Web Hosting' content as part of the Internet resource alignment strategy.
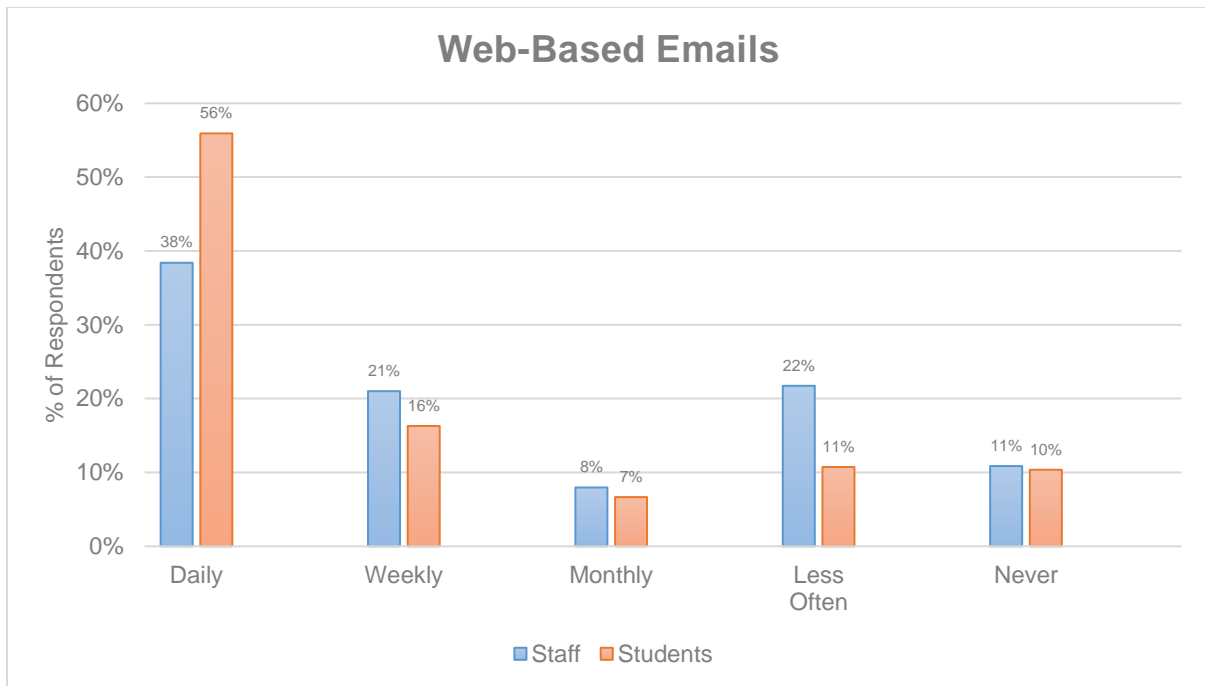
Figure 6.19: Web-Based Emails.

'Web-based Emails' is a sites that allows users to use email services, which will include business and personal type emails. Examples includes: 126.com, mail.com, mail.ru and outlook.com (Fortinet, 2017). Figure 6.19 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'Web-Based Emails'. Thirty-eight percent (n = 53) of the staff respondents indicated they access 'Web-Based Emails' content 'Daily' while 22 percent (n = 30) indicating 'Less Often' and 21 percent (n = 29) indicating 'Weekly'. Fifty-six percent (n = 302) of the student respondents indicated they access 'Web-Based Emails' content 'Daily' while 16 percent (n = 88) indicating 'Weekly'. Based on the frequencies, the relationship between staff and students 'Web-Based Emails' access was found to be significantly different (Chi² (d.f. = 4, n = 678) = 18.40; p = .001; V = 0.16 Small). Students access 'Web-Based Emails' more frequently that staff do.

According to the Firewall data, staff accessed 'Web-Based Emails' content 0.30 percent (1 011.1GB) of the time while students accessed 'Web-Based Emails' content 0.30 percent (3.2TB) of the time. 'Web-Based Emails' was listed as priority number 25 for staff and priority number 20 for students as per the staff and student top 20 Internet uses as per the Firewall data list. 'Web-Based Emails' content was not included in previous questions in the survey, however, 'Business Emails' and 'Personal Emails' were. Both categories constitute 'Web-Based Emails'.

To gain a better representation of the 'Web-Based Emails' distribution between business and personal email usage, the staff (n = 138) and students (n = 540) were requested to give their input for the content groups 'Business Emails' and 'Personal Emails'. Fifty-nine percent (n = 82) of the staff respondents indicated they access 'Business Emails' content 'Daily'. Forty-seven percent (n = 253) of the student respondents indicated that they 'Never' access 'Business Emails' content while 19 percent (n = 100) indicating 'Daily' and 19 percent (n = 101) indicating 'Less Often'. Based on the frequencies, the relationship between staff and students 'Business Emails' access was found to be significantly different (Chi^2 (d.f. = 4, n = 678) = 100.48; p < .0005; V = 0.38 Medium). Staff use the HEI Internet to access 'Business Emails' more that students do.

Fifty-four percent (n = 74) of the staff respondents indicated that they access 'Personal Emails' content 'Daily' while 16 percent (n = 22) indicating 'Weekly' and 16 percent (n = 22) indicating 'Less Often'. Fifty-nine percent (n = 317) of the student respondents indicated that they access 'Personal Emails' content 'Daily' while 17 percent (n = 90) indicating 'Weekly'. Based on the frequencies, the relationship between staff and students was found not to be statistically significant (Chi^2 (d.f. = 4, n = 678) = 4.37; p = .359). Staff and students access 'Personal Emails' at a similar frequency.

'Business Emails' was identified by HEI as habit number 2 for staff and an unimportant habit (0 percent) for students. Furthermore, 'Business Emails' was identified as the number 1 purpose on the 'Top four primary uses for Nelson Mandela University Internet' in all periods by staff. 'Personal Emails' was identified by HEI as habit number 1 for students and a relatively low habit for staff. Furthermore, 'Personal Emails' was identified as the number 3 purpose for student on the 'Top four primary uses for Nelson Mandela University Internet during office hours' and 'Top four primary uses for Nelson Mandela University Internet after office hours' and number 4 purpose for staff on the 'Top four primary uses for Nelson Mandela University Internet over weekends'.

The Firewall data does indicate that 'Web-Based Emails' content is accessed to some extent while the survey findings listed above support these findings. The findings indicate that staff prefer to use their email accounts for business purposes but both staff and student prefer to use the Internet for personal use. Irrespective of the content, all emails will traverse via the firewall and will be classified in the 'Web-Based Emails' category. HEIs should take note of the staff and students 'Business Emails' and 'Personal Emails' requirements within the 'Web-Based Emails' content and implement the required Internet resources accordingly.
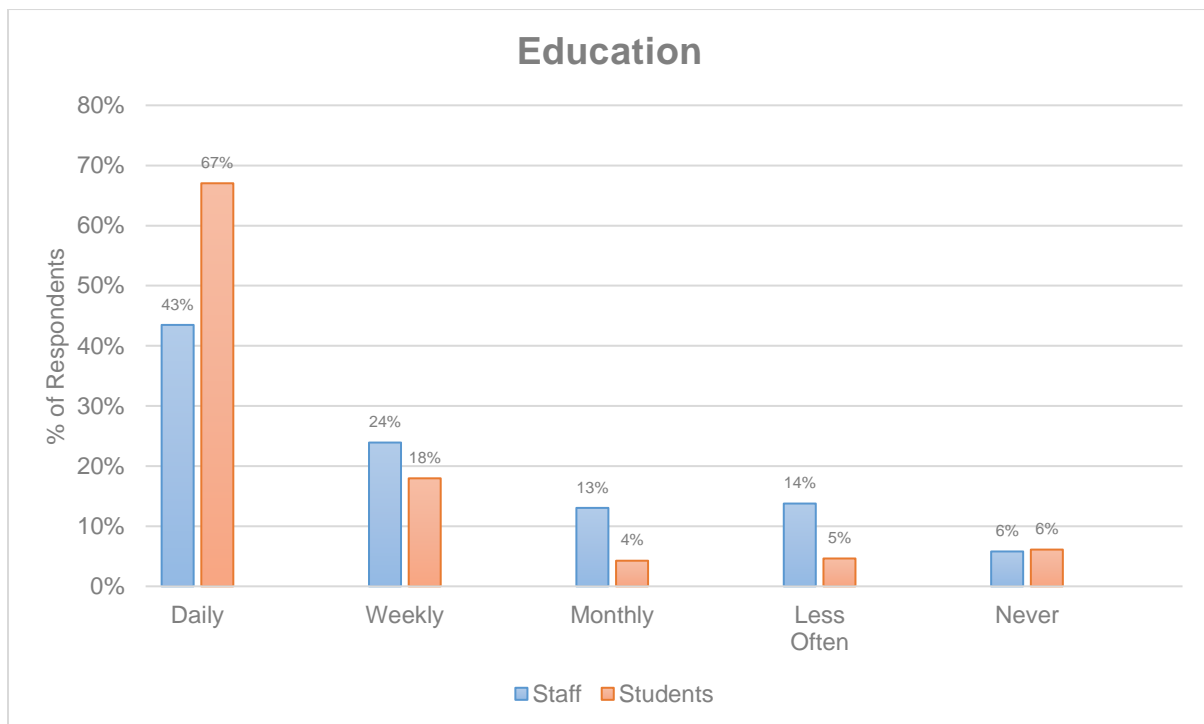
Figure 6.20: Education.

'Education' is a website dedicated to educational institutions such as non-academic research institutions, other educational facilities and schools, and websites that relate to educational activities and events. In addition, Education is also dedicated to selling, providing curriculum materials or providing information on educational materials. Included in these sites are academic journals and similar publications where scholars and professors submit academic/research articles. Examples include bab.la, mit.edu, nationalgeographic.com and wikia.com (Fortinet, 2017). Figure 6.20 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'Education'. Forty-three percent (n = 60) of the staff respondents indicated that they access 'Education' content 'Daily' while 24 percent (n = 33) indicating 'Weekly'. Sixty-seven percent (n = 362) of the student respondents indicated that they access 'Education' content 'Daily' while 18 percent (n = 97) indicating 'Weekly'. Based on the frequencies, the relationship between staff and students 'Education' access was found to be significantly different (Chi² (d.f. = 4, n = 678) = 40.02; p < .0005; V = 0.24 Small). Students access 'Education' more frequently when compared to staff who access it less often.

To gain a deeper understanding of the academic requirements in the 'Education' content category, a question, was added to determine the 'Research' component. From all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'Research', 49 percent (n = 67) of the staff respondents indicated that they access 'Research' content

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'Daily' while 22 percent (n = 31) indicated 'Weekly' and 17 percent (n = 23) indicated 'Less Often'. Forty-two percent (n = 225) of the student respondents indicated that they access 'Research' content 'Daily' while 34 percent (n = 183) indicated 'Weekly'. Based on the frequencies, the relationship between staff and students 'Research' access was found to be significantly different (Chi² (d.f. = 4, n = 678) = 11.01; p = .026; V = 0.13 Small). Staff access 'Research' more frequently than students do.

According to the Firewall data, staff accessed 'Education' content 0.92 percent (3TB) of the time while students accessed 'Education' content 0.43 percent (4.6TB) of the time. 'Education' was listed as priority number 15 for both staff and students as per the staff and student top 20 Internet uses as per the Firewall data list. 'Education' was identified by HEI as habit number 3 for staff and habit number 2 for students. 'Research' content being a subcategory of the 'Education' in the Firewall data, was identified by HEIs as habit number 1 for staff and habit number 4 for students. Furthermore, 'Research' was identified as the number 3 purpose by staff and number 1 purpose for student on the 'Top four primary uses for Nelson Mandela University Internet during office hours', the number 2 purpose by staff and number 3 purpose for students on the 'Top four primary uses for Nelson Mandela University Internet after office hours' and the number 2 purpose by staff and number 3 purpose for student on the 'Top four primary uses for Nelson Mandela University Internet over weekends'. The 'Education' content is therefore consequently indicated in the survey and is reflected accordingly in the Firewall data.
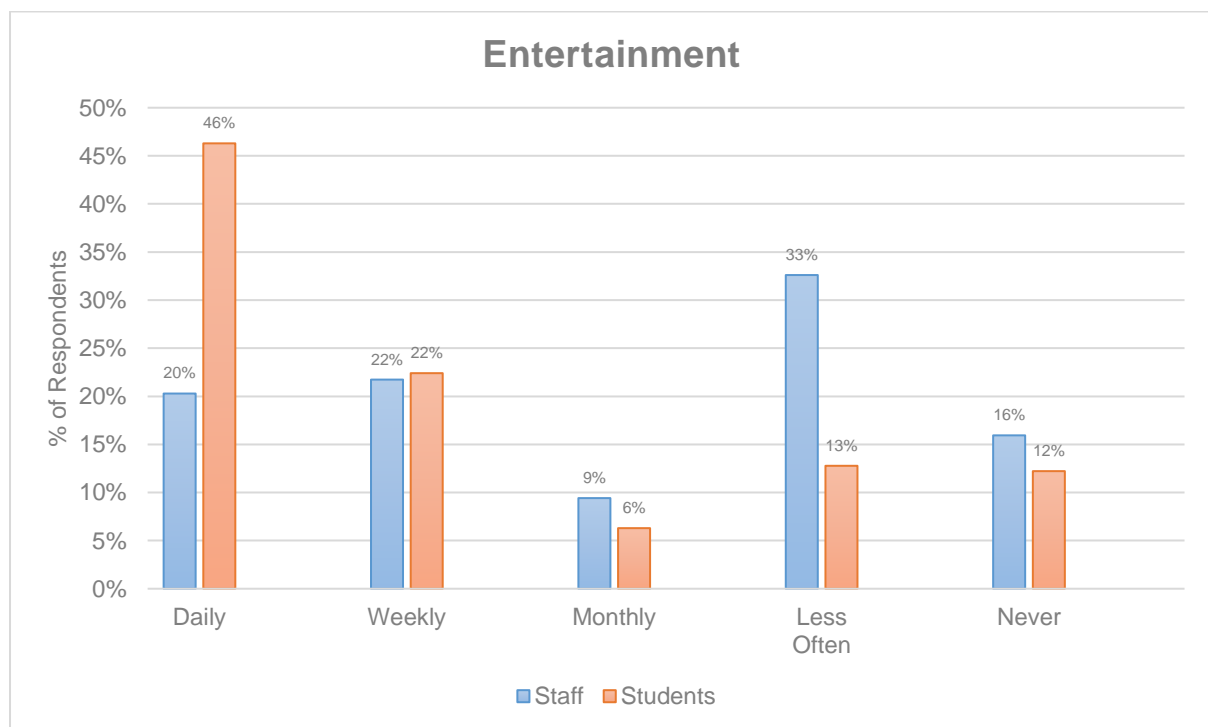
Figure 6.21: Entertainment.

'Entertainment' is a website that promotes or provides information about motion pictures, non-news television and radio, programming guides and music, movie theatres, humour, books, comics, magazines, galleries and artists or review on entertainment. Examples include subscene.com, tmz.com, douban.com and imdb.com (Fortinet, 2017). Figure 6.21 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'Entertainment'. Thirty-three percent (n = 45) of the staff respondents indicated that they access 'Entertainment' content 'Less Often' while 22 percent (n = 30) indicating 'Weekly' and 20 percent (n = 28) indicating 'Daily'. Forty-six percent (n = 250) of the student respondents indicated that they access 'Entertainment' content 'Daily' while 22 percent (n = 121) indicating 'Weekly'. Based on the frequencies, the relationship between staff and students 'Entertainment' access was found to be significantly different (Chi² (d.f. = 4, n = 678) = 46.58; p < .0005; V = 0.26 Small). Students access 'Entertainment' content more frequently than staff do.

According to the Firewall data, staff accessed 'Entertainment' content 1.03 percent (3.4TB) of the time while students accessed 'Entertainment' content 0.77 percent (8.2TB) of the time. 'Entertainment' was listed as priority number 14 for staff and priority number 12 for students as per the staff and student top 20 Internet uses as per the Firewall data list. 'Entertainment' content was identified by HEIs as a low rating for staff and habit number 5 for students. The survey findings therefore underrepresent the actual amount of 'Entertainment' content being accessed by the Nelson Mandela University Internet community. The category of 'Entertainment' is identified as cyberloafing and measures should be put in place to ensure it is controlled.

'Advertising' is a website that provides advertising graphics or other advertising content files, which mostly include advert servers (domain name often with 'ad.', such as ad.google.com). Examples include directrev.com, clkmon.com, neobux.com and adcash.com (Fortinet, 2017). Figure 6.22 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'Advertising'. Thirty-eight percent (n = 53) of the staff respondents indicated that they access 'Advertising' content 'Less Often' while 37 percent (n = 51) indicating 'Never'. Fifty-six percent (n = 301) of the student respondents indicated that they 'Never' access 'Advertising' content while 23 percent (n = 126) indicating 'Less Often'. Based on the frequencies, the relationship between staff and students 'Advertising' access was found to be significantly different (Chi² (d.f. = 4, n = 678) = 30.41; p < .0005; V = 0.21 Small). Students access 'Advertising' content less than staff do.
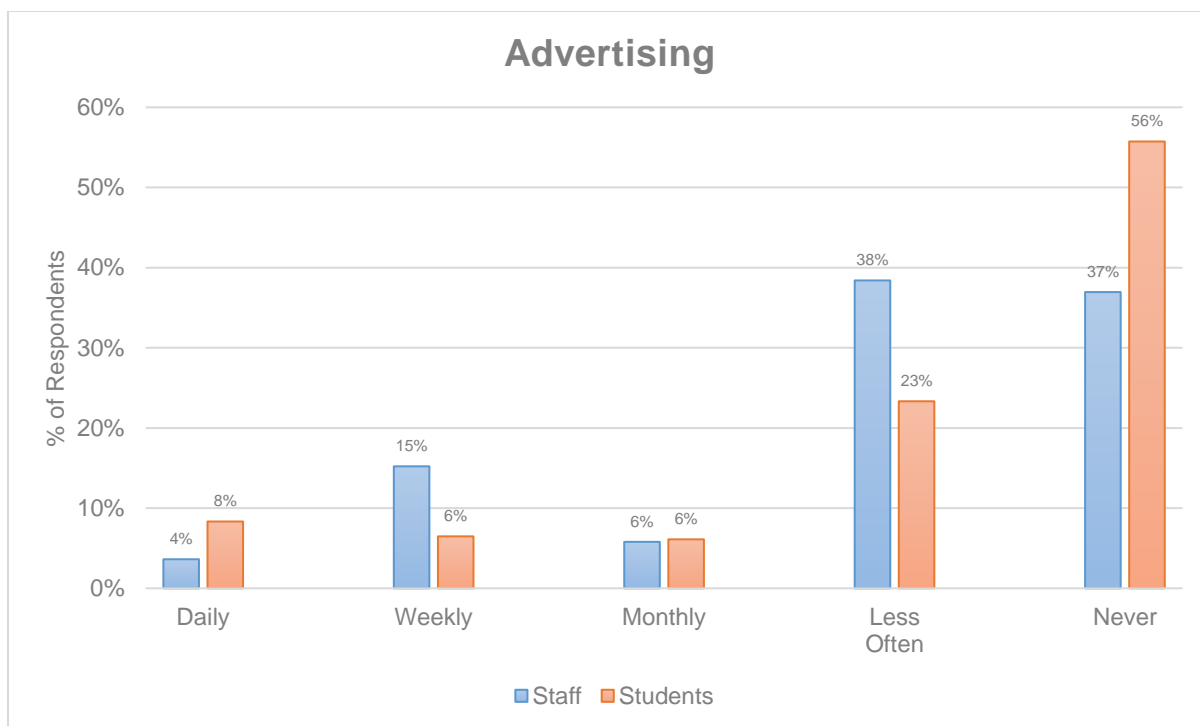
Figure 6.22: Advertising.

According to the Firewall data, staff accessed 'Advertising' content 3.58 percent (11.9TB) of the time while students accessed 'Advertising' content 1.40 percent (14.9TB) of the time. 'Advertising' was listed as priority number 6 for staff and priority number 9 for students as per the staff and student top 20 Internet uses as per the Firewall data list. 'Advertising' content was not covered in the previous questions. The survey findings as listed above are totally underrepresented in the captured Firewall data. It is clear that staff and students do access 'Advertising' content, but it could be without them even being aware of it. The majority of websites use advertising as an income and hence display adverts on the side of their pages. In many cases, the websites force the adverts to load first before loading the rest of the page content. Users have become accustomed to these adverts and the advertising campaigns therefore go unnoticed. HEIs should take note of the 'Advertising' content and the amount of bandwidth being allocated to it and implement measures to control this unwanted content.

'Games' is a website that promotes or provides information about computer games, electronic games, online games, video games, games, or role-playing games. Examples include twitch.tv, goodgamestudios.com, gamer.com.tw and gameforge.com (Fortinet, 2017). Figure 6.23 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'Games'. Seventy-four percent (n = 102) of the staff respondents indicated that they 'Never' access 'Games' content while 17 percent (n = 24) indicating 'Less Often'. Fifty-six percent (n = 305) of the student respondents indicated that they 'Never' access

'Games' content while 21 percent (n = 111) indicating 'Less Often'. Based on the frequencies, the relationship between staff and students 'Games' access was found to be significantly different (Chi² (d.f. = 4, n = 678) = 18.21; p = .001; V = 0.16 Small). Students access 'Games' content more frequently than staff.
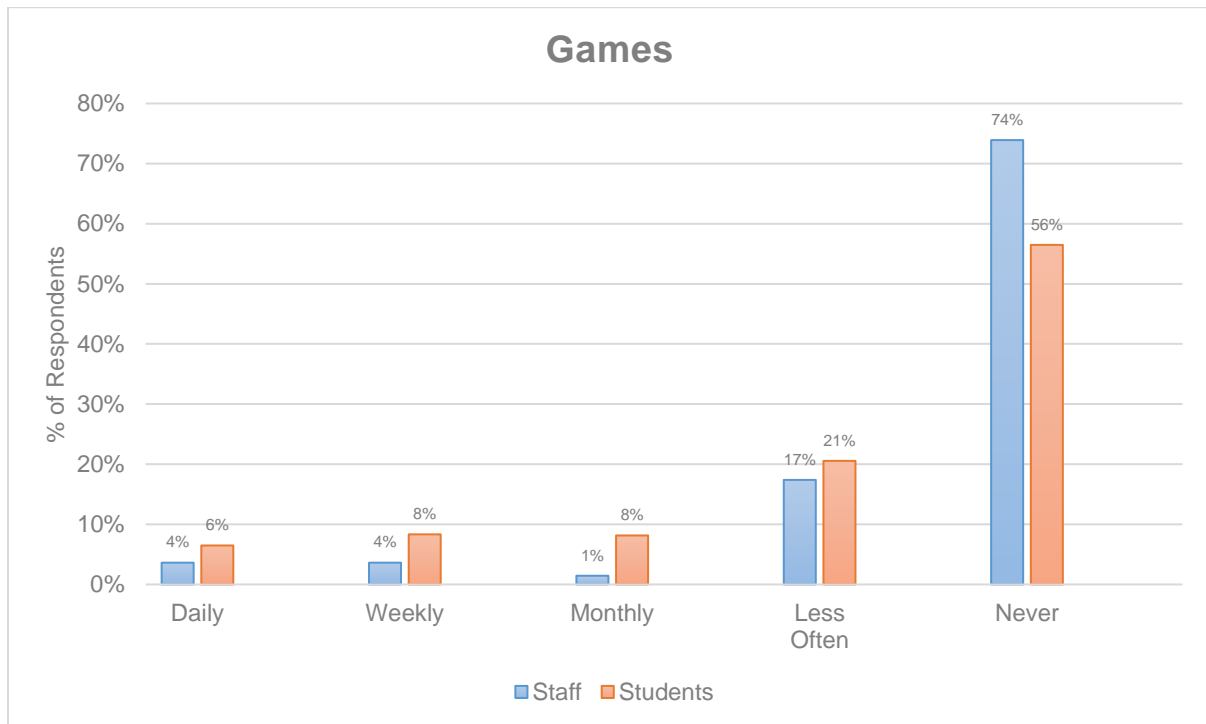
Figure 6.23: Games.

According to the Firewall data, staff accessed 'Games' content 1.63 percent (5.4TB) of the time while students accessed 'Games' content 0.71 percent (7.6TB) of the time. 'Games' was listed as priority number 10 for staff and priority number 13 for students as per the staff and student top 20 Internet uses as per the Firewall data list. 'Games' content ('Online Gaming') received a relatively low rating for both staff and students on the 'Top four primary uses for Nelson Mandela University Internet 'during all hours'. The survey findings as listed above are totally underrepresented when compared to the captured Firewall data. It is clear that staff and students do access 'Games' content and that staff access games content more often than students. The category of 'Games' is identified as cyberloafing and measures should be put in place to ensure it is controlled.
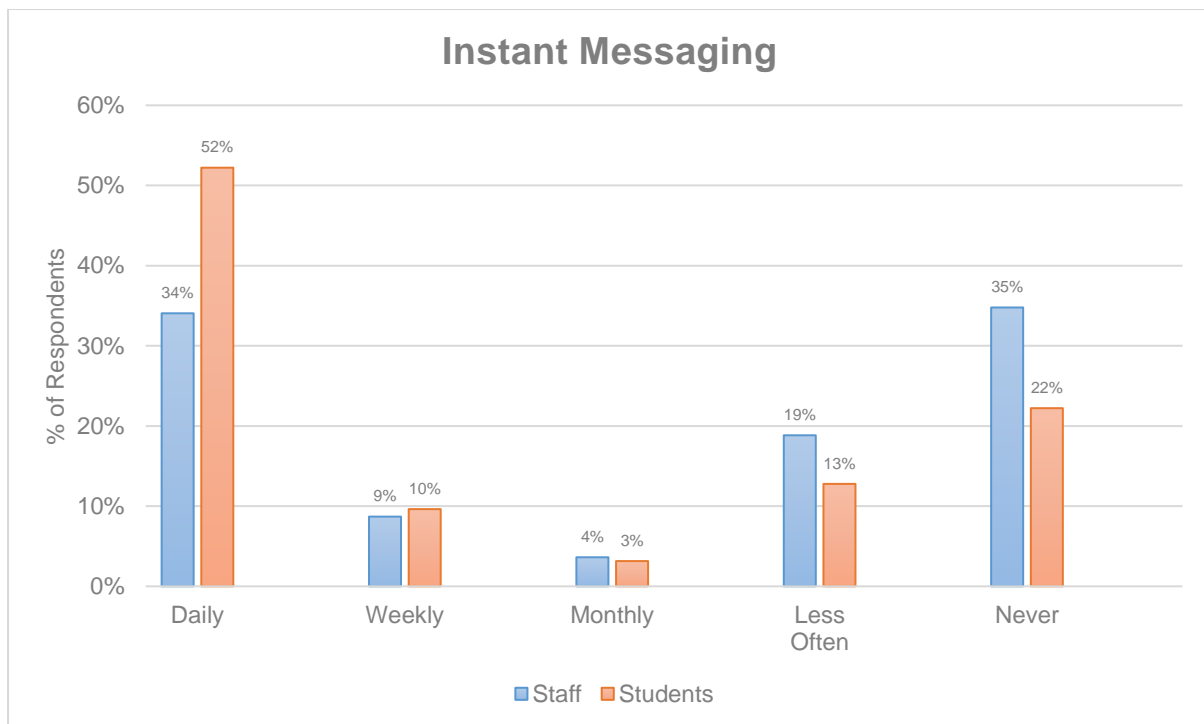
Figure 6.24: Instant Messaging.

'Instant Messaging' is a website that allows users to communicate in real-time over the Internet. Examples include imvu.com, camfrog.com, whatsapp.com and way2sms.com (Fortinet, 2017). Figure 6.24 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'Instant Messaging'. Thirty-Five percent (n = 48) of the staff respondents indicated that they 'Never' access 'Instant Messaging' content while 34 percent (n = 47) indicating 'Daily'. Fifty-two percent (n = 282) of the student respondents indicated that they access 'Instant Messaging' content 'Daily' while 22 percent (n = 120) indicating 'Never'. Based on the frequencies, the relationship between staff and students 'Instant Messaging' access was found to be significantly different (Chi² (d.f. = 4, n = 678) = 17.53; p = .002; V = 0.16 Small). Students access 'Instant Messaging' content more frequently than staff do.

According to the Firewall data, staff accessed 'Instant Messaging' content 0.05 percent (166GB) of the time while students accessed 'Instant Messaging' content 0.04 percent (385.3GB) of the time. 'Instant Messaging' was not in the staff and student top 20 Internet uses as per the Firewall data list. This could be due to the relatively small packet size of messages being sent or the fact that most Instant Messaging traffic is encrypted. 'Instant Messaging' content was identified by HEI as habit number 7 for both staff and students. 'Instant Messaging' was identified as the primary purpose (purpose number 1) in the 'Top four primary uses for Nelson Mandela University Internet' during all hours for students and none

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for staff. The Firewall data does, however, indicate that both staff and students uses 'Instant Messaging' with staff using it more compared to the use of other content. HEIs must take note of the daily use of 'Instant Messaging' and the required bandwidth requirements (relevant packet or data size of sending a message, picture and video).
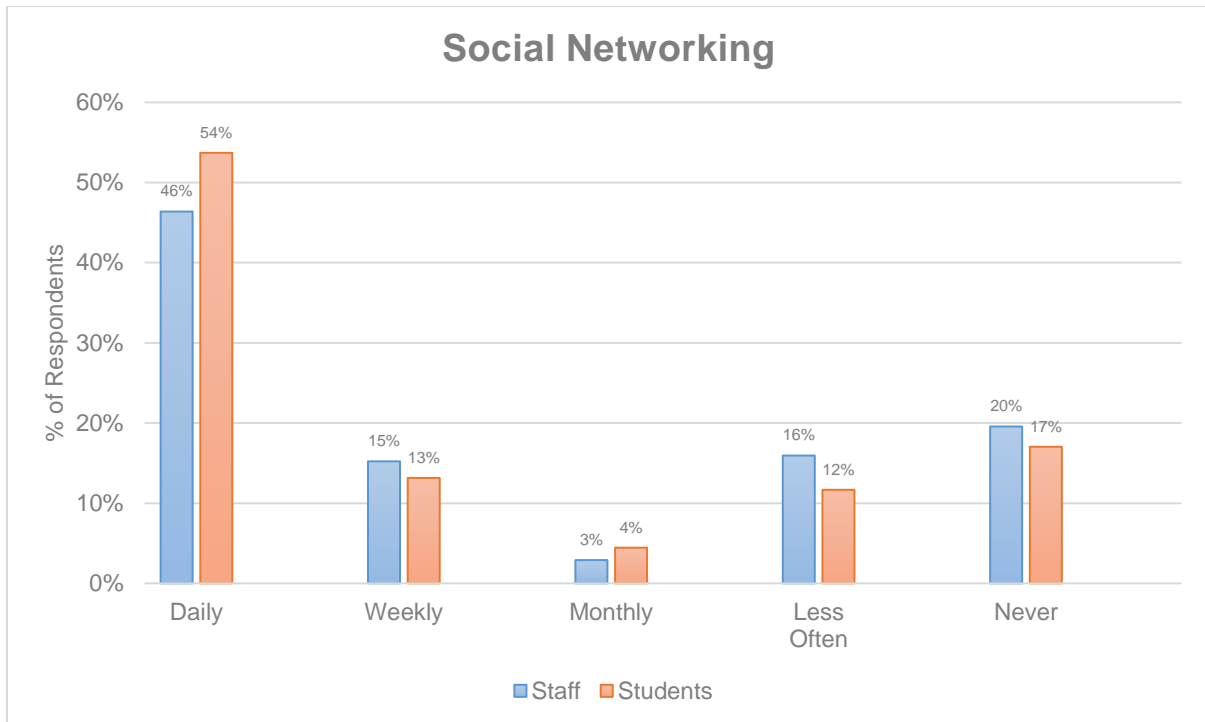
Figure 6.25: Social Networking.

'Social Networking' is a website that is a platform to build social relations or social networks among people who share similar real-life connections, backgrounds, activities or interests. Examples include vk.com, weibo.com, twitter.com and facebook.com (Fortinet, 2017). Figure 6.25 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'Social Networking'. Forty-six percent (n = 64) of the staff respondents indicated that they access 'Social Networking' content 'Daily' while 20 percent (n = 27) indicating 'Never'. Fifty-four percent (n = 290) of the student respondents indicated that they access 'Social Networking' content while 17 percent (n = 92) indicating 'Never'. Based on the frequencies, the relationship between staff and students was found to be not statistical significant (Chi² (d.f. = 4, n = 678) = 4.12; p = .391). Students are accessing 'Social Networking' content more frequently than staff do.

According to the Firewall data, staff accessed 'Social Networking' content 2.35 percent (7.8TB) of the time while students accessed 'Social Networking' content 1.86 percent (19.8TB) of the time. 'Social Networking' was listed as priority number 8 for staff and priority number 6 for

students as per the staff and student top 20 Internet uses as per the Firewall data list. 'Social Networking' content was identified by HEI as habit number 6 for staff and habit number 3 for students. 'Social Networking' was identified as the purpose number 4 in the 'Top four primary uses for Nelson Mandela University Internet over weekends' for students and none for staff. The Firewall data does, however, indicate that both staff and students are very active with 'Social Networking' content, even more so as indicated by the responses in the survey. 'Social Networking' content is a great way to waste time for both staff and students as well as a great way to connected study groups and market University departments. In addition, the content on social networking sites can become extremely resource intensive if not regulated. HEIs should take note of these findings and allocate the required Internet resources to manage 'Social Networking'.
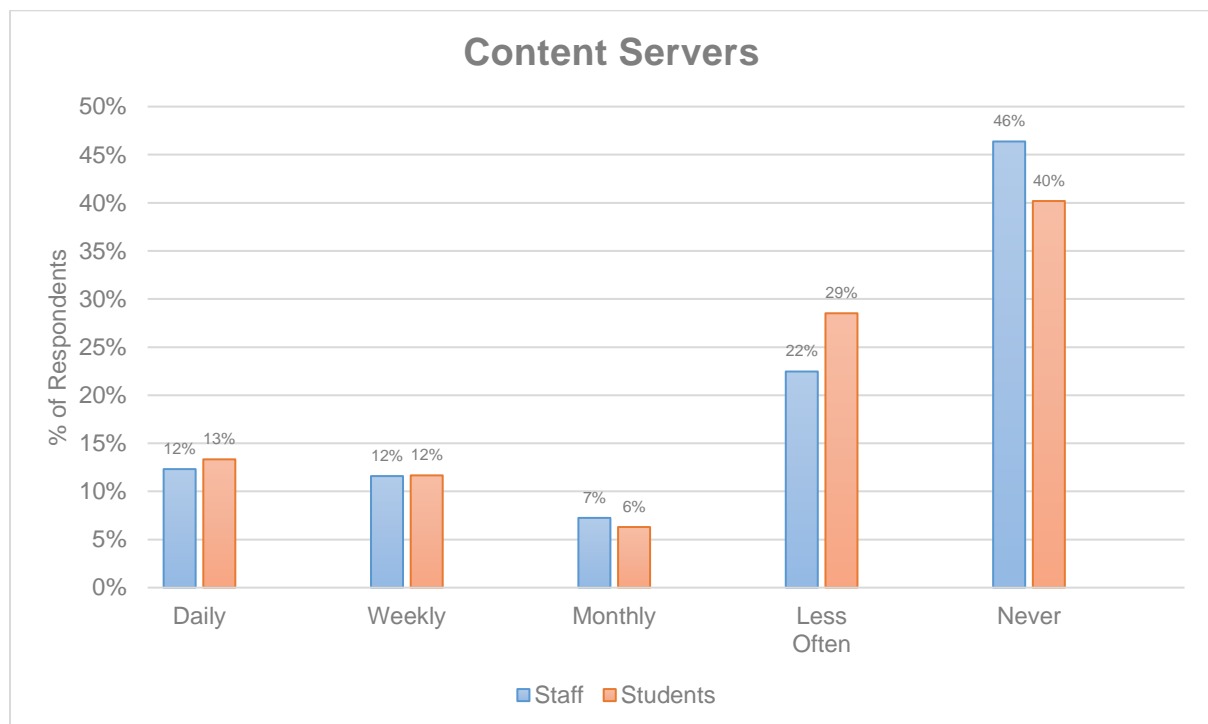
Figure 6.26: Content Servers.

'Content Servers' is a website that host servers that distribute content for subscribing websites, which include web and image servers. Examples include pinimg.com, twimg.com cloudfront.net and akamaihd.net (Fortinet, 2017). Figure 6.26 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'Content Servers'. Forty-six percent (n = 64) of the staff respondents indicated that they 'Never' access 'Content Servers' content while 22 percent (n = 31) indicating 'Less Often'. Forty percent (n = 217) of the student respondents indicated that they 'Never' access 'Content Servers' content while 29 percent (n = 154) indicating 'Less Often'. Based on the frequencies, the relationship between

staff and students 'Content Servers' access was found not to be statistically significant (Chi²
(d.f. = 4, n = 678) = 2.73; p = .603). Staff and students access 'Content Servers' content at a
similar frequency.

According to the Firewall data, staff accessed 'Content Servers' content 5.21 percent (17.3TB)
of the time while students accessed 'Content Servers' content 3.42 percent (36.4TB) of the
time. 'Content Servers' was listed as priority number 3 for staff and priority number 4 for
students as per the staff and student top 20 Internet uses as per the Firewall data list. 'Content
Servers' content was not covered in the previous questions in the survey. The survey findings
indicate that 'Content Servers' is seldom accessed while the Firewall data indicate that both
staff and students access 'Content Servers' extensively. HEIs must take note of the
misalignment in 'Content Servers' and realign the management of Internet resources
accordingly.
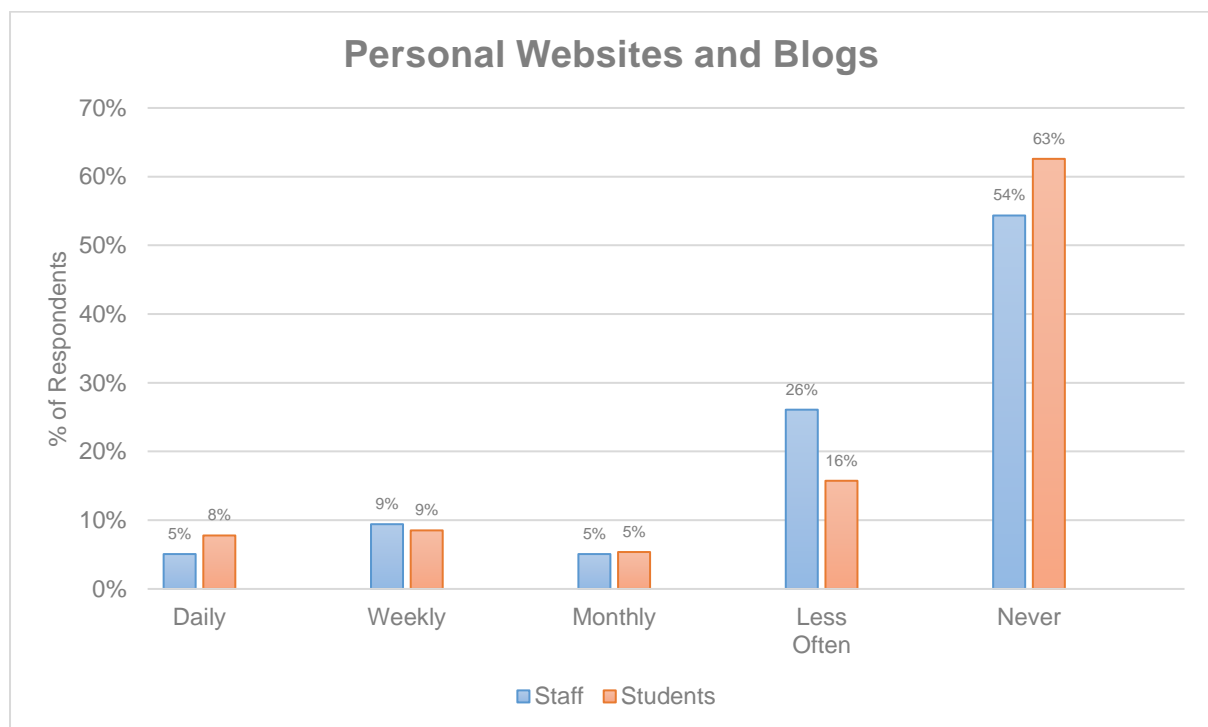
Figure 6.27: Personal Websites and Blogs.

'Personal Websites and Blogs' is a website that houses private web pages that host personal
ideas, opinions and information of the owners. Examples include tumblr.com, pinterest.com,
wordpress.com and blogspot.com (Fortinet, 2017). Figure 6.27 depicts all responses (n = 678)
received from staff (n = 138) and students (n = 540) for the content group 'Personal Websites
and Blogs'. Fifty-four percent (n = 75) of the staff respondents indicated that they 'Never'
access 'Personal Websites and Blogs' content while 26 percent (n = 36) indicating 'Less

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Often'. Twenty-six percent (n = 36) of the staff respondents indicated that they 'Never' access 'Personal Websites and Blogs' content while and 16 percent (n = 85) indicating 'Less Often'. Based on the frequencies, the relationship between staff and students 'Personal Websites and Blogs' access was found not to be statistically significant (Chi² (d.f. = 4, n = 678) = 9.05; p = .060). Staff and students access 'Personal Websites and Blogs' content at a similar frequency.

According to the Firewall data, staff accessed 'Personal Websites and Blogs' content 0.77 percent (2.6TB) of the time while students accessed 'Personal Websites and Blogs' content 0.38 percent (4TB) of the time. 'Personal Websites and Blogs' content was listed as priority number 18 for staff and priority number 16 for students as per the staff and student top 20 Internet uses as per the Firewall data list. The 'Personal Websites' content was not covered in the previous questions but the 'Blogs' content was. 'Blogs' was given a relatively low rating for both staff and students on the 'Top four primary uses for Nelson Mandela University Internet' during all hours. The findings in the survey list do not correspond with the Firewall data. Staff and students are accessing 'Personal Websites and Blogs' content regularly and should therefore be managed accordingly.
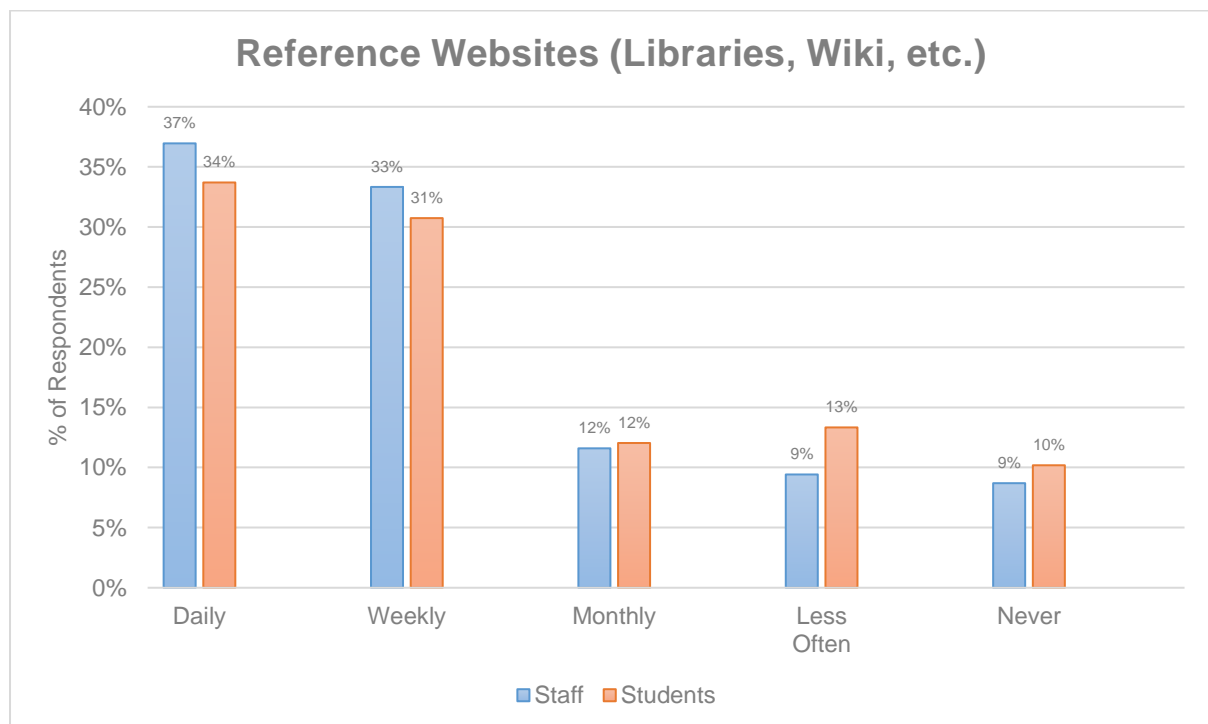
Figure 6.28: Reference Websites (Libraries, Wiki, etc.).

Reference websites are websites that provide general reference data in the form of standards, directories, maps, encyclopedias, thesauri, dictionaries libraries, etc. Examples include yelp.com, wikimedia.org, about.com and ikipedia.org (Fortinet, 2017). Figure 6.28 depicts all

responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'Reference Websites (Libraries, Wiki etc.)'. Thirty-seven percent (n = 51) of the staff respondents indicated that they access 'Reference Websites' content 'Daily' while 33 percent (n = 46) indicate 'Weekly'. Thirty-four percent (n = 182) of the student respondents indicated that they access 'Reference Websites' content 'Daily' while 31 percent (n = 166) indicate 'Weekly'. Based on the frequencies, the relationship between staff and students 'Reference Websites' access was found not to be statistically significant (Chi² (d.f. = 4, n = 678) = 2.18; p = .702). Staff and students access 'Reference Websites' content at a similar frequency.

According to the Firewall data, staff accessed 'Reference Websites' content 0.90 percent (3TB) of the time while students accessed 'Reference Websites' content 0.31 percent (3.3TB) of the time. 'Reference Websites' content was listed as priority number 16 for staff and priority number 19 for students as per the staff and student top 20 Internet uses as per the Firewall data list. It is expected that the 'Research' content which was previously identified as a missing fortigate category should form part of the 'Reference Websites' content. The 'Reference Websites' content was not covered in the previous questions of the survey. According to the findings listed above, 'Reference Websites' is frequently being accessed. If compared to the category 'Research', the alignment would fit. The category 'Reference Websites' is, however, second to many cyberloafing websites (as identified on the Firewall data) which includes 'Entertainment', 'Pornography', 'Social Networking', 'Games', etc. As an Academic institution, it is expected that this category should be used extensively, unless all the research material is housed internally, which is not always the case.

'Shopping and Auction' is a website that feature sale or on-line promotion of general goods and services such as music, jewellery, flowers, electronics, etc, but exclude real estate. Examples include raru.com, takealot.com, tmall.com, ebay.com, amazon.com and taobao.com (Fortinet, 2017). Figure 6.29 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'Shopping and Auction'. Forty-one percent (n = 57) of the staff respondents indicated that they 'Never' access 'Shopping and Auction' content while 24 percent (n = 33) indicating 'Less Often'. Fifty-nine percent (n = 318) of the student respondents indicated that they 'Never' access 'Shopping and Auction' content while 19 percent (n = 101) indicating 'Less Often'. Based on the frequencies, the relationship between staff and students 'Shopping and Auction' access was found to be significantly different (Chi² (d.f. = 4, n = 678) = 17.94; p = .001; V = 0.16 Small). Staff access 'Shopping and Auction' content more frequently than students do.
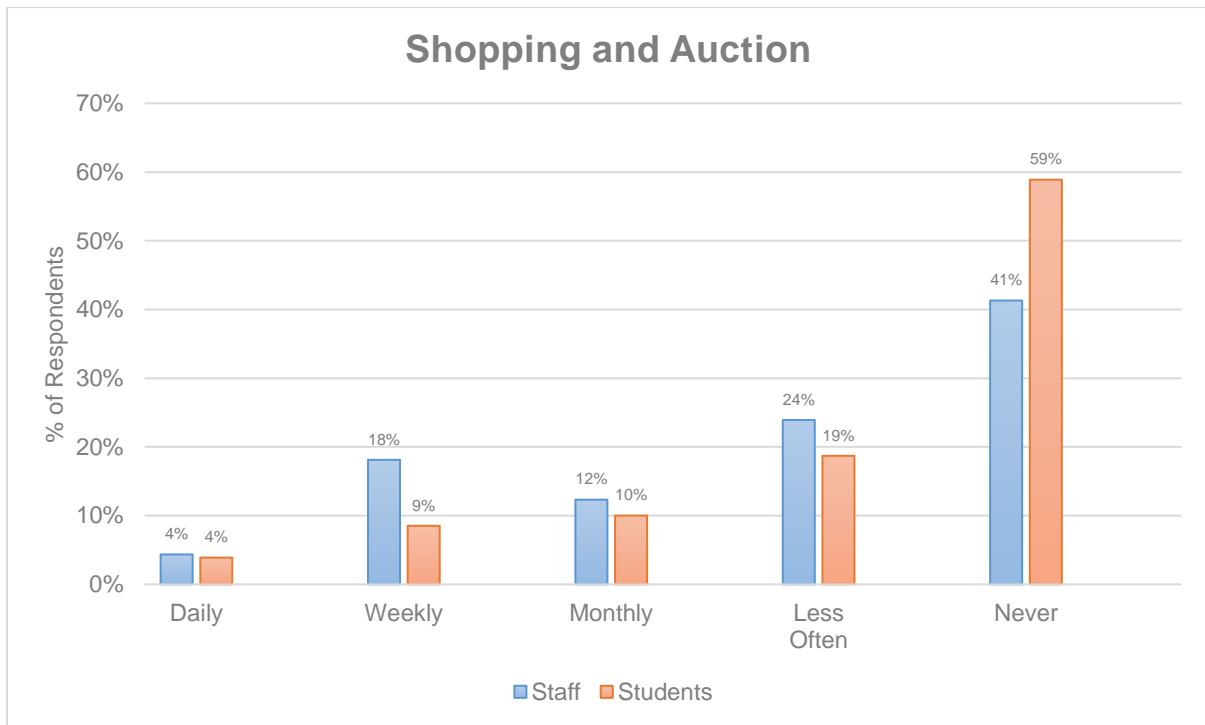
Figure 6.29: Shopping and Auction.

According to the Firewall data, staff accessed 'Shopping and Auction' content 1.09 percent (3.6TB) of the time while students accessed 'Shopping and Auction' content 0.24 percent (2.6TB) of the time. 'Shopping and Auction' content was listed as priority number 12 for staff and priority number 21 for students as per the staff and student top 20 Internet uses as per the Firewall data list. 'Shopping and Auction' was given a relatively low rating by both staff and students on the 'Top four primary uses for Nelson Mandela University Internet' during all hours. The Firewall data, however, indicated that there are many staff and students accessing 'Shopping and Auction' content compared to what they indicate in the survey. HEIs should recognise these findings and realign their HEI management of Internet resources accordingly.

'Job Search' is a website that offers support or information about the seeking of employment or employees. Examples include freelancer.com, elance.com, odesk.com and indeed.com (Fortinet, 2017). Figure 6.30 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'Job Search'. Forty-one percent (n = 56) of the staff respondents indicated that they access 'Job Search' content 'Less Often' while 33 percent (n = 46) indicating 'Never'. Thirty-eight percent (n = 204) of the student respondents indicated that they 'Never' access 'Job Search' content while 26 percent (n = 141) indicating 'Less Often'. Based on the frequencies, the relationship between staff and students 'Job Search' access was found to be significantly different (Chi² (d.f. = 4, n = 678) = 17.12; p = .002; V = 0.16 Small). Students are accessing 'Job Search' content more frequently than staff do.
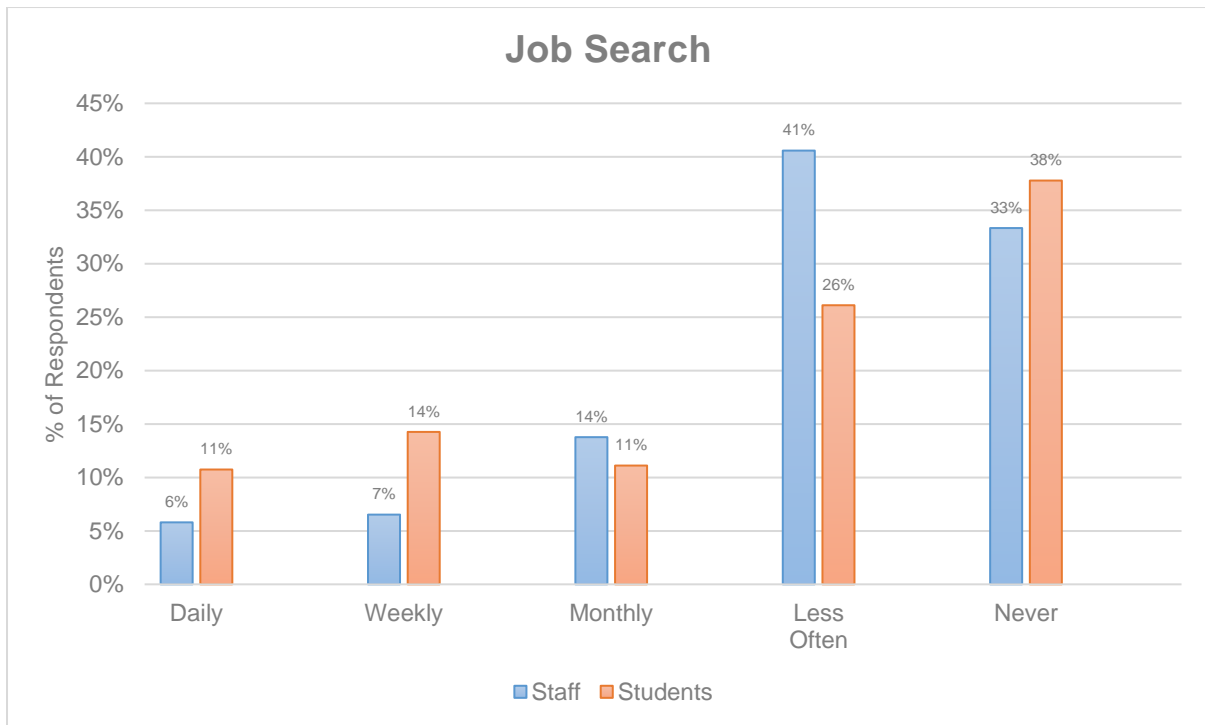
Figure 6.30: Job Search.

According to the Firewall data, staff accessed 'Job Search' content 0.08 percent (274.6GB) of the time while students accessed 'Job Search' content 0.04 percent (386.2GB) of the time. 'Job Search' content did not feature on the staff and student top 20 Internet uses as per the Firewall data list. The 'Job Search' content was not covered in the previous questions. The findings above indicate that both staff and student do not access 'Job Search' content frequently. These survey findings are supported by the Firewall data.

'Meaningless Content' is a website that houses URLs that cannot be conclusively categorised due to lack of or ambiguous content. Examples include 0427d7.se, gateable.com, 4dsply.com, and loading-delivery1.com (Fortinet, 2017). Figure 6.31 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'Meaningless Content'. Fifty-three percent (n = 73) of the staff respondents indicated that they 'Never' access 'Meaningless Content' content while 28 percent (n = 28) indicating 'Less Often'. Forty percent (n = 214) of the student respondents indicated that they 'Never' access 'Meaningless Content' content while 25 percent (n = 133) indicating 'Less Often'. Based on the frequencies, the relationship between staff and students 'Meaningless Content' access was found to be significantly different (Chi² (d.f. = 4, n = 678) = 15.64; p = .004; V = 0.15 Small). Staff access 'Meaningless Content' less frequently than students do.
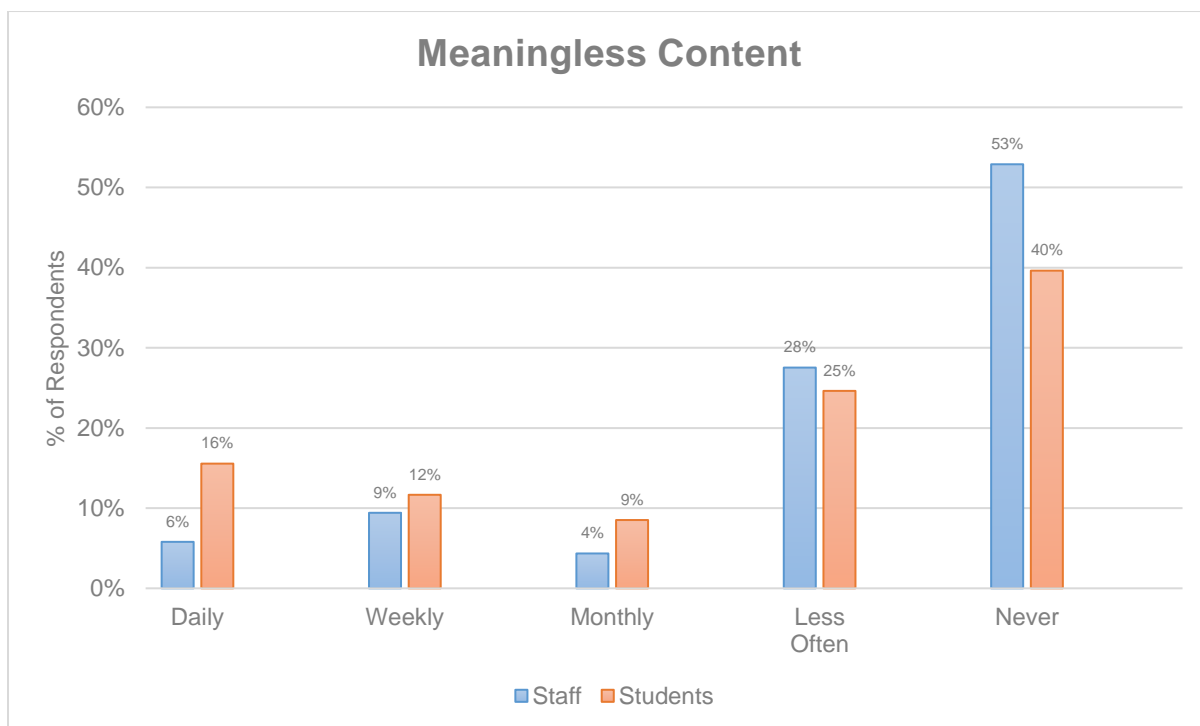
Figure 6.31: Meaningless Content.

According to the Firewall data, staff accessed 'Meaningless Content' content 1.25 percent (4.1TB) of the time while students accessed 'Meaningless Content' content 1.56 percent (16.6TB) of the time. 'Meaningless Content' content was listed as priority number 11 for staff and priority number 7 for students as per the staff and student top 20 Internet uses as per the Firewall data list. The 'Meaningless Content' content was not covered in the previous questions in the survey. The survey findings indicate that both staff and student do not access 'Meaningless Content' frequently, yet the Firewall data indicates otherwise. HEIs must recognise this and realign their HEI management of Internet resources as per the findings.

'News and Media' is a website that offer current opinion and news, which includes those sponsored by general-circulation magazines, newspapers, or other media. This web filter category also includes Radio and TV sites. Examples include bbc.co.uk, ifeng.com, gmw.cn and cnn.com (Fortinet, 2017). Figure 6.32 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'News and Media'. Forty percent (n = 55) of the staff respondents indicated that they access 'News and Media' content 'Daily' while 27 percent (n = 37) indicating 'Weekly' and 18 percent (n = 25) indicating 'Less Often'. Thirty-five percent (n = 187) of the student respondents indicated that they access 'News and Media' content 'Daily' while 26 percent (n = 139) indicating 'Weekly' and 16 percent (n = 89) indicating 'Less Often'. Based on the frequencies, the relationship between staff and students 'News and

Media' access was found to be significantly different (Chi² (d.f. = 4, n = 678) = 10.35; p = .035; V = 0.12 Small). Staff access 'News and Media' more frequently than students do.
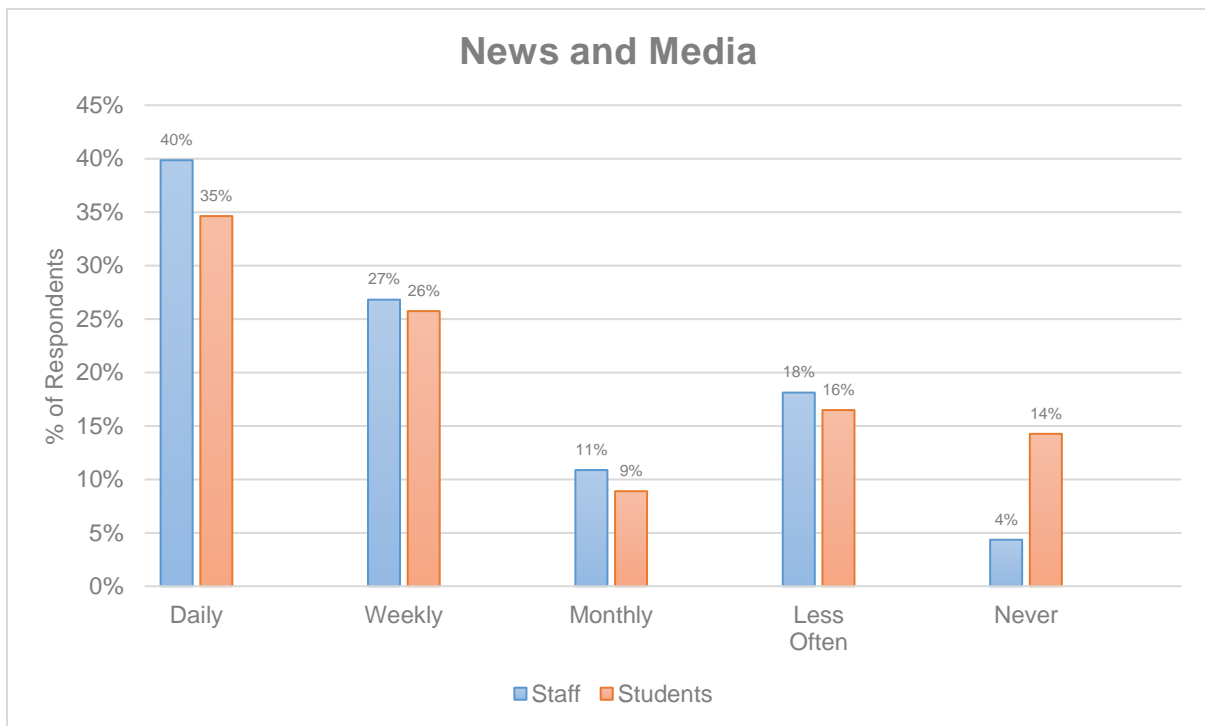
Figure 6.32: News and Media.

According to the Firewall data, staff accessed 'News and Media' content 0.73 percent (2.4TB) of the time while students accessed 'News and Media' content 0.19 percent (2TB) of the time. 'News and Media' content was listed as priority number 19 for staff and priority number 24 for students as per the staff and student top 20 Internet uses as per the Firewall data list. 'News and Media' was identified by HEI as habit number 5 for staff and a low rating habit for students. 'News and Media' (News and Sports) was given a relatively low to average rating for both staff and students on the 'Top four primary uses for Nelson Mandela University Internet' during all hours. The findings above indicate that staff access 'News and Media' more than students, which is supported by the Firewall data. HEIs should, however, review their habits, as previously identified in the survey, to reflect that students also access 'News and Media' to some extent.
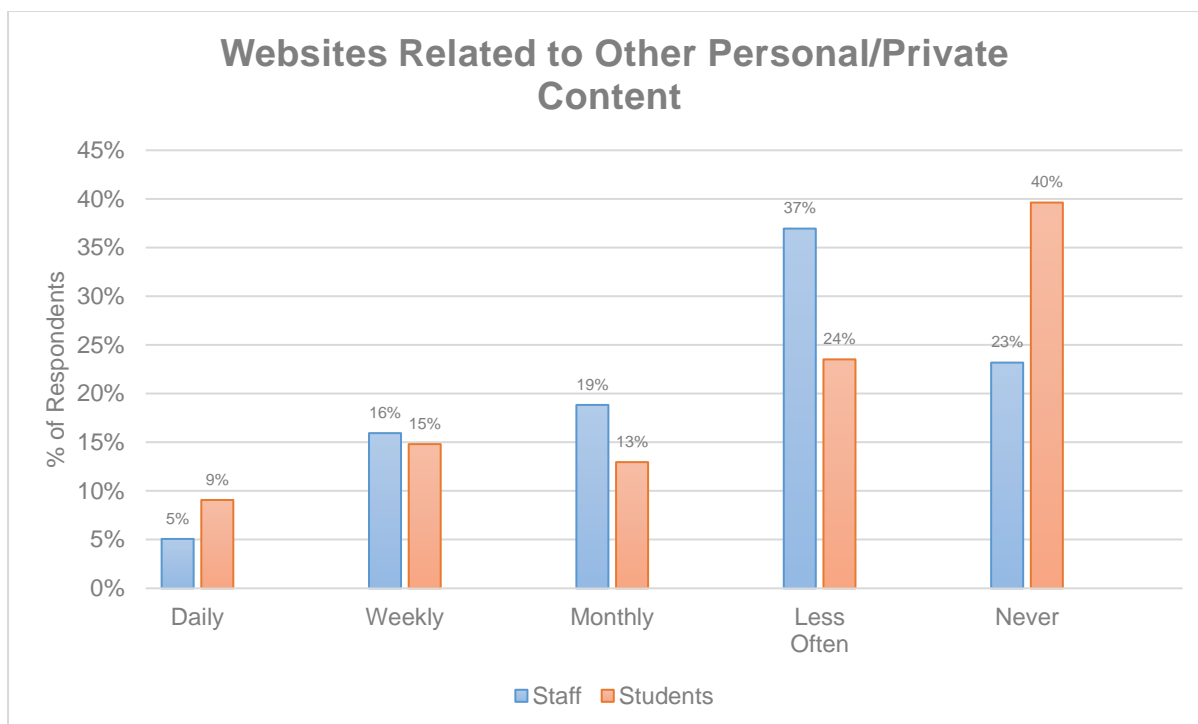
Figure 6.33: Websites Related to Other Personal/Private Content.

The content included in this question are 'Brokerage and Trading', 'Child Education', 'Folklore', 'Global Religion', 'Medicine', 'Personal Privacy', 'Real Estate' and 'Restaurant and Dining' (Fortinet, 2017). Figure 6.33 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'Websites Related to Other Personal/Private Content'. Thirty-seven percent (n = 51) of the staff respondents indicated that they 'Websites Related to Other Personal/Private Content' 'Less Often' while 23 percent (n = 32) indicating 'Never' and 19 percent (n = 26) indicating 'Monthly'. Forty percent (n = 214) of the student respondents indicated that they 'Never' access 'Websites Related to Other Personal/Private Content' while 24 percent (n = 127) indicating 'Less Often' and 15 percent (n = 80) indicating 'Weekly'. Based on the frequencies, the relationship between staff and students 'Websites Related to Other Personal/Private Content' access was found to be significantly different (Chi² (d.f. = 4, n = 678) = 20.65; p < .0005; V = 0.17 Small). Staff access 'Websites Related to Other Personal/Private Content' more frequently that students.

According to the Firewall data, staff accessed 'Websites Related to Other Personal/Private Content' 0.46 percent (1.2TB) of the time while students accessed 'Websites Related to Other Personal/Private Content' 0.09 percent (893.6GB) of the time. In the category of 'Websites Related to Other Personal/Private Content', the key components for staff included 'Global Religion' content 0.15 percent (411.9GB), 'Restaurant and Dining' content 0.10 percent (269.5GB) and 'Real Estate' content 0.09 percent (246.1GB). 'Websites Related to Other

Personal/Private Content' was not prioritised in the staff and student top 20 Internet uses as per the Firewall data list as this is a collection of content. 'Websites Related to Other Personal/Private Content' was not covered in the previous questions. It is clear from the Firewall data that staff access 'Websites Related to Other Personal/Private Content', specifically 'Global Religion', 'Restaurant and Dining' and 'Real Estate' more often that indicated in the findings above. Students on the other hand access the content less as indicated above. HEIs should acknowledge these discrepancies and realign the HEI management of Internet resources accordingly.
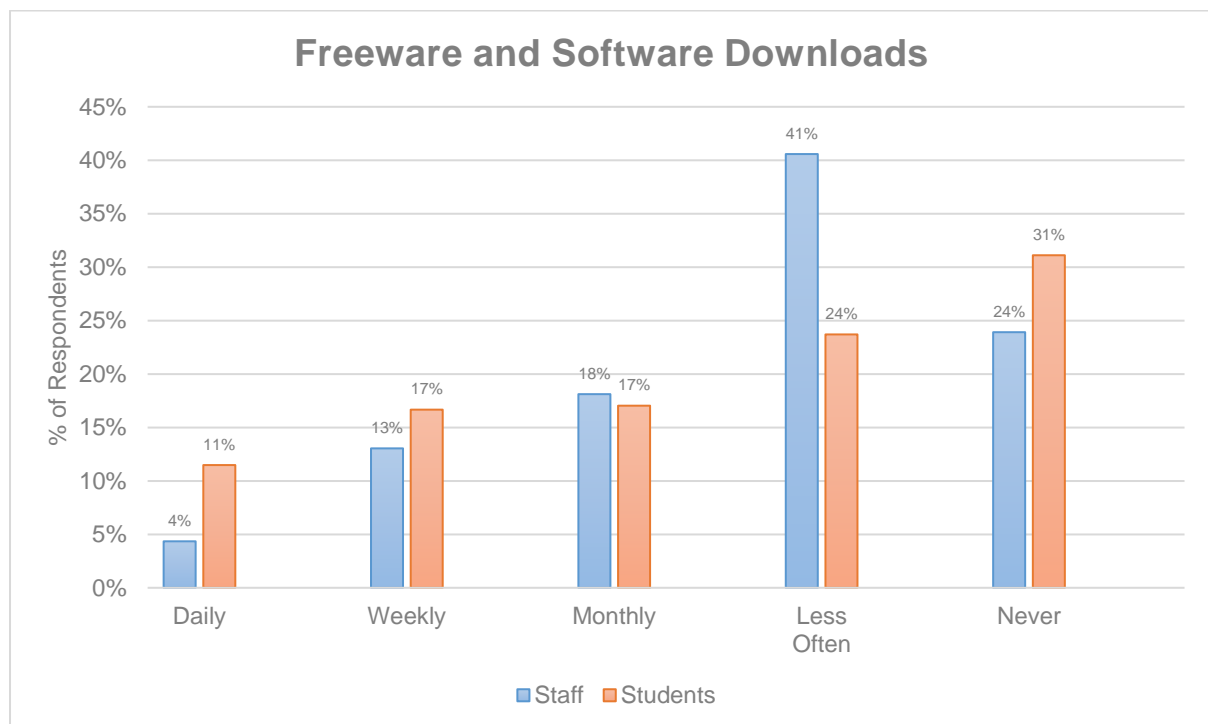
Figure 6.34: Freeware and Software Downloads.

'Freeware and Software Downloads' is a website whose main purpose is to provide freeware and software downloads. Examples include mysearchdial.com, sharelive.net, eazel.com and softonic.com. (Fortinet, 2017). Figure 6.34 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'Freeware and Software Downloads'. Forty-one percent (n = 56) of the staff respondents indicated that they access 'Freeware and Software Downloads' content 'Less Often' while 24 percent (n = 33) indicating 'Never' and 18 percent (n = 25) indicating 'Monthly'. Thirty-one percent (n = 168) of the student respondents indicated that they 'Never' access 'Freeware and Software Downloads' content while 24 percent (n = 128) indicating 'Less Often', 17 percent (n = 92) indicating 'Monthly' and 17 percent (n = 90) indicating 'Weekly'. Based on the frequencies, the relationship between staff and students 'Freeware and Software Downloads' access was found to be significantly

different (Chi² (d.f. = 4, n = 678) = 20.01; p < .0005; V = 0.17 Small). Students access 'Freeware and Software Downloads' content more often than staff do.

According to the Firewall data, staff accessed 'Freeware and Software Downloads' content 0.24 percent (803.2GB) of the time while students accessed 'Freeware and Software Downloads' content 0.36 percent (3.8TB) of the time. 'Freeware and Software Downloads' content was listed as priority number 27 for staff and priority number 17 for students as per the staff and student top 20 Internet uses as per the Firewall data list. 'Freeware and Software Downloads' content was not covered in the previous questions in the survey. The survey findings indicated a low usage as compared to the Firewall data. As previously mentioned, staff are given Nelson Mandela University Council funded devices which are in most cases already setup with the required software. 'Freeware and Software Download' will only be accessed for personal devices or when a small program is required to assist with some form of departmental requirement. Students mostly have their personal devices which they must maintain as per the HEI BYOD policy. It is expected for them to use the free Nelson Mandela University Internet to access 'Freeware and Software Downloads' content as most of them do not have Internet at home. HEIs should acknowledge these requirements and realign the HEI management of Internet resources accordingly.
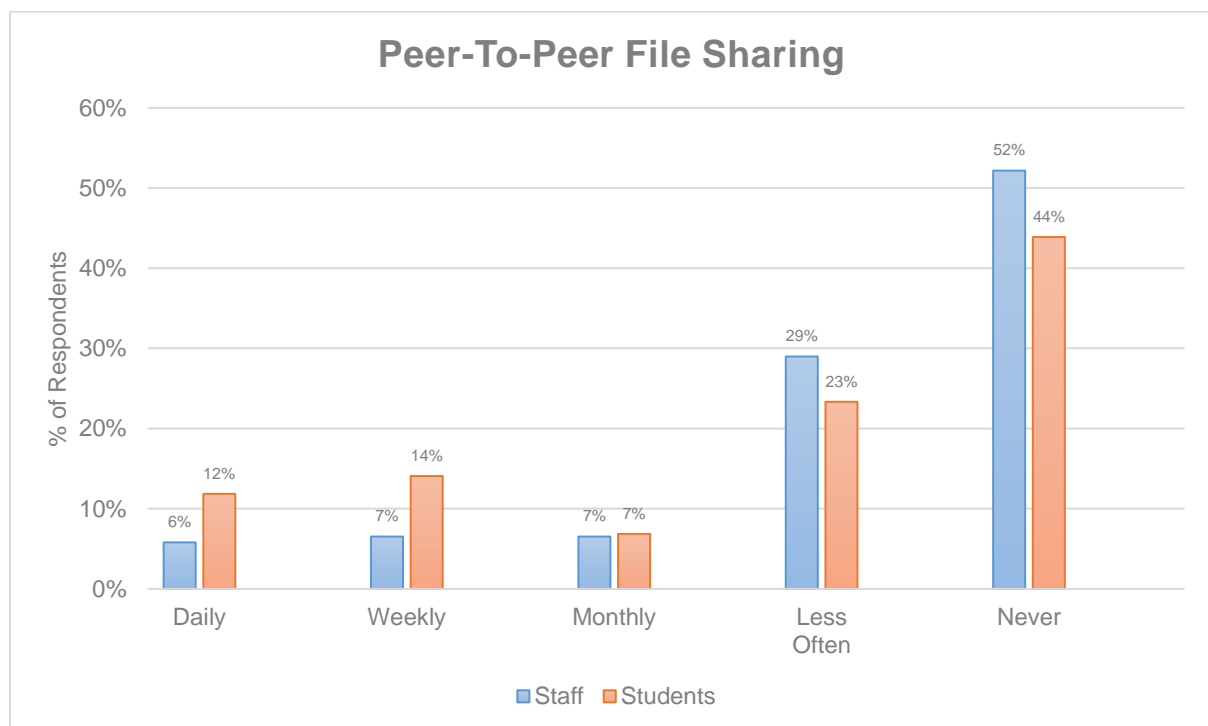
Figure 6.35: Peer-To-Peer File Sharing.

'Peer-to-Peer File Sharing' is a website that allow users to share content between each other. Examples include ppstream.com, eztv.it, qtrax.com and rutracker.org (Fortinet, 2017). Figure 6.35 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'Peer-To-Peer File Sharing'. Fifty-two percent (n = 72) of the staff respondents indicated that they 'Never' access 'Peer-To-Peer File Sharing' content while 29 percent (n = 40) indicating 'Less Often'. Forty-four percent (n = 237) of the student respondents indicated that they 'Never' access 'Peer-To-Peer File Sharing' content while 23 percent (n = 126) indicating 'Less Often'. Based on the frequencies, the relationship between staff and students 'Peer-To-Peer File Sharing' access was found to be significantly different (Chi² (d.f. = 4, n = 678) = 11.90; p = .018; V = 0.13 Small). Students access 'Peer-To-Peer File Sharing' content more often than staff do.

According to the Firewall data, staff accessed 'Peer-To-Peer File Sharing' content 0.01 percent (34.5GB) of the time while students accessed 'Peer-To-Peer File Sharing' content 0.00 percent (10.2GB) of the time. 'Peer-To-Peer File Sharing' content was not listed in the staff and student top 20 Internet uses as per the Firewall data list and was also not covered in the previous questions in the survey. The survey findings indicate that 'Peer-To-Peer File Sharing' content is being accessed more often when as compared to the Firewall data which indicate a low access rate. This is a relief as 'Peer-To-Peer File Sharing' is extremely dangerous and illegal (copyright issues) in most cases. In addition, the content shared in 'Peer-To-Peer File Sharing' is extremely bandwidth intensive and should be monitored closely.

'Streaming Media and Download' is a website that allows for the downloading of MP3 or other multimedia files. Examples include dailymotion.com, youku.com, vube.com and youtube.com (Fortinet, 2017). Figure 6.36 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'Streaming Media and Download'. Twenty-eight percent (n = 39) of the staff respondents indicated that they access 'Streaming Media and Download' content 'Less Often' while 28 percent (n = 38) indicating 'Never', 17 percent (n = 23) indicating 'Weekly' and 17 percent (n = 10) indicating 'Monthly'. Twenty-six percent (n = 139) of the student respondents indicated that they access 'Streaming Media and Download' content 'Daily' while 24 percent (n = 127) indicating 'Never', 22 percent (n = 117) indicating 'Weekly' and 19 percent (n = 101) indicating 'Less Often'. Based on the frequencies, the relationship between staff and students 'Streaming Media and Download' access was found to be significantly different (Chi² (d.f. = 4, n = 678) = 21.36; p < .0005; V = 0.18 Small). Students access 'Streaming Media and Download' content more frequently than staff do.
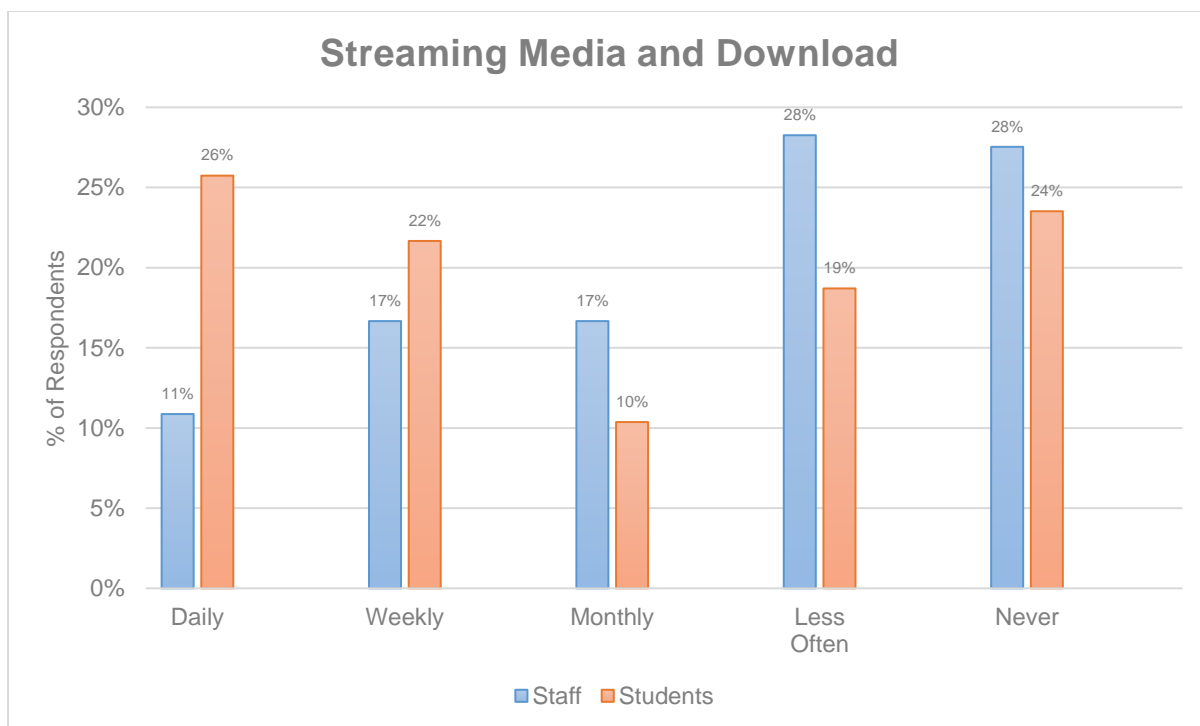
Figure 6.36: Streaming Media and Download.

According to the Firewall data, staff accessed 'Streaming Media and Download' content 5.03 percent (16.7TB) of the time while students accessed 'Streaming Media and Download' content 3.17 percent (33.7TB) of the time. 'Streaming Media and Download' content was listed as priority number 4 for staff and priority number 5 for students as per the staff and student top 20 Internet uses as per the Firewall data list. 'Streaming Media and Download' was not specifically asked for but was included in content such as 'Social Media' and 'Internet TV'. A direct comparison with the previous question can therefore not be made. The findings above indicate that staff tend to access 'Streaming Media and Download' but not as often as students. The Firewall data, however, indicates the opposite. Both staff and students access 'Streaming Media and Download' content frequently with staff accessing it slightly more than students. HEIs are expected to acknowledge this while taking a balanced approach to managing 'Streaming Media and Download' content. 'Streaming Media and Download' content can be an extremely valuable resource in the educational environment whilst still being an extremely counter-productive tool at the other end. Care should be taken to manage this content group.

'Malicious Websites' is a website that host dangerous downloadable software and websites that are infected with malicious or destructive software, which is programmed to manipulate, attack, disrupt or damage the device without the user's consent. Examples include clip.vn, zeroredirect1.com, fishcod.com and delta-search.com (Fortinet, 2017). Figure 6.37 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group

'Malicious Websites'. Eighty-eight percent (n = 122) of the staff respondents and 73 percent (n = 394) of the student respondents indicated that they 'Never' access 'Malicious Websites' content. Based on the frequencies, the relationship between staff and students 'Malicious Websites' access was found to be significantly different (Chi² (d.f. = 4, n = 678) = 14.63; p = .006; V = 0.15 Small). Students access 'Malicious Websites' more frequently than staff do.
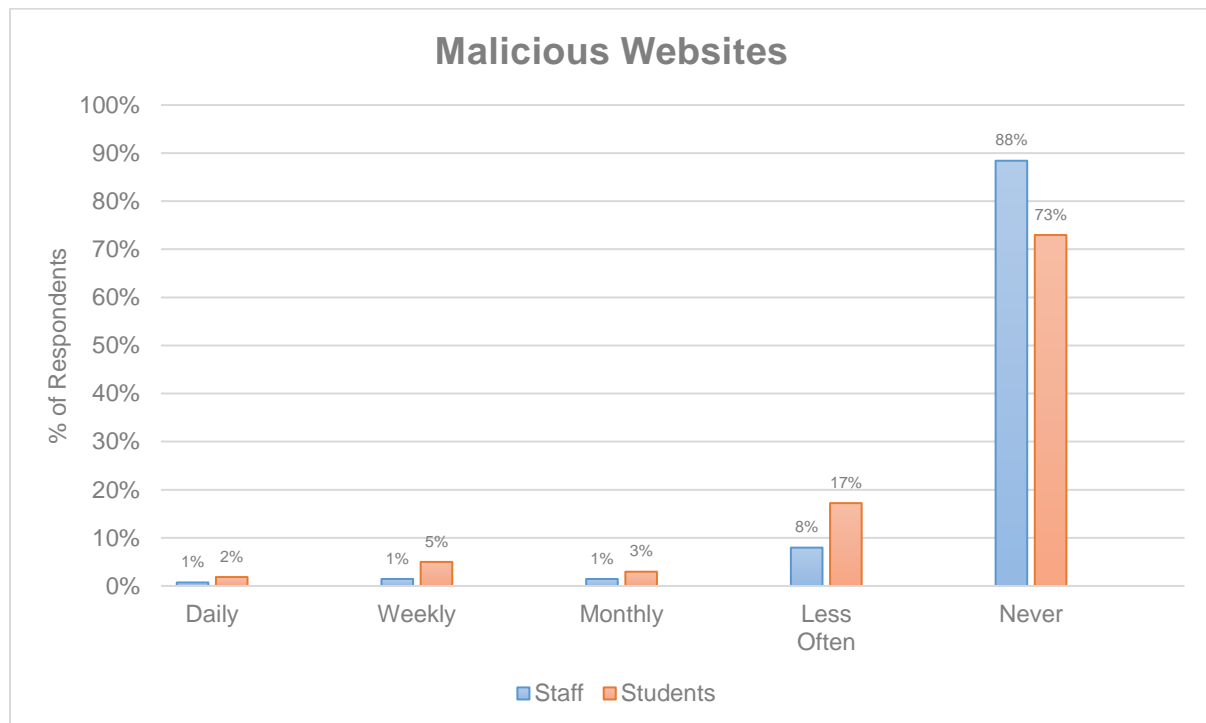
Figure 6.37: Malicious Websites.

According to the Firewall data, staff accessed 'Malicious Websites' content 0.04 percent (145.8GB) of the time while students accessed 'Malicious Websites' content 0.03 percent (315.1GB) of the time. 'Malicious Websites' content was not listed in the staff and student top 20 Internet uses as per the Firewall data list and was also not covered in the previous questions. The findings as listed above indicate a very low participation rate and is supported by the Firewall data. It is, however, still alarming that some still access 'Malicious Websites'. This content is extremely hazardous to the Nelson Mandela University environment and should be blocked at all costs.

'Pornography' is a mature content website which displays or presents sexual acts with the intent to sexually excite and arouse. Examples include xnxx.com, pornhub.com, xhamster.com and xvideos.com (Fortinet, 2017). Figure 6.38 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'Pornography'. Ninety-six percent (n = 132) of the staff respondents and 86 percent (n = 462) of the student

respondents indicated that they 'Never' access 'Pornography' content. Based on the frequencies, the relationship between staff and students 'Pornography' access was found not to be statistical significant (Chi² (d.f. = 4, n = 678) = 8.36; p = .079). Staff and students access 'Pornography' content at the same frequency, which is very seldom.
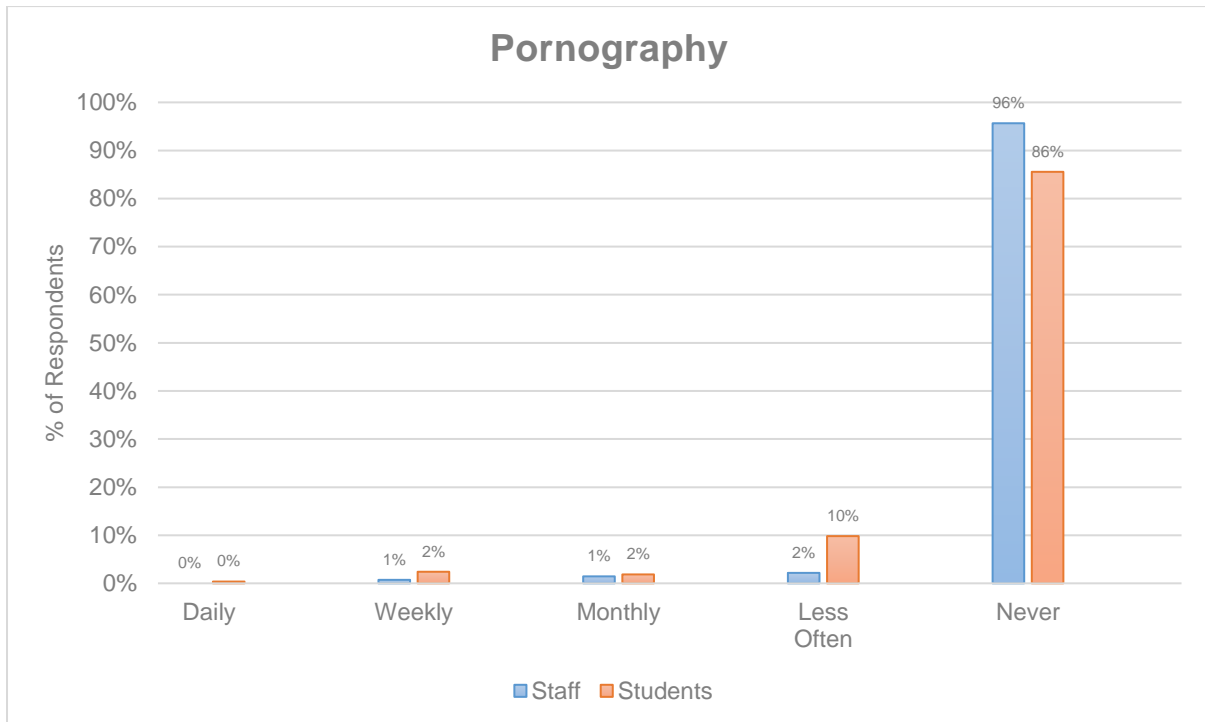
Figure 6.38: Pornography.

According to the Firewall data, staff accessed 'Pornography' content 1.07 percent (3.5TB) of the time while students accessed 'Pornography' content 0.84 percent (9TB) of the time. 'Pornography' content was listed as priority number 13 for staff and priority number 10 for students as per the staff and student top 20 Internet uses as per the Firewall data list. 'Pornography' content was not covered in the previous questions in the survey. The survey findings indicated that staff and students hardly ever access 'Pornography' content, yet the Firewall data proves that it is accessed quite often by both parties. 'Pornography' content is not allowed in the Nelson Mandela University environment and is clearly stated in the ICT General Policy. The firewall findings clearly indicated that the 'Pornography' content category is not being managed and is open to those who wish to access it. ICT Services should investigate this and apply the corrective measures accordingly.
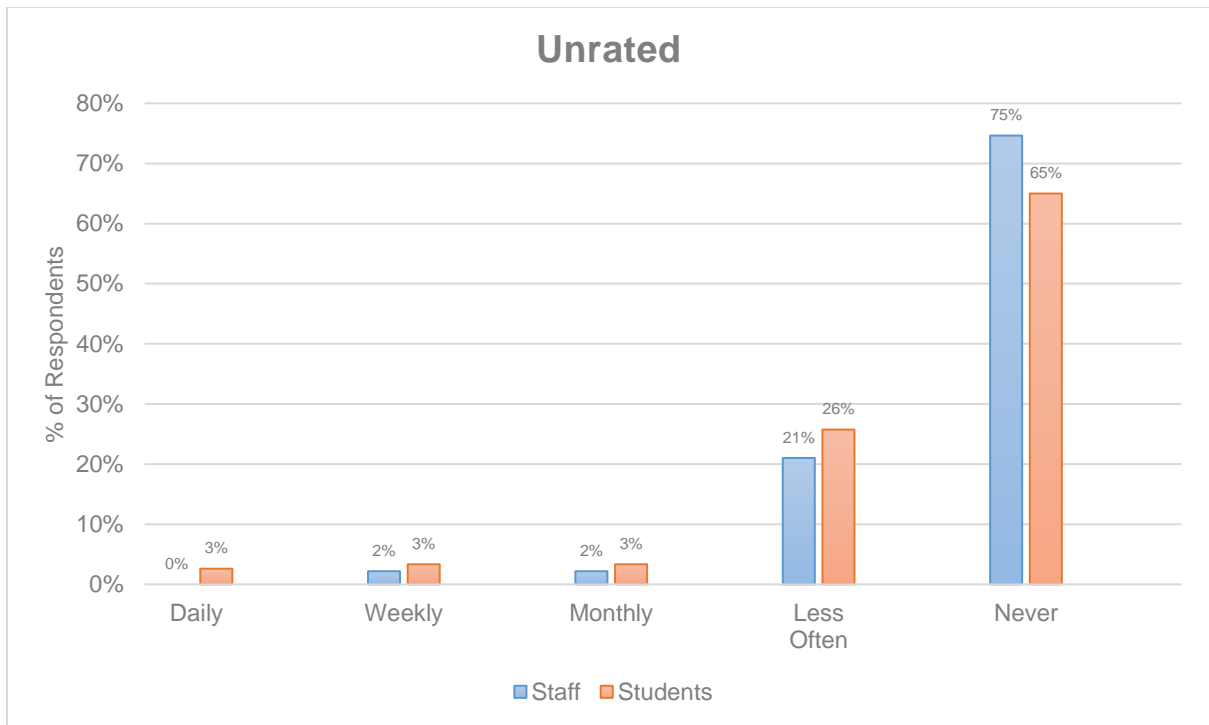
Figure 6.39: Unrated.

'Unrated' is a website that are either newly created or any other website that does not meet the requirements for the other identified web filter categories (Fortinet, 2017). Figure 6.39 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the content group 'Unrated'. Seventy-five percent (n = 103) of the staff respondents indicated that they 'Never' access 'Unrated' content while 21 percent (n = 29) indicating 'Less Often'. Sixty-five percent (n = 351) of the student respondents indicated that they 'Never' access 'Unrated' content while 26 percent (n = 139) indicating 'Less Often'. Based on the frequencies, the relationship between staff and students 'Unrated' access was found not to be statistically significant (Chi² (d.f. = 4, n = 678) = 7.05; p = .133). Staff and students access 'Unrated' content at the same frequency, which is very seldom.

According to the Firewall data, staff accessed 'Unrated' content 1.05 percent (3.5TB) of the time while students accessed 'Unrated' content 0.75 percent (7.9TB) of the time. 'Unrated' content was listed as priority number 20 (Unrated) and 21 (FortiGuard Unrated) for staff and priority number 14 (Unrated) and 22 (FortiGuard) for students as per the staff and student top 20 Internet uses as per the Firewall data list. It should be noted that a change in categories was documented during the research period. The categories of 'Unrated' and 'FortiGuard Unrated' include the same content but due to the name change was captured as different categories. The 'Unrated' total findings as per the Firewall data are the combined findings for both. 'Unrated' content was not covered in the previous questions in the survey. The survey

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findings and staff and students indicate that they do not access 'Unrated' content. However, the Firewall data indicate that it is accessed quite often by both parties. It is, however, not expected that staff and students should know what the firewall classifies as 'Unrated'. The onus should fall on the vendor to ensure the 'Unrated' categories are updated and classified correctly. This will confirm that the rules applied to these categories are correctly managed by the implemented ACLs. The HEI should use the relationship with the firewall vendors to reduce the 'Unrated' content as much as possible.

Table 6.3: Holistic View of Firewall Data per Category.

Category	Staff		Students	
	Total Size	Total %	Total Size	Total %
(empty)	83.2TB	25.08%	524.1TB	49.30%
General Interest - Business	146.3TB	44.09%	343.4TB	32.30%
General Interest - Personal	73.3TB	22.08%	133.6TB	12.57%
Bandwidth Consuming	19.8TB	5.97%	42.1TB	3.96%
Security Risk	151.1GB	0.04%	329.3GB	0.03%
Potentially Liable	431.9GB	0.13%	1.2TB	0.11%
Adult/Mature Content	5.2TB	1.56%	10.4TB	0.98%
UNRATED	3.5TB	1.05%	7.9TB	0.75%
GRAND TOTAL	331.7TB	100%	1PB	100%

This concludes the individual analysis of the significant findings as per the Firewall data category's internal content. The next part will examine the Firewall data per category, as a whole. Table 6.3 will provide a holistic view of the content being accessed on the Nelson Mandela University Internet.

Table 6.3 specifies that 25.08 percent (83.2 TB) of the staff data is 'Empty' and 49.30 percent (524.1TB) of the student data is 'Empty'. This means that a quarter of the staff data is unclassified and therefore unmanaged and almost half of the student data is unclassified and therefore unmanaged. The data being classified under the 'Empty' category could, for example, range from legitimate business information to illegal content being downloaded to sensitive corporate information being transferred to external parties. There is no way of knowing what the information pertains to as it is not visible to the firewall. HEIs are urged to investigate and activate the decryption/inspection feature on the firewall that will allow all traffic to be inspected, correctly classified and consequently managed correctly as per the institutional organisational goals. This is a direct requirement from NREN and HEIs cannot

say they did not know that this illegal activity was happening on a corporate network. The inspection of encrypted traffic should be balanced with privacy regulations, which is another core value of the Internet. The decryption/inspection feature may reduce the speed of the traffic as an additional processing step is added. Speed is a critical characteristic stated by both the HEI and Nelson Mandela University Internet community. HEIs should therefore take note of this discussion and find a balanced approach to manage the 'Empty' content, maintain an acceptable bandwidth speed and protect the users and corporate information.

Forty-four point zero-nine percent (146.3 TB) of staff information is considered to be business related and 32.30 percent (343.4TB) of student information is considered to be business related. This means that more than half of the content being accessed by staff is not considered to be work/academic related and more than two-thirds of the content being accessed by students is not considered to the work/academic related. If this is linked to time spent on the Internet, it basically means that staff spend more than half of the time on the Internet working on non-work/non-academic related content and students spend more than two-thirds of the time on the Internet on non-academic related content. The HEIs should spend time reviewing the categories and internal descriptions to reclassify them as per the HEI's requirements. Policies, procedures and rules should then be built around these controls to ensure that the Internet is used mostly for work purposes with non-work purposes being used only when needed or allowed.

Twenty-two point zero-eight percent (73.3TB) of staff information sought by staff is considered to be of personal interest and 12.57 percent (133.6TB) of student information sought by students is considered to be of personal interest. The findings are as expected and therefore manageable. Five point nine-seven percent (19.8TB) of staff information is considered to be bandwidth-consuming and 3.96 percent (42.1TB) of student information is considered to be bandwidth-consuming. The findings are as expected and therefore manageable. The category must, however, be monitored as with the increase in popularity of these sites and the rich data they contain, the problem arising may quickly become unmanageable. Also, it may be beneficial to implement control to balance the personal use of bandwidth-consuming content with the business/educational use of bandwidth-consuming content. Zero point zero-four percent (151.1GB) of staff information is considered to be security risk related and 0.03 percent (329.3GB) of student information is considered to be security risk related. Even through the content being accessed is relatively low, it is still considered to be high due to its nature. The safety and security core Internet value of the Nelson Mandela University Internet should be upheld. Any access to these sites is considered a risk and could negatively influence

the entire Nelson Mandela University Internet community. Strict security controls must be activated to reduce this to almost non-existing.

Zero point one-three percent (431.9GB) of information sought by staff is considered to be potentially liable and 0.11 percent (1.2TB) of information sought by student is considered to be potentially liable. Potentially liable content falls into a similar category as security risk. It is ideal to not have this kind of activity on the network as this may get the user and/or HEI into legal trouble. Potentially liable content as captured on the firewall is still considered a high risk due to its nature. HEIs must implement measures to control this kind of access without jeopardising potential research opportunities. One point five-six percent (5.2TB) of information sought by staff is considered to be related to adult/mature content and 0.98 percent (10.4TB) of information sought by student is considered to be related to adult/mature content. The large amount of adult/mature content being accessed by staff and students is extremely alarming and this is a direct violation of the NREN policies as well as General ICT policy. This kind of content is taking valuable ICT Internet resources away from those who wish to work. The HEI must review their Internet restriction and block adult/mature content completely.

One point zero-five percent (3.5TB) of information sought by staff is considered to be unrated and 0.75 percent (7.9TB) of information sought by student is considered to be unrated. As previously discussed, HEIs should engage with the Fortguard vendors and ask for a speedy classification of new websites. The high level of 'Unrated' content on the Nelson Mandela University Internet goes unclassified and is therefore not properly managed. In addition, the HEI must review this category and assign to it an intermediate policy level to ensure the content within it is not over or under classified/throttled, etc. Lastly, in total, staff accessed 331.7TB of Internet content whilst student accessed 1PB of Internet content. It is clear that students use almost two-thirds more of the Nelson Mandela University Internet than staff. This is mainly due to the population difference and could also be influenced by the type of generation the user falls into. The younger generation tend to use the Internet more than the older generation. HEIs are expected to maintain a balance and share the Internet equally according to business and personal requirements. This can only be accomplished by installing the correct physical infrastructure and implementing/activating the correct technical and operational Internet controls.

The summated scores analysis of results for Section 4: Content according to the demographic group can be found on the attached CD. The following section will present and discuss the findings for Section 5: Primary Purpose.

6.7. Section 5: Primary Purpose

Tables 6.4 - 6.6 depict the findings captured from the staff (n = 138) and students (n = 540) regarding the primary purpose of using the Nelson Mandela University Internet during office hours, after office hours and over weekends.

6.7.1. Analysis of Results for Section 5: Primary Purpose

Table 6.4: Top Four Primary Uses for Nelson Mandela University Internet During Office Hours.

	Staff	Students
Purpose 1	Business emails (work and research related)	Research (e.g. Journal, articles)
Purpose 2	Work (Job specific content search)	Instant Messenger (e.g. WhatsApp, WeChat, Facebook Messenger)
Purpose 3	Research (e.g. Journal, articles)	Personal Emails
Purpose 4	Web Browsing (General)	Web Browsing (General)

Table 6.4 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the question, 'What are your top 4 primary uses for Nelson Mandela University's Internet during office hours on weekdays?'. A detailed analysis was conducted and is included on the CD. From the findings, the top four uses for Nelson Mandela University's Internet during office hours on weekdays were extracted and are presented in Table 6.4. Seventy-nine percent (n = 109) of the staff respondents identified 'Business Emails' as one of the top four and 31 percent (n = 166) of the student respondents identified 'Business Emails' as one of the top four uses for Nelson Mandela University's Internet during office hours on weekdays. Based on the frequencies, the relationship between staff and students use of 'Business Emails' was found to be significantly different (Chi² (d.f. = 4, n = 678) = 123.32; p < .0005; V = 0.43 Medium). Staff use the HEI Internet to access 'Business Emails' more that students do during office hours.

Fifty percent (n = 69) of the staff respondents identified 'Research' as one of the top four and 55 percent (n = 296) of the student respondents identified 'Research' as one of the top four uses for Nelson Mandela University's Internet during office hours on weekdays. Based on the frequencies, the relationship between staff and students use of 'Research' was found to be not statistical significant (Chi² (d.f. = 4, n = 678) = 2.24; p = .525). Staff and students use the

HEI Internet for 'Research' purpose about the same during office hours. 52 percent (n = 72) of the staff respondents identified 'Work' as one of the top four and 15 percent (n = 80) of the student respondents identified 'Work' as one of the top four uses for Nelson Mandela University's Internet during office hours on weekdays. Based on the frequencies, the relationship between staff and students use for 'Work' was found to be significantly different (Chi² (d.f. = 4, n = 678) = 107.02; p < .0005; V = 0.40 Medium). Staff use the HEI Internet for 'Work' purpose more that students do during office hours.

Fourteen percent (n = 19) of the staff respondents identified 'Instant Messenger' as one of the top four and 46 percent (n = 249) of the student respondents identified 'Instant Messenger' as one of the top four uses for Nelson Mandela University's Internet during office hours on weekdays. Based on the frequencies, the relationship between staff and students use of 'Instant Messenger' was found to be significantly different Chi² (d.f. = 4, n = 678) = 51.63; p < .0005; V = 0.28 Small). Students use the HEI Internet for the purpose of 'Instant Messenger' more that staff do during office hours. Eighteen percent (n = 25) of the staff respondents identified 'Personal Emails' as one of the top four and 44 percent (n = 235) of the student respondents identified 'Personal Emails' as one of the top four uses for Nelson Mandela University's Internet during office hours on weekdays. Based on the frequencies, the relationship between use of 'Personal Emails' by staff and students was found to be significantly different (Chi² (d.f. = 4, n = 678) = 37.86; p < .0005; V = 0.24 Small). Students use the HEI Internet to access 'Personal Emails' more that staff do during office hours.

Thirty-three percent (n = 42) of the staff respondents identified 'Web Browsing (General)' as one of the top four and 42 percent (n = 228) of the student respondents identified 'Web Browsing (General)' as one of the top four uses for Nelson Mandela University's Internet during office hours on weekdays. Based on the frequencies, the relationship between staff and students use of 'Web Browsing (General)' was found not to be statistically significant (Chi² (d.f. = 4, n = 678) = 5.94; p = .115). Students and students use the HEI Internet for the purpose of 'Web Browsing (General)' about the same as during office hours.

The findings indicated that during the day the majority of staff use the Internet for 'Business emails (work and research related)'. This is followed by a large number of staff 'Work (Job specific content search)' and 'Research (e.g. Journal, articles)'. A small, yet relevant number of staff use the Internet for 'Web Browsing (General)'. There are more students who use the Internet during the day for 'Research (e.g. Journal, articles)'. This is followed closely by 'Instant Messenger (e.g. WhatsApp, WeChat, Facebook Messenger)', 'Personal Emails' and lastly,

'Web Browsing (General)'. It is clear from the staff findings that Business emails (work and research related)' is the most used by both administrative and academic staff. 'Work (Job specific content search)' is very focused for administrative staff whilst 'Research (e.g. Journal, articles)' is again focused for academic staff. The purpose of all three are related to business content. The third identified purpose, being 'Web Browsing (General)', is in most cases linked to cyberloafing which must be controlled during business hours. For students, 'Research (e.g. Journal, articles)' was identified as the top priority. The gap between this purpose and the following are, however, minimal. The purposes of 'Instant Messenger (e.g. WhatsApp, WeChat, Facebook Messenger)', 'Personal Emails' and 'Web Browsing (General)' are, however, linked to cyberloafing which must be controlled during business hours. The findings do specify that students tend to engage in personal activities to a much greater extent than staff do during office hours.

Table 6.5: Top Four Primary Uses for Nelson Mandela University Internet After Office Hours.

	Staff	Students
Purpose 1	Business emails (work and research related)	Instant Messenger (e.g. WhatsApp, WeChat, Facebook Messenger)
Purpose 2	Research (e.g. Journal, articles)	Web Browsing (General)
Purpose 3	Web Browsing (General)	Research (e.g. Journal, articles)
Purpose 4	Work (Job specific content search)	Personal Emails

Table 6.5 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the question, 'What are your top four primary uses for Nelson Mandela University's Internet after hours on weekends?'. A detailed analysis was conducted and is included on the CD. From the findings, the top four uses for Nelson Mandela University's Internet after hours on weekdays were extracted and are presented in Table 6.5. Sixty-five percent (n = 90) of the staff respondents identified 'Business Emails' as one of the top three and 15 percent (n = 80) of the student respondents identified 'Business Emails' as one of the top four uses for Nelson Mandela University's Internet after hours on weekdays. Based on the frequencies, the relationship between the use by staff and students of 'Business Emails' was found to be significantly different (Chi² (d.f. = 4, n = 678) = 182.50; p < .0005; V = 0.52 Large). Staff use the HEI Internet to access 'Business Emails' more that students do after office hours.

Nineteen percent (n = 26) of the staff respondents identified 'Instant Messenger' as one of the top four and 51 percent (n = 274) of the student respondents identified 'Instant Messenger' as one of the top four uses for Nelson Mandela University's Internet after hours on weekdays. Based on the frequencies, the relationship between staff and students use of 'Instant Messenger' was found to be significantly different (Chi² (d.f. = 4, n = 678) = 46.57; p < .0005; V = 0.26 Small). Students use the HEI Internet for 'Instant Messenger' purpose more than staff do after office hours. Fifty-one percent (n = 70) of the staff respondents identified 'Research' as one of the top four and 38 percent (n = 203) of the student respondents identified 'Research' as one of the top four uses for Nelson Mandela University's Internet after hours on weekdays. Based on the frequencies, the relationship between staff and students use of 'Research' was found to be significantly different (Chi² (d.f. = 4, n = 678) = 9.01; p = .029; V = 0.12 Small). Staff use the HEI Internet for 'Research' more than students do after office hours.

Thirty-eight percent (n = 53) of the staff respondents identified 'Web Browsing (General)' as one of the top four and 40 percent (n = 217) of the student respondents identified 'Web Browsing (General)' as one of the top four uses for Nelson Mandela University's Internet after hours on weekdays. Based on the frequencies, the relationship between the use of 'Web Browsing (General)' by staff and students was found not to be statistically significant (Chi² (d.f. = 4, n = 678) = 7.20; p = .066). Staff and students use the HEI Internet for the purpose of 'Web Browsing (General)' about the same as during office hours. Thirty-four percent (n = 47) of the staff respondents identified 'Work' as one of the top four and 9 percent (n = 51) of the student respondents identified 'Work' as one of the top four uses for Nelson Mandela University's Internet after hours on weekdays. Based on the frequencies, the relationship between the use for 'Work' by staff and students was found to be significantly different (Chi² (d.f. = 4, n = 678) = 61.80; p < .0005; V = 0.30 Medium). Staff use the HEI Internet for 'Work' more than students do after office hours.

Thirty-two percent (n = 44) of the staff respondents identified 'Personal Emails' as one of the top four and 37 percent (n = 200) of the student respondents identified 'Personal Emails' as one of the top four uses for Nelson Mandela University's Internet after hours on weekdays. Based on the frequencies, the relationship between the use of 'Personal Emails' by staff and students was found not to be statistically significant (Chi² (d.f. = 4, n = 678) = 2.79; p = .426). Staff and students use the HEI Internet to access 'Personal Emails' equally during office hours.

The findings indicated that after office hours the majority of staff still use the Internet for 'Business emails (work and research related)'. This is followed by a large number of staff using

the Internet for 'Research (e.g. Journal, articles)'. 'Web Browsing (General)' and 'Work (Job specific content search)' follow within close proximity of one another. The focus areas remain the same with the only noticeable change being a drop in 'Work (Job specific content search)' by two places and a climb by one place for 'Research (e.g. Journal, articles)' and 'Web Browsing (General)'. The cyberloafing activity of 'Web Browsing (General)' now takes priority over 'Work (Job specific content search)'. The students' primary purpose after hours is identified as 'Instant Messenger (e.g. WhatsApp, WeChat, Facebook Messenger)'. This is followed by 'Web Browsing (General)', 'Research (e.g. Journal, articles)' and 'Personal Emails'. 'Instant Messenger (e.g. WhatsApp, WeChat, Facebook Messenger)' are now at top priority, 'Research (e.g. Journal, articles)' drops from top to number three priority, 'Web Browsing (General)' drops two places and 'Personal Emails' falls to priority number four. The primary purposes content remains the same for both groups.

Table 6.6: Top Four Primary Uses for Nelson Mandela University Internet Over Weekends.

	Staff	Students
Purpose 1	Business emails (work and research related)	Instant Messenger (e.g. WhatsApp, WeChat, Facebook Messenger)
Purpose 2	Research (e.g. Journal, articles)	Web Browsing (General)
Purpose 3	Web Browsing (General)	Research (e.g. Journal, articles)
Purpose 4	Personal Emails	Social Networking (e.g. Facebook, Twitter, LinkedIn)

Table 6.6 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the question, 'What are your top 4 primary uses for Nelson Mandela University's Internet over weekends?'. A detailed analysis was conducted and is included on the CD. From the findings, the top four uses for Nelson Mandela University's Internet over weekends were extracted and are presented in Table 6.6. Sixty-four percent (n = 88) of the staff respondents indicated 'Business Emails' as one of the top four and 15 percent (n = 79) of the student respondents indicated 'Business Emails' as one of the top four uses for Nelson Mandela University's Internet over weekends. Based on the frequencies, the relationship between the use by staff and students of 'Business Emails' was found to be significantly different (Chi² (d.f. = 4, n = 678) = 185.84; p < .0005; V = 0.52 Large). Staff use the HEI Internet to access 'Business Emails' more than students do over weekends.

Seventeen percent (n = 24) of the staff respondents indicated 'Instant Messenger' as one of the top four and 49 percent (n = 263) of the student respondents indicated 'Instant Messenger' as one of the top four uses for Nelson Mandela University's Internet over weekends. Based on the frequencies, the relationship between the use of 'Instant Messenger' by staff and students was found to be significantly different (Chi² (d.f. = 4, n = 678) = 45.45; p < .0005; V = 0.26 Small). Students use the HEI Internet for the purpose of 'Instant Messenger' more than staff do over weekends. Forty-seven percent (n = 65) of the staff respondents indicated 'Research' as one of the top four and 38 percent (n = 204) of the student respondents indicated 'Research' as one of the top four uses for Nelson Mandela University's Internet over weekends. Based on the frequencies, the relationship between staff and students use for 'Research' was found not to be statistically significant (Chi² (d.f. = 4, n = 678) = 6.16; p = .104). Staff and students use the HEI Internet for the purpose of 'Research' about the same over weekends.

Forty-six percent (n = 64) of the staff respondents indicated 'Web Browsing (General)' as one of the top four and 40 percent (n = 215) of the student respondents indicated 'Web Browsing (General)' as one of the top four uses for Nelson Mandela University's Internet over weekends. Based on the frequencies, the relationship of use between staff and students for 'Web Browsing (General)' was found not to be statistically significant (Chi² (d.f. = 4, n = 678) = 3.58; p = .310). Staff and students use the HEI Internet for the purpose of 'Web Browsing (General)' about the same over weekends. Thirty-four percent (n = 47) of the staff respondents indicated 'Personal Emails' as one of the top four and 35 percent (n = 190) of the student respondents indicated 'Personal Emails' as one of the top four uses for Nelson Mandela University's Internet over weekends. Based on the frequencies, the relationship of use between for 'Personal Emails' by staff and students was found not to be statistically significant (Chi² (d.f. = 4, n = 678) = 7.55; p = .056). The use of the HEI Internet by staff and students to access 'Personal Emails' is about the same over weekends.

Twenty-eight percent (n = 38) of the staff respondents indicated 'Social Networking' as one of the top four and 36 percent (n = 195) of the student respondents indicated 'Social Networking' as one of the top four uses for Nelson Mandela University's Internet over weekends. Based on the frequencies, the relationship of use between staff and students was found not to be statistically significant (Chi² (d.f. = 4, n = 678) = 5.39; p = .146). The use by staff and students of the HEI Internet for the purpose of 'Social Networking' is about the same over weekends.

The findings indicated that over weekends the majority of staff still use the Internet for 'Business emails (work and research related)'. This is followed by a large number of staff using the Internet for 'Research (e.g. Journal, articles)' and 'Web Browsing (General)'. A small portion, yet still relevant, use the Internet for 'Personal Emails', which is a new activity for staff. The students' primary purpose over weekends still remains as 'Instant Messenger (e.g. WhatsApp, WeChat, Facebook Messenger)'. This is followed by 'Web Browsing (General)', 'Research (e.g. Journal, articles)', which is the same as after hours. The fourth purpose is 'Social Networking (e.g. Facebook, Twitter, LinkedIn)' which is also a new purpose for students in general. The two new activities for staff (Personal Emails) and students (Social Networking (e.g. Facebook, Twitter, LinkedIn)) are both considered cyberloafing activities. This, however, should not cause any issues as this falls outside general business hours. Security (technical and physical operational) controls must nevertheless still be implemented to ensure no abuse is detected which hinders those who wish to work or activity which will get the University in legal trouble.

The summated score analysis of results for Section 5: Primary Purpose according to the demographic group can be found on the attached CD. The following section will present and discuss the findings for Section 6: Management.

6.8. Section 6: Management

Figures 6.43 - 6.53 depicts the findings captured from the staff (n = 138) and students (n = 540) regarding the participants' general views on aspects of the Nelson Mandela University's Internet management practices and value offerings. It should be noted that the question regarding Internet price was removed as the instability of the #feesmustfall movement still remains. The researcher did not want to draw attention to fact that there are costs associated with the Nelson Mandela University Internet.

6.8.1. Analysis of Results for Section 6: Management

Figure 6.40 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the statement 'The Internet speed designated to me for work use is:'. Thirty-nine percent (n = 54) of the staff respondents indicated that the Internet speed designated to them for work use is 'Excellent' while 28 percent (n = 38) indicated 'Above Average' and 25 percent (n = 35) indicated 'Average'. Thirty-two percent (n = 175) of the student respondents indicated that the Internet speed designated to them for work use is 'Average' while 24 percent (n = 132) indicated 'Above Average' and 24 percent (n = 131) indicated 'Excellent'. Based on the frequencies, the relationship of the view between staff and students on Internet speed

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designated to them for work use was found to be significantly different (Chi² (d.f. = 4, n = 678) = 19.97; p = .001; V = 0.17 Small). Staff found the Internet speed designated to them for work use more acceptable that the students did.
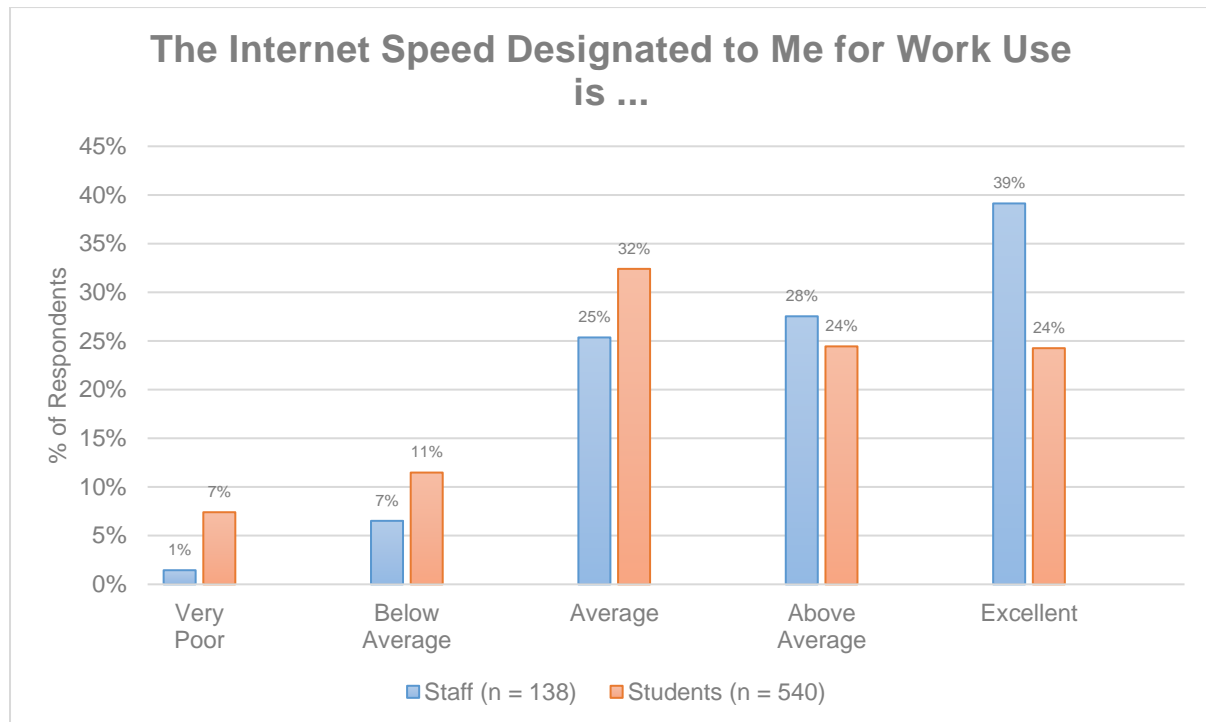
Figure 6.40: The Internet Speed Designated to Me for Work Use is.

The findings therefore indicate that the majority of staff and students are happy with the Internet speed allocated for work/academic purposes. It is, however, apparent that staff are more accepting about the speed than students. This could be due to the generation gap. Furthermore, as this is a research institute, the people dissatisfied with the Internet speed could be those that use the Internet extensively and require a fast Internet connection. For example, students in the Architecture department that have to render their drawings over the Internet. This requires a fast connection and an abundance of processing power.

Figure 6.41 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the statement 'The Internet speed designated to me for personal use is:'. Thirty-six percent (n = 49) of the staff respondents indicated that the Internet speed designated to them for personal work is 'Average' while 30 percent (n = 42) indicated 'Excellent' and 25 percent (n = 35 indicated 'Above Average'. Forty percent (n = 271) of all respondents indicated that the Internet speed designated to them for personal work is 'Average' while 20 percent (n = 110) indicated 'Above Average' and 16 percent (n = 86) indicated 'Excellent'. Based on the frequencies, the relationship of the view between staff and students on Internet speed

designated to them for personal use was found to be significantly different (Chi² (d.f. = 4, n = 678) = 25.17; p < .0005; V = 0.19 Small). Staff found the Internet speed designated to them for personal use more acceptable than the students did.
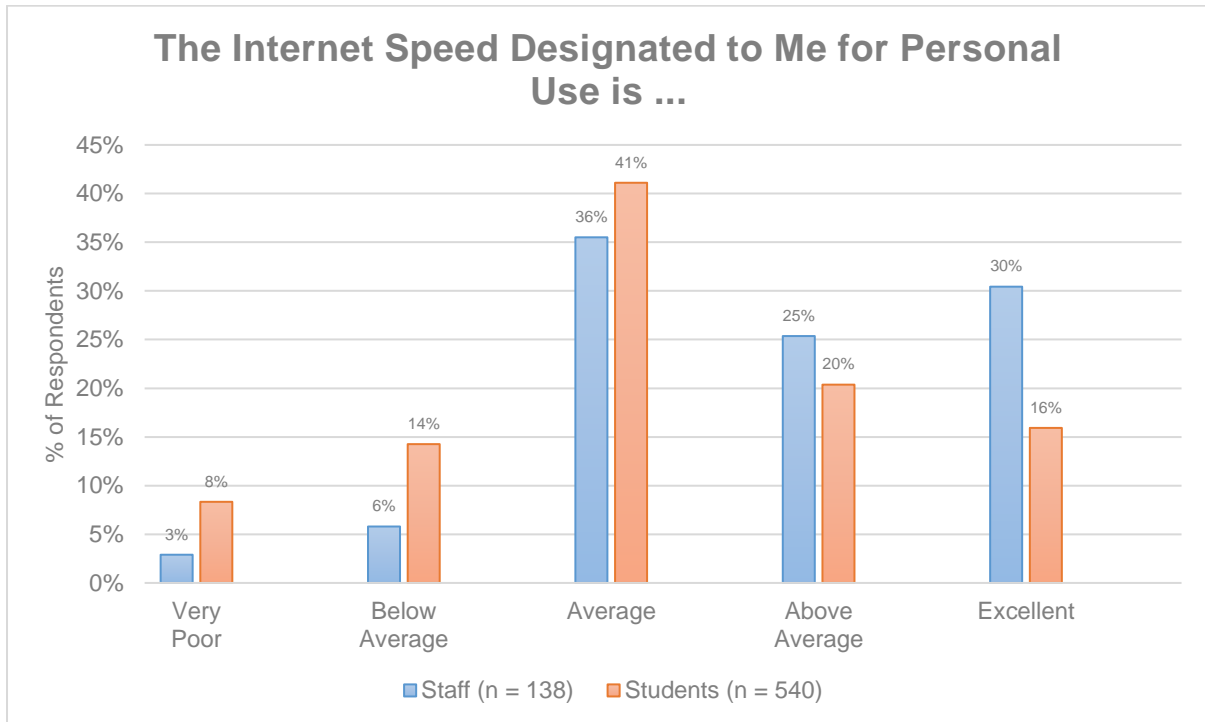
Figure 6.41: The Internet Speed Designated to Me for Personal Use is.

The findings indicate that staff again tend to be more lenient regarding the Internet speed for personal use than students. However, there is still a general greater response rate leaning towards it being 'average'. As can be remembered from the HEI Internet Business Model, 'Speed' was identified as a problem that needs to be addressed and is being solved for both parties. 'Speed' was also identified as the second most important product and service being offered to staff and the third most important product and service being offered to students. Lastly, both staff and students identified 'Speed' to be the most important primary Internet value required from the Nelson Mandela University Internet. ICT Services therefore need to realign their business model to ensure 'Speed' receives top priority whilst adhering to the provided cost structures. This will improve the overall satisfaction levels of both staff and students.
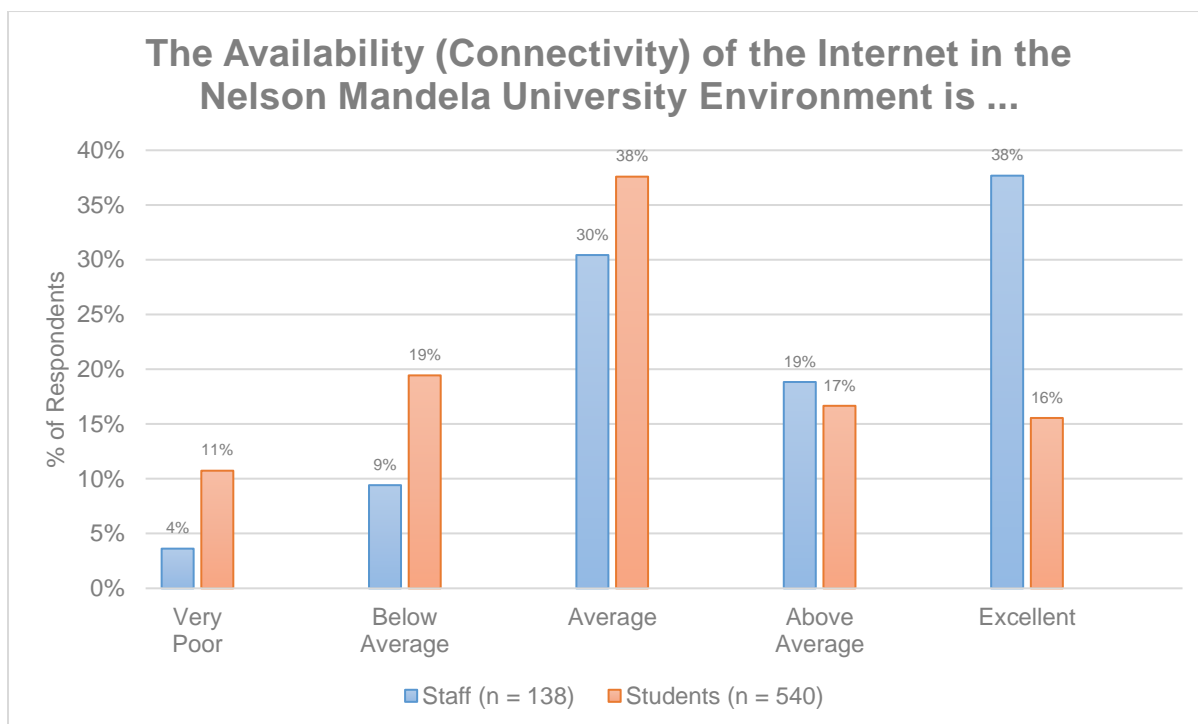
Figure 6.42: The Availability (Connectivity) of the Internet in the Nelson Mandela University Environment is.

Figure 6.42 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the statement 'The availability (connectivity) of the Internet in the Nelson Mandela University environment is:'. Thirty-eight percent (n = 52) of the staff respondents indicated that the availability (connectivity) of the Internet in the Nelson Mandela University environment is 'Excellent' while 30 percent (n = 42) indicated 'Average' and 19 percent (n = 26) indicated 'Above Average'. Thirty-eight percent (n = 203) of the student respondents indicated that the availability (connectivity) of the Internet in the Nelson Mandela University environment is 'Average' while 19 percent (n = 105) indicated 'Below Average' and 17 percent (n = 90) indicated 'Above Average'. Based on the frequencies, the relationship of the view between staff and students on availability (connectivity) of the Internet in the Nelson Mandela University environment was found to be significantly different (Chi² (d.f. = 4, n = 678) = 41.02; p < .0005; V = 0.25 Small). Staff found the availability (connectivity) of the Internet in the Nelson Mandela University environment more acceptable than the students did.

It is clear that staff have a mostly positive feeling with some being neutral while students had a mixed reaction as positive, neutral and negative were closely linked. As can be remembered, the preferred device for staff was desktop computers and laptops which are a balance of stationed and mobile devices. The positive responses could come from those who are using their desktop computers while the neutral responses could be from those that are mobile and

using their laptops. Students identified the preferred devices as smartphones and laptops which are both mobile. The findings therefore support these statements.

As indicated on the HEI Internet Business Model (Figure 5.23), 'Availability (connectivity)' was identified as a problem that needs to be addressed for both groups. 'Availability (connectivity)' was also identified as the third most important product and service being offered to staff and the most important product and service being offered to students. This is, however, not so as students presented a mixed response to their views on' Availability (connectivity)'. Lastly, both staff and students identified 'Availability (connectivity)' to be the second most important primary Internet value required from the Nelson Mandela University Internet. ICT Services therefore need to realign their business model to ensure 'Availability (connectivity)' receives adequate priority levels, keeping in mind that physical infrastructure was identified as the most expensive product and service in the HEI Internet Business Model (Figure 5.23). This will improve the overall satisfaction levels of both staff and students.
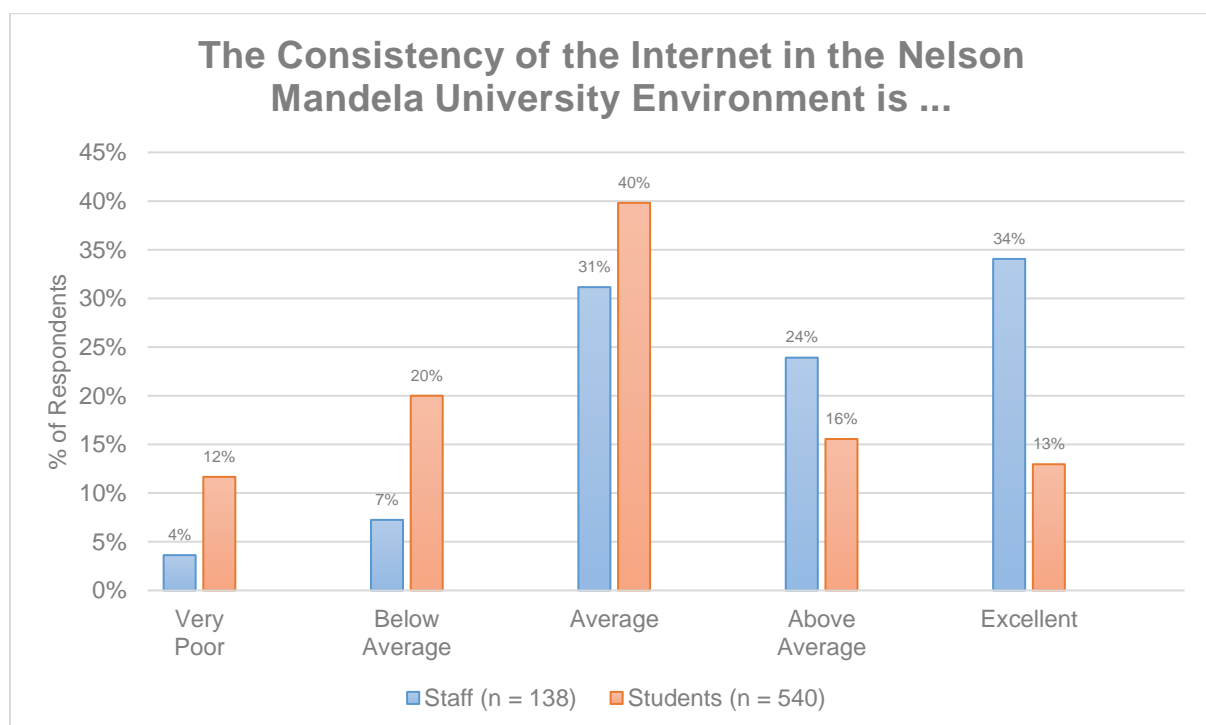
Figure 6.43: The Consistency of the Internet in the Nelson Mandela University Environment is.

Figure 6.43 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the statement 'The consistency of the Internet in the Nelson Mandela University environment is:'. Thirty-four percent (n = 47) of the staff respondents indicated that the consistency of the Internet in the Nelson Mandela University environment is 'Excellent' while

31 percent (n = 43) indicated 'Average' and 24 percent (n = 33) indicated 'Above Average'. Forty percent (n = 215) of the student respondents indicated that the consistency of the Internet in the Nelson Mandela University environment is 'Average' while 20 percent (n = 108) indicated 'Below Average' and 16 percent (n = 84) of indicated 'Above Average'. Based on the frequencies, the relationship of the view between staff and students on the consistency of the Internet in the Nelson Mandela University environment was found to be significantly different (Chi² (d.f. = 4, n = 678) = 52.32; p < .0005; V = 0.28 Small). Staff found the consistency of the Internet in the Nelson Mandela University environment more acceptable than the students did.

The 'Consistency' of the Internet is linked to the infrastructure built by SANReN, operated by TENET and the relationship status between these partners. These are present in the HEI Internet Business Model. Also, as can be remembered from the HEI Internet Business Model, 'Consistency' was identified as a problem that needs to be addressed and is being solved for both groups. 'Consistency' was also identified as the fourth most important product and service offered to staff and students. Lastly, both staff and students gave 'Consistency' a relative low (5th position) as a primary Internet value that they require. Additionally, in recent months (before the distribution of the survey), SA HEIs have experienced multiple network failures outside of their control. All these factors could contribute to the responses received above. Nelson Mandela University should adopt the 'Risk Control' to remediate downtime as caused by external Internet outrages which, as seen above, negatively influence users' view of the Nelson Mandela University Internet.
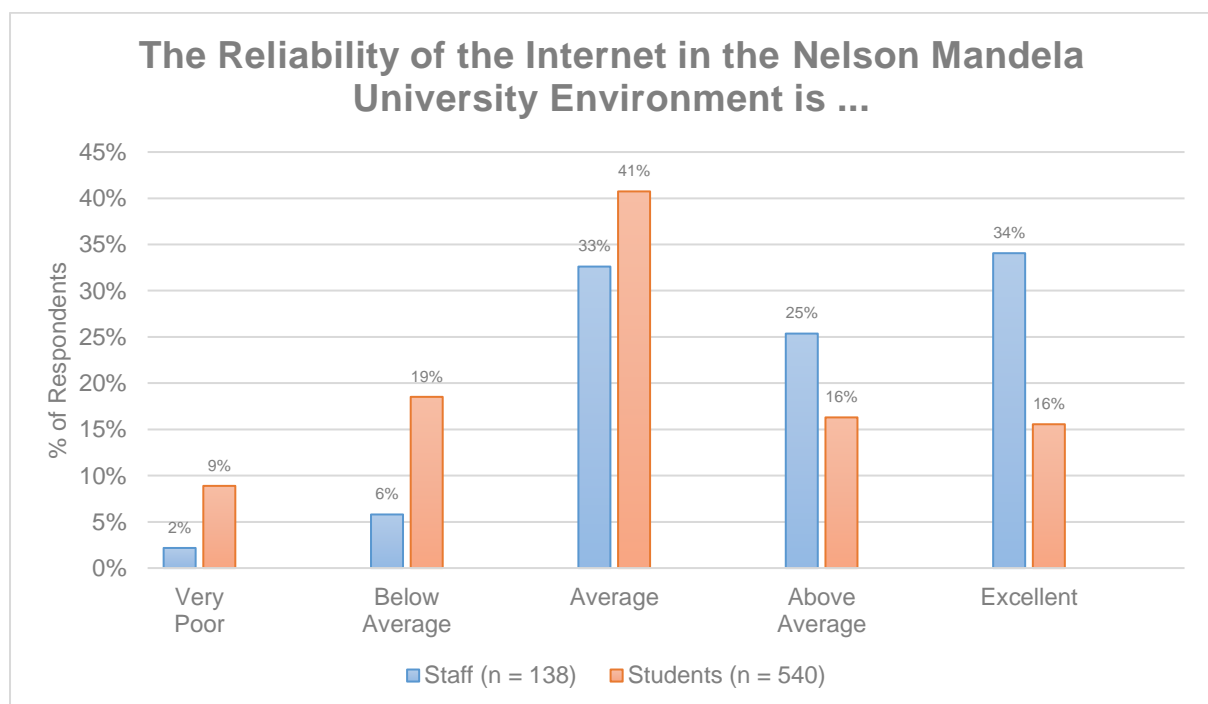
Figure 6.44: The Reliability of the Internet in the Nelson Mandela University Environment is.

Figure 6.44 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the statement 'The reliability of the Internet in the Nelson Mandela University environment is:'. Thirty-four percent (n = 47) of the staff respondents indicated that the reliability of the Internet in the Nelson Mandela University environment is 'Excellent' while 33 percent (n = 45) indicated 'Average' and 25 percent (n = 35) indicated 'Above Average'. Forty-one percent (n = 220) of the student respondents indicated that the reliability of the Internet in the Nelson Mandela University environment is 'Average' while 19 percent (n = 100) indicated 'Below Average', 16 percent (n = 88) indicated 'Above Average' and 16 percent (n = 84) indicating 'Excellent'. Based on the frequencies, the relationship of the view between staff and students on the reliability of the Internet in the Nelson Mandela University environment was found to be significantly different (Chi² (d.f. = 4, n = 678) = 44.07; p < .0005; V = 0.25 Small). Staff found the reliability of the Internet in the Nelson Mandela University environment more acceptable than the students did.

As per the HEI Internet Business Model (Figure 5.23), 'Reliability' was identified as a problem that needs to be addressed and is being solved for both parties as a top priority. 'Reliability' was also identified as the most important product and service being offered to staff and the second most important product and service being offered to students. This is, however, not so as the findings indicate otherwise, especially for something that is given top priority. Both staff and students identified 'Reliability' to be the fourth most important primary Internet value required from the Nelson Mandela University Internet. ICT Services therefore need to realign their business model to ensure 'Reliability' receives adequate priority levels. In addition, the technical Internet controls must be reviewed to ensure that staff and student traffic is classified and treated as per the required priority levels. A stable network connection with constant and well-classified traffic will ensure that the overall satisfaction levels of both staff and students are improved.

Figure 6.45 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the statement 'The trustworthiness of the Internet in the Nelson Mandela University environment is:'. Thirty-four percent (n = 47) of the staff respondents indicated that the trustworthiness of the Internet in the Nelson Mandela University environment is 'Average' and 'Excellent' while 26 percent (n = 36) indicated 'Above Average'. Forty-five percent (n = 241) of the student respondents indicated that the trustworthiness of the Internet in the Nelson Mandela University environment is 'Average' while 22 percent (n = 118) indicated 'Excellent' and 20 percent (n = 106) indicated 'Above Average'. Based on the frequencies, the relationship of the view between staff and students on the trustworthiness of the Internet in

the Nelson Mandela University environment was found to be significantly different (Chi² (d.f. = 4, n = 678) = 17.79; p = .001; V = 0.16 Small). Staff found the trustworthiness of the Internet in the Nelson Mandela University environment more acceptable than the students did.
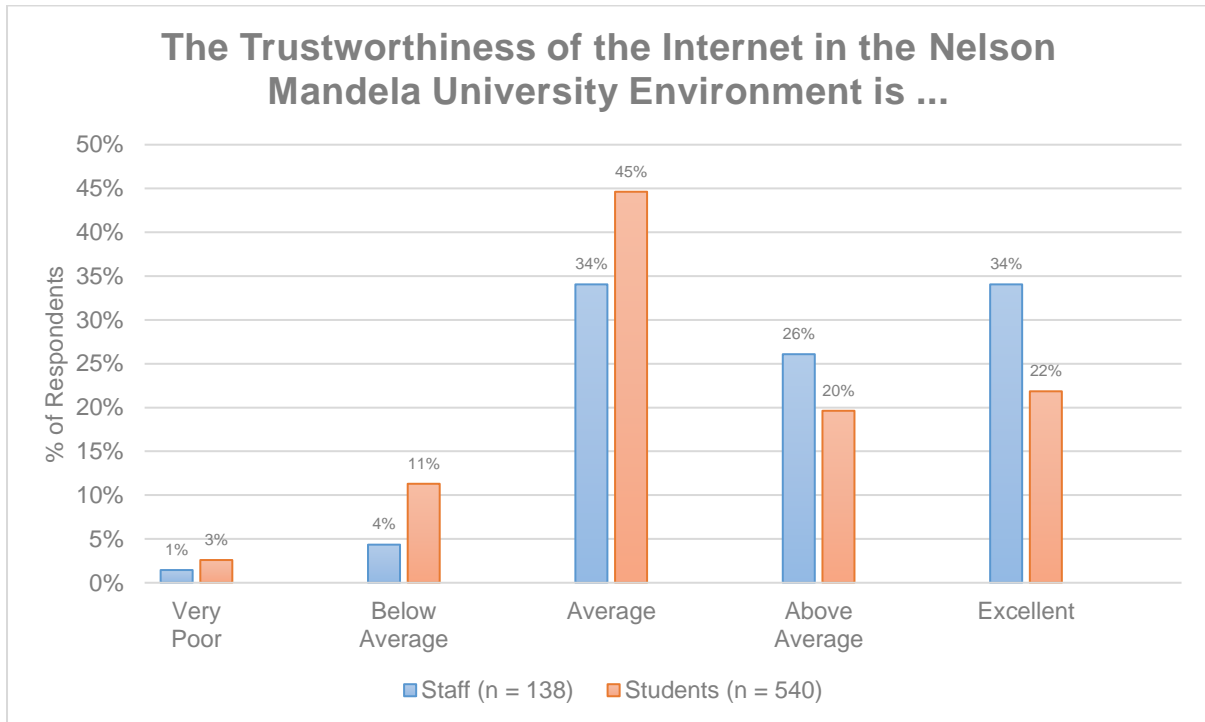
Figure 6.45: The Trustworthiness of the Internet in the Nelson Mandela University Environment is.

The findings indicate that more of the staff find the 'Trustworthiness' of the Internet in the Nelson Mandela University environment to be 'Excellent' and 'Average' (equally). This is followed with some staff finding it 'Above Average'. The majority of students indicated 'Average' which was followed by some indicating 'Excellent' whilst some find it 'Above Average'. It is clear that staff have a mostly positive feeling with some being neutral while students had a mostly neutral feeling with some being positive. 'Trust' is one of the core Internet values for IG. As per the HEI Internet Business Model (Figure 5.23), 'Trustworthiness' was identified as a relatively low problem that needs to be addressed and is being solved for both parties as a low priority. 'Trustworthiness' did also not really feature as an important product and service being offered to staff and students. The misalignment between 'Trust' being a global core value of the Internet and receiving an overall low rating within the HEI Internet Business Model must be addressed.

Figure 6.46 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the statement 'The relevance (keeping up-to-date with my needs) of the Internet in

the Nelson Mandela University environment is:'. Thirty-eight percent (n = 52) of the staff respondents indicated that the relevance (keeping up-to-date with my needs) of the Internet in the Nelson Mandela University environment is 'Average' while 35 percent (n = 48) indicated 'Excellent' and 22 percent (n = 31) indicated 'Above Average'. Fifty percent (n = 270) of the student respondents indicated that the relevance (keeping up-to-date with my needs) of the Internet in the Nelson Mandela University environment is 'Average' while 20 percent (n = 110) indicated 'Above Average' and 18 percent (n = 95) indicated 'Excellent'. Based on the frequencies, the relationship of the view between staff and students on the relevance of the Internet in the Nelson Mandela University environment was found to be significantly different (Chi² (d.f. = 4, n = 678) = 24.37; $p < .0005$; V = 0.19 Small). Staff found the relevance of the Internet in the Nelson Mandela University environment more acceptable than the students did.
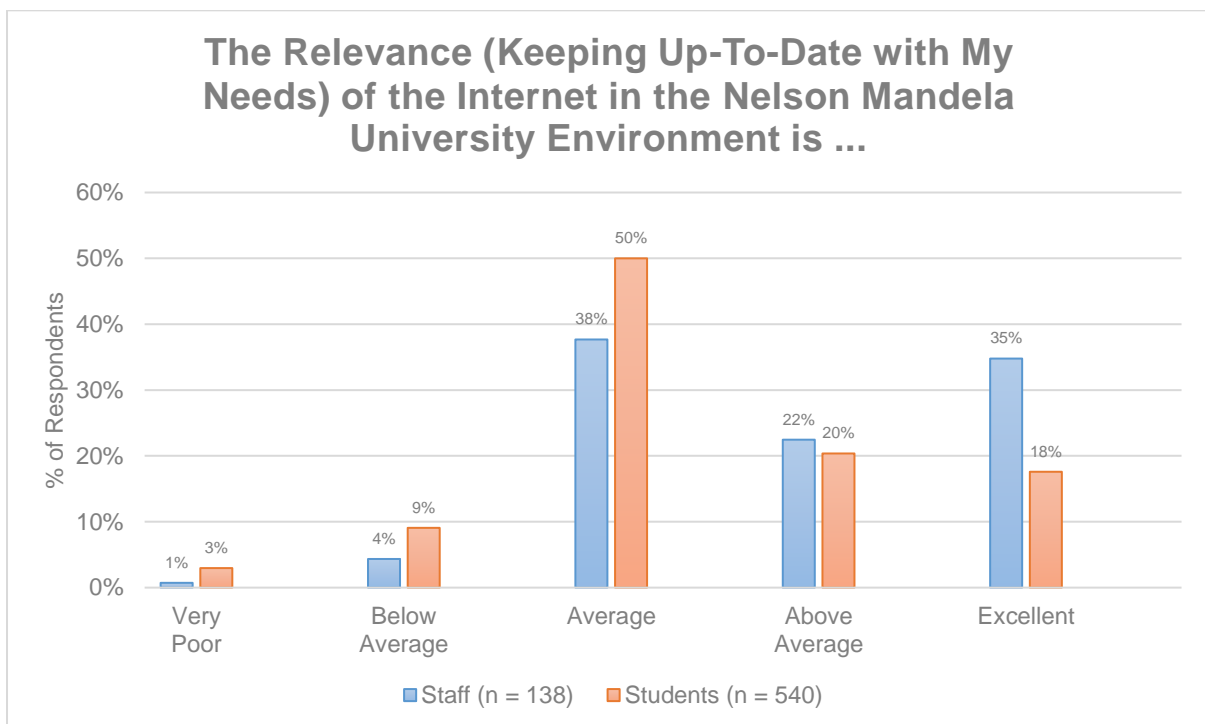
Figure 6.46: The Relevance (Keeping Up-To-Date with My Needs) of the Internet in the Nelson Mandela University Environment is.

As per the HEI Internet Business Model (Figure 5.23), the majority of HEIs indicated that they continuously measure the performance of Internet resources and continuously review/re-align the Internet Business Model. This means that the overall feedback for 'Relevance' must be superb, but this is clearly not the case. In addition, staff and students identified 'Relevance' to be the second last most important primary Internet value required from the Nelson Mandela University Internet, meaning there are other more important Internet vales that they want addressed before 'Relevance'.
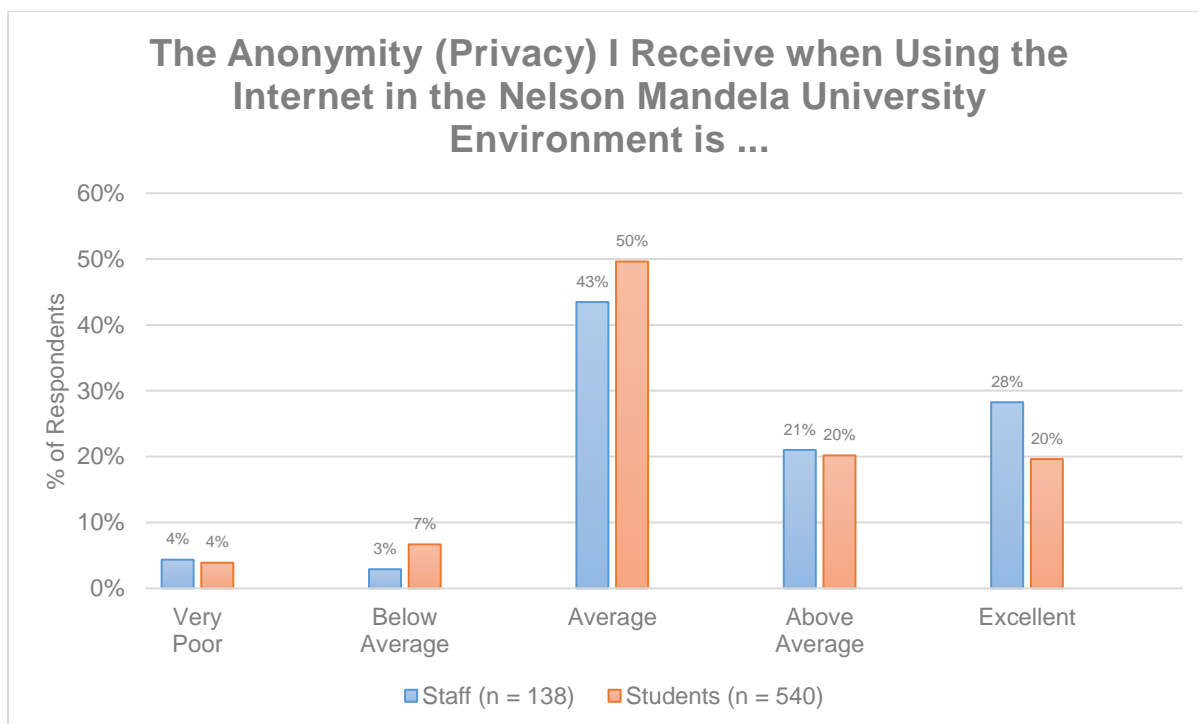
Figure 6.47: The Anonymity (Privacy) I Receive when Using the Internet in the Nelson Mandela University Environment is.

Figure 6.47 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the statement 'The anonymity (Privacy) I receive when using the Internet in the Nelson Mandela University environment is:'. Forty-three percent (n = 60) of the staff respondents indicated that the anonymity (Privacy) I receive when using the Internet in the Nelson Mandela University environment is 'Average' while 28 percent (n = 39) indicated 'Excellent' and 21 percent (n = 29) indicated 'Above Average'. Fifty percent (n = 268) of the student respondents indicated that the anonymity (Privacy) I receive when using the Internet in the Nelson Mandela University environment is 'Average' while 20 percent (n = 109) indicated 'Above Average' and 20 percent (n = 106) indicated 'Excellent'. Based on the frequencies, the relationship of the view between staff and students on the anonymity received when using the Internet in the Nelson Mandela University environment was found not to be statistically significant (Chi² (d.f. = 4, n = 678) = 7.43; p = .115). The views of staff and students on 'anonymity' when using the Internet in the Nelson Mandela University environment are similar.

'Anonymity (Privacy)' is one of the core Internet values for IG and was identified as the second most important core Internet value that HEIs aim to deliver. 'Anonymity (Privacy)' was, however, identified as a relatively unimportant problem that needs to be addressed and is being solved for both parties as a low priority. 'Anonymity (Privacy)' did also not really feature as an important product and service being offered to staff and students. The misalignment

between 'Anonymity (Privacy)' being a global core value of the Internet and the HEI Internet Management Business Model, yet does not feature at all in the rest of the business model is a concern. Staff and students have recognised this and have therefore have given mostly average feedback regarding this Internet value.
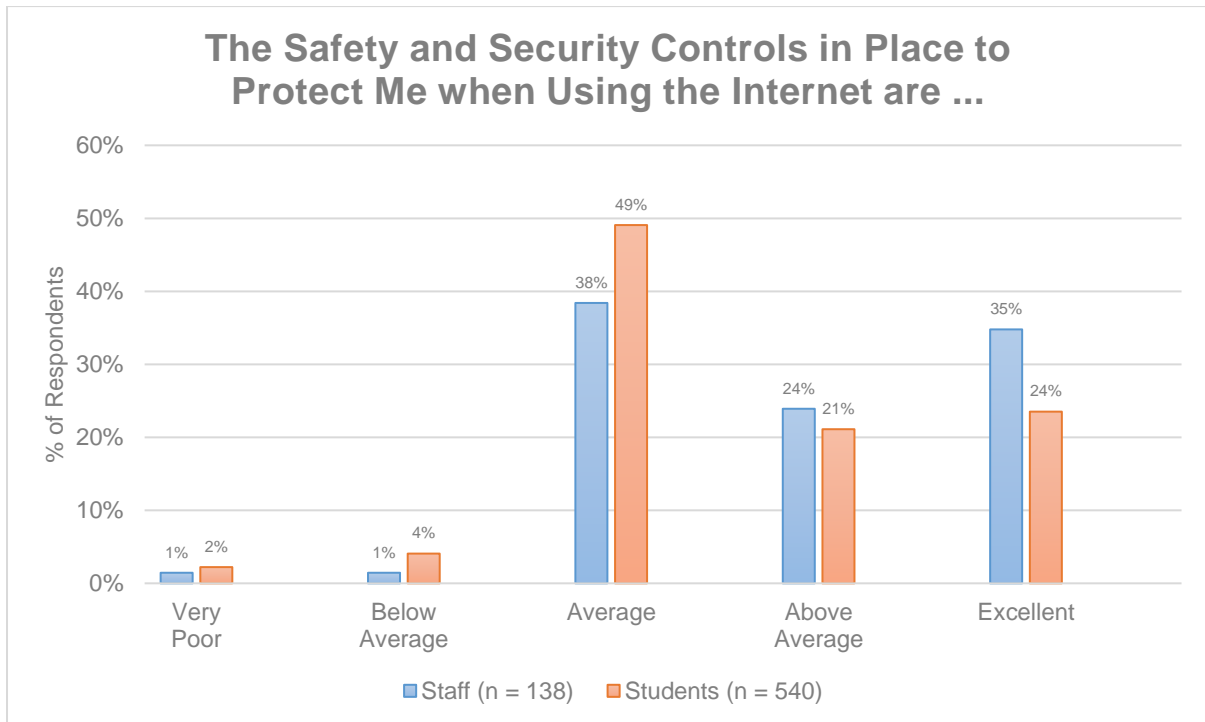
Figure 6.48: The Safety and Security Controls in Place to Protect Me when Using the Internet are.

Figure 6.48 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the statement 'The safety and security controls in place to protect me when using the Internet are:'. Thirty-eight percent (n = 53) of the staff respondents indicated that the safety and security controls in place to protect them when using the Internet is 'Average' while 35 percent (n = 48) indicated 'Excellent' and 24 percent (n = 33) indicated 'Above Average'. Forty-nine percent (n = 265) of the student respondents indicated that the safety and security controls in place to protect them when using the Internet is 'Average' while 24 percent (n = 127) indicated 'Excellent' and 21 percent (n = 114) indicated 'Above Average'. Based on the frequencies, the relationship of the view between staff and students on the safety and security controls in place to protect them when using the Internet was found to be significantly different (Chi² (d.f. = 4, n = 678) = 10.93; p = .027; V = 0.13 Small). Staff found the safety and security controls in place to protect them when using the Internet more acceptable than the students did.

'Security' is one of the core Internet values as per IG and was identified as the most important core Internet value that HEIs aim to deliver. 'Safety and Security (or Safe and Secure)' was, listed as the third most important Internet value for both staff and students and was identified as a problem that needs to be addressed and as per the HEI Internet Management Business Model findings, and is being solved for both groups. These, however, received a relatively average to low rating as compared to the others. Lastly, 'Safety and Security' was given an average rating for staff and an almost non-existent rating for students as part of the bundles of Internet-related products and services offered. The misalignment between IG, Internet core values, Internet problems, the problems that need to be addressed and the bundles of Internet-related products and services offered are vast and should be addressed.
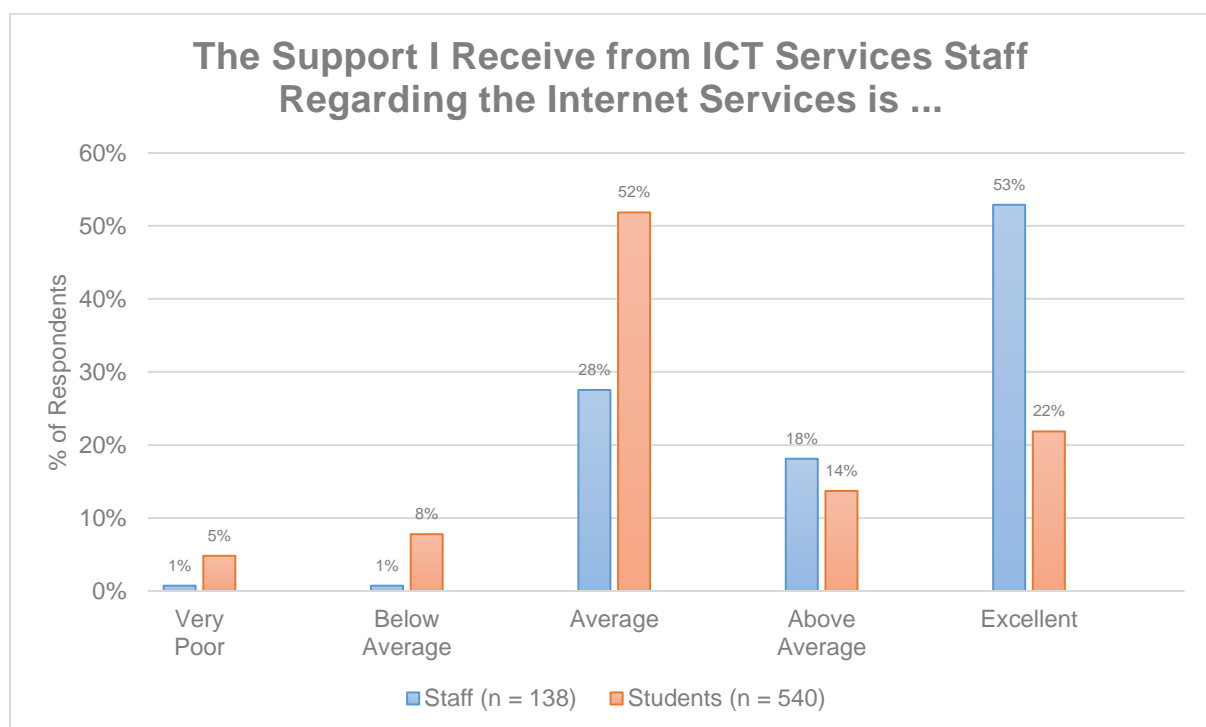
Figure 6.49: The Support I Receive from ICT Services Staff Regarding the Internet Services is.

Figure 6.49 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the statement 'The support I receive from ICT Services staff regarding the Internet services is:'. Fifty-three percent (n = 73) of the staff respondents indicated that the support the receive from ICT Services staff regarding the Internet services is 'Excellent' while 28 percent (n = 38) indicated 'Average' and 18 percent (n = 25) indicated 'Above Average'. Fifty-two percent (n = 280) of the student respondents indicated that they support the receive from ICT Services staff regarding the Internet services is 'Average' while 22 percent (n = 118) indicated 'Excellent' and 14 percent (n = 74) indicated 'Above Average'. Based on the frequencies, the

relationship of the view between staff and students on the support they receive from ICT Services staff regarding the Internet services was found to be significantly different (Chi² (d.f. = 4, n = 678) = 66.17; p < .0005; V = 0.31 Medium). Staff found the support they receive from ICT Services staff regarding the Internet services more acceptable than the students did.

As was stated earlier, staff have council-funded devices which are assigned to them for work purposes whereas students mostly have BYOD which are funded by themselves. The Nelson Mandela University ICT General policy states that the best effort will be made to assist BYOD. The Nelson Mandela University ICT General policy also gives the contact details and methods for logging Internet-related issues. Previous findings found that staff are much more aware of the policies than students are. Also, it was found that HEIs use email as the preferred method to provide Internet user support for both staff and students which was followed by all HEI providing Internet user support for students via phone while the majority of HEIs provide Internet user support for staff via phone. Both methods were supported in the methods of communication preferred by staff and students. It should however be noted that staff have direct access to email and a company phone which is used to log calls to the ICT Helpdesk whereas students have to use their personal smartphones (and therefore airtime) to call the ICT helpdesk or they have to go to the closest student support centre for assistance. Also, if the users' (both staff and students) Internet is down, they will have trouble logging a call with a device which is unable to connect to the Internet, thus causing a dilemma. If the issue is logged and is not linked to the device but rather to the physical Nelson Mandela University network infrastructure, a Network Engineer is assigned to the call and is addressed according to the priority level assigned to the call.

Figure 6.50 depicts all responses (n = 678) received from staff (n = 138) and students (n = 540) for the statement 'My overall perception/feeling of the Internet at Nelson Mandela University is'. Forty-one percent (n = 57) of the staff respondents indicated that their overall perception/feeling of the Internet at Nelson Mandela University is 'Excellent' while 30 percent (n = 41 indicated 'Average' and 27 percent (n = 37) indicated 'Above Average'. Forty-six percent (n = 246) of the student respondents indicated that their overall perception/feeling of the Internet at Nelson Mandela University is 'Average' while 21 percent (n = 112) indicated 'Above Average' and 19 percent (n = 103) indicated 'Excellent'. Based on the frequencies the relationship of the view between staff and students on the overall perception/feeling of the Internet at Nelson Mandela University was found to be significantly different (Chi² (d.f. = 4, n = 678) = 45.83; p < .0005; V = 0.26 Small). Staff indicated that the overall perception/feeling of the Internet at Nelson Mandela University was more acceptable than the students view.

My Overall Perception/Feeling of the Internet at Nelson Mandela University is ...
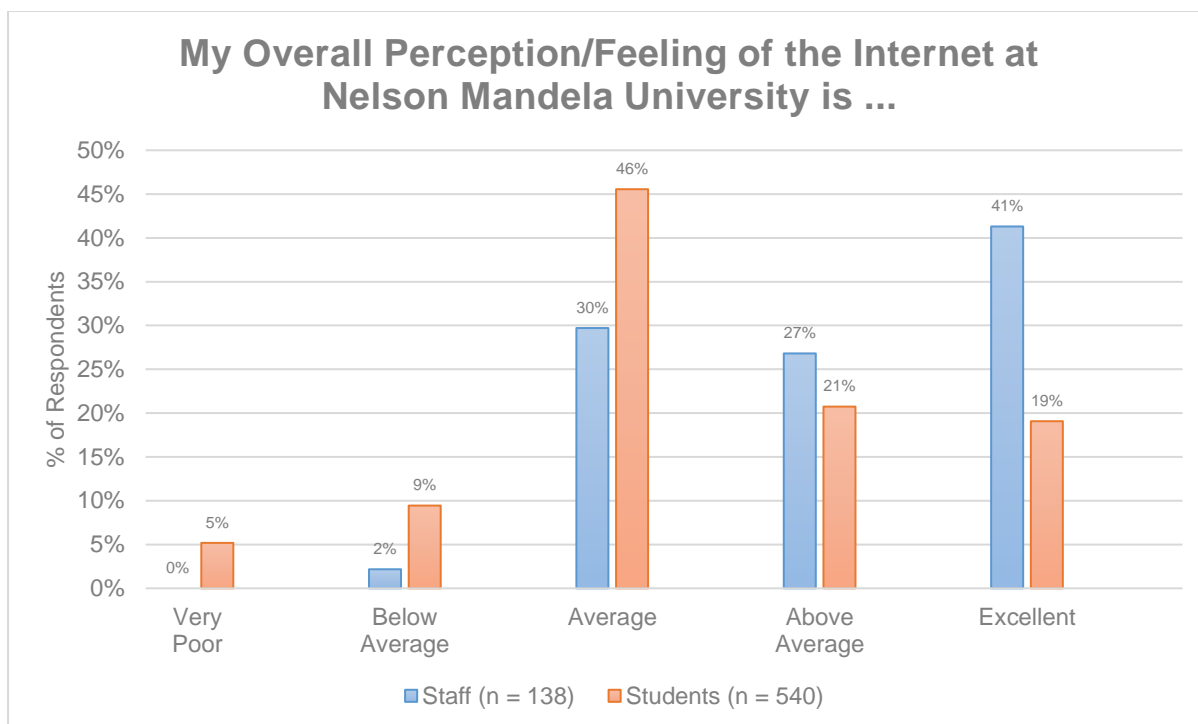
Figure 6.50: My Overall Perception/Feeling of the Internet at Nelson Mandela University is.

As per the HEI Internet Business Model, the majority of HEIs have a one-size-fits-all approach to managing the Internet resources. This means that staff and students are treated the same to as large extent. It is, however, apparent that the overall views covered above are very different. Staff tend to have a better Internet experience compared to that of the students. This is found throughout the entire Section 6: Management. This could be due to the fact that staff tend to use the Internet more for business purposes whereas students tend to use it more for personal purposes. In addition, the generation difference between the groups ensures that they have different approaches and adoption strategies to technology, which Internet plays a part. These differences amongst the groups, including their work/academic focuses must be recognised by the HEI and action be taken accordingly. It is clear that the common Internet resource approach is not working as the user groups have different requirements throughout. On a final note, the students lack of awareness regarding the ICT General Policy and Nelson Mandela University Acceptable Use Policy may mean that students are less educated on how the Nelson Mandela University Internet management resources are used.

The summated scores analysis of results for Section 6: Management according to the demographic group can be found on the attached CD. The following section summarises the chapter.

6.9. Summary

This chapter addressed RQ$_6$ which states, "*What are the staff and students within Nelson Mandela University using the Internet for?*" and RQ$_7$ which states, "*What are the staff and students within Nelson Mandela University using the Internet for, according to the Firewall log files?*". The chapter co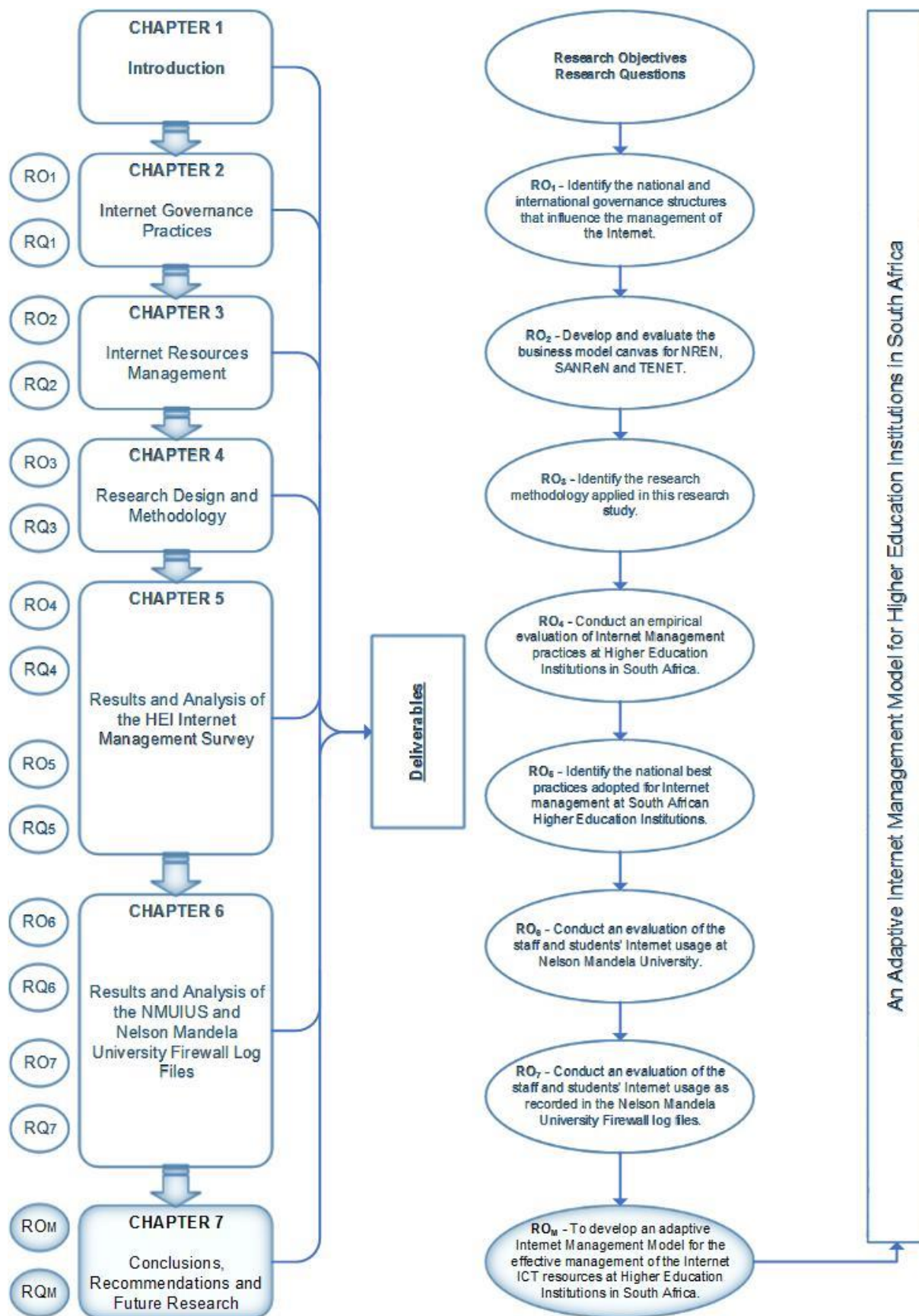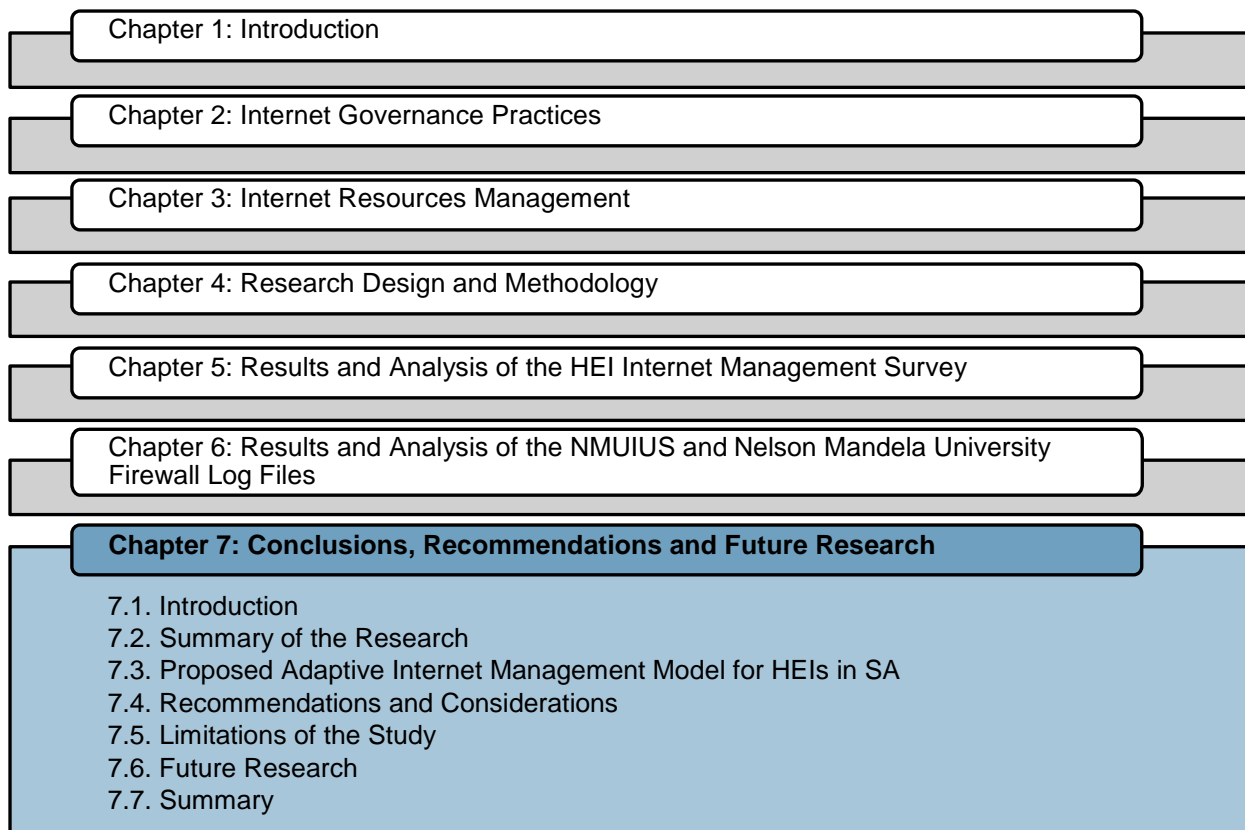mpleted the objectives which were to conduct an evaluation of the usage of Internet by staff and students at Nelson Mandela University and to conduct an evaluation of the Internet usage by staff and students as recorded in the Nelson Mandela University Firewall Log files.

Chapter 6 provided a comprehensive analysis of the collected empirical data groupings. This was achieved by conducting an empirical evaluation of the usage practices of the Internet by Nelson Mandela University staff and students. In addition, an empirical evaluation of the actual Internet usage by Nelson Mandela University staff and students as per the Firewall data were conducted and compared. The two findings were then presented in a clear and logical manner whilst identifying the anomalies. The findings indicated that staff tend to be more aware of the policies and relevant practices while students appeared to be somewhat unaware.

The findings continued to indicate that staff and students have different needs for the Internet and these needs also change slightly according to the time of day and day of the week. Regarding content access, some of the users indicated that Internet practices were true whilst others were false. This creates an imbalance in the Internet management practices and the requirements of business and the users. The majority of falsely reported Internet practices were focused on activities with content closely linked to cyberloafing. In addition, these activities were undersold, meaning that those interviewed said that they accessed content rarely while the Firewall data indicated that such content was frequently being accessed and by many users. Furthermore, it was clear that a large portion of the Nelson Mandela University Internet is used to access non-work/non-academic related content. It was also clear that the staff received a pleasant Nelson Mandela University Internet experience while the students received a slightly degraded Nelson Mandela University Internet experience. The overall feedback from the majority of users was average and above.

Chapter 7 will present the proposed adaptive Internet Management Model for Higher Education Institutions as derived from the collective findings. The chapter will conclude by providing the limitations of the study as well the opportunity for future research. Therefore, the research objective of this chapter is focused on RO$_M$, which is to present the components

of the proposed adaptive Internet Management Model that will ensure effective management of Internet usage at Higher Education Institutions in South Africa.   This will be achieved by asking RQ_M, which questions "*What are the components of an adaptive Internet Management Model that will ensure the effective management of the Internet ICT resources at Higher Education Institutions in South Africa?*".

7. CONCLUSIONS, RECOMMENDATIONS AND FUTURE RESEARCH

7.1. Introduction

Chapter 6 focused on the compilation, distribution, collection, analysis and presentation of the findings of the NMUIUS. The NMUIUS was created by means of reviewing current literature studies which were aligned with the main research question and research objective. The NMUIUS was then distributed to all Nelson Mandela University Internet users. The empirical results were collected, analysed and presented. In addition, the Nelson Mandela University Firewall log data were analysed and presented as part of the NMUIUS Section 4.

Chapter 7 addresses RQ_M which states, "*What are the components of an adaptive Internet Management Model that will ensure the effective management of the Internet ICT resources at Higher Education Institutions in South Africa?*". The objective of the chapter is to develop an adaptive Internet Management Model for the effective management of the Internet resources at Higher Education Institutions in South Africa. To achieve this objective, the following top-down approach was followed. Firstly, the international and national Internet governance structures were reviewed and identified. These are the structures that guide the overall governance and thus future of the Internet.

Secondly, the international and national HEI Internet management structures were reviewed and identified. These are the structures that guide the HEI Internet management resources that connect all the HEIs, Colleges, schools, libraries etc. Thirdly, the research methodology applied in this thesis had to be identified. This assisted the researcher to follow a structured and proven process to achieve the main research objective and questions. Fourthly, the national best practices adopted for Internet management at South African Higher Education Institutions were identified. Fifthly, the Nelson Mandela University Internet practices used by the staff and students were identified and were compared to the record of the actual Internet practices they used. This assisted with the review of the micro and macro HEI Internet management environment and was used to create the proposed adaptive Internet Management Model for HEI in SA. Figure 7.1 illustrates an overview of the research objective for this chapter.

Chapter 7 summarises the research process followed in this thesis. Thereafter, a list of recommendations and considerations is presented, which are based on all collected and

analysed empirical data. The proposed adaptive Internet Management Model for Higher Education Institutions in South African is presented and discussed. Chapter 7 concludes by identifying the limitations of the research study and the possible future research that can stem from this thesis. See Figure 7.2 for a Structural overview of Chapter 7.

7.2. Summary of the Research

The research study consisted of seven research questions, which are derived from the research objectives that were identified and analysed in order to address the main research question and research objective. The following sub-section discusses these research questions and research objectives.

7.2.1. Main Research Question (RQ_M) and Research Objective (RO_M)

The Main Research Question (RQ_M) of the research study was defined as, "*What are the components of an adaptive Internet Management Model that will ensure the effective management of the Internet ICT resources at Higher Education Institutions in South Africa?".* In order to gain a holistic view of the main research problem and surrounding environment, the following seven research questions (**RQ_1** to **RQ_7**) based on the secondary research objectives, had to be answered first:

RQ_1 - *What national and international governance structures are available that influence the management of the Internet?*

RQ_2 - *What is the current business model canvas for NREN, SANReN and TENET?*

RQ_3 - *What research methodology can be used for this study?*

RQ_4 - *What are the current Internet Management practices at Higher Education Institutions in South Africa?*

RQ_5 - *What are the national best practices adopted for Internet management at South African Higher Education Institutions?*

RQ_6 - *What are the staff and students within Nelson Mandela University using the Internet for?*

RQ_7 - *What are the staff and students within Nelson Mandela University using the Internet for, according to the Firewall log files?*

Figure 7.1: Chapter 7 Overview of the Research Objective.

| Chapter 1: Introduction |
| Chapter 2: Internet Governance Practices |
| Chapter 3: Internet Resources Management |
| Chapter 4: Research Design and Methodology |
| Chapter 5: Results and Analysis of the HEI Internet Management Survey |
| Chapter 6: Results and Analysis of the NMUIUS and Nelson Mandela University Firewall Log Files |

Chapter 7: Conclusions, Recommendations and Future Research

7.1. Introduction
7.2. Summary of the Research
7.3. Proposed Adaptive Internet Management Model for HEIs in SA
7.4. Recommendations and Considerations
7.5. Limitations of the Study
7.6. Future Research
7.7. Summary

Figure 7.2: Structural Overview of Chapter 7.

7.2.2. Research Question RQ$_1$ and Research Objective RO$_1$

The first research question (RQ$_1$) asks, "*What national and international governance structures are available that influence the management of the Internet?*" and is addressed in Chapter 2. The objective of the question is to identify the national and international governance structures that influence the management of the Internet. Current literature studies were examined to find an appropriate answer to the identified research question.

Chapter 2 introduces the key IT governance frameworks that govern and manage IT. The chapter then defines IG and reviews the five available thought processes for IG models as defined by Solum (2008), with support from Collins (2007), that can be adopted to efficiently and effectively govern the Internet. The literature identified that each model does not have the ability to address the immense responsibilities and requirements of IG. The literature study therefore continued to identify what the current implemented national and IG structures entail. The Multi-Stakeholder Model (MSM) was therefore identified, which presented the various stakeholders involved with IG and the respective structures that were created to address specific IG issues. The chapter continued by discussing the recently implemented IG ecosystem sphere, which is a roadmap or framework used to address any new arising IG

issues. The Internet as a public good was argued and supporting evidence gathered from the current state of the IG ecosystem was presented.

The review of the MSM led to the realisation that the currently implemented MSM is a combined effort of all five IG models as identified by Solum (2008), with support from Collins (2007). The MSM is therefore known as a hybrid model. The MSM integrates the benefits of each model whilst reducing or removing their respective drawbacks. It should be acknowledged that IG is extremely sophisticated and diverse by its nature and therefore requires a complex regulatory system to ensure that it is managed properly. The most complete IG model therefore requires an optimal mix of all 5 IG models, which include transnational institutions, international organisations, national governments and market regulations because of with respect to the Internet's changing policy and technical environment. The MSM, although complex and sometimes messy, satisfies this demanding need. The MSM is committed to a vision of an 'Internet for everyone' and as such, has argued towards making the Internet a public good. The Internet is a basic human need and requires that the Internet products and services be regulated with the focus on the mutual benefit for all citizens and consequently reinforcing the view of public good of public production. The Internet would consequently become available to all and not just for those who could financially afford it.

7.2.3. Research Question (RQ$_2$) and Research Objective (RO$_2$)

The second research question (RQ$_2$) asks, "*What is the current business model canvas for NREN, SANReN and TENET?*" and is addressed in Chapter 3. The objective of chapter 3 was to develop and evaluate the business model canvas for NREN, SANReN and TENET. Current literature studies and reports were examined to find an appropriate answer for the identified research question.

Chapter 3 highlighted the current Internet management practices with emphasis on HEIs and research institutes. This chapter elaborated on Global NRENs and their business purpose and services being offered. Thereafter, the focus shifted to the South African NRENs, SANReN CA and TENET. A detailed elaboration of the business was discussed for each entity, concluding with their respective business model canvas (Figure 3.4, Figure 3.6, and Figure 3.7). It was realised that in moving from a global NREN to the local NRENs there was a common business focus. The chapter concluded by discussing some of the key Internet management issues currently affecting businesses.

7.2.4. Research Question (RQ₃) and Research Objective (RO₃)

The third research question (RQ$_3$) asks, "*What research methodology can be used for this study?*" and is addressed in Chapter 4. The objective of Chapter 4 was to identify the research methodology to be applied in this research study. Current research methodology practices were reviewed and suitable research methodologies were extracted and presented and applies to this thesis.

Chapter 4 commenced by defining what is meant by research. This was followed by discussing the research design with emphasis on the research onion. Thereafter, the chapter used the research onion model and peeled back the layers of the research onion. The discussion focused on the research philosophy, research approaches, research strategies, time horizons and techniques and procedures. The chosen methods for this research study are positivism, deductive reasoning, surveys, cross-sectional studies and case study. These are the methods used in the study as each layer of the research onion is removed.

7.2.5. Research Question (RQ₄) and Research Objective (RO₄)

The fourth research question (RQ$_4$) asks, "*What are the current Internet Management practices at Higher Education Institutions in South Africa?*" and is addressed in Chapter 5. The first objective of Chapter 5 was to conduct an empirical evaluation of Internet management practices of all HEIs in SA and present the findings in the form of the business model canvas.

Chapter 5 focuses on identifying and discussing the participants' biographical information, general information about the universities, ICT governance practices and each of the nine building blocks that constitute the business model canvas. The findings indicated that the Internet and its relevant resources are extremely important for all HEIs. These findings are to a large extent aligned with the NRENs business models and the requirements of the Internet community. The HEIs cater for a large Internet community but do not differentiate between them, most HEIs follow good ICT governance practices. The Internet is provided at no cost and is funded via Council funds. The staff and student requirements are mostly similar with minor priority differences in key content needs. Internet resources are aligned to support the physical infrastructure of the Internet. The types of relationships that staff and students expect and which are implemented are Personal Assistance, Self-Service and Automated Services in that order. Most HEIs consider the NRENs as key partners and suppliers with additional secondary support from local suppliers. Some interventions are required to those HEIs which do not comply with the Internet Management Business Model.

7.2.6. Research Question RQ$_5$ and Research Objective RO$_5$

The fifth research question (RQ$_5$) asks, "*What are the national best practices adopted for Internet management at South African Higher Education Institutions?*" and is addressed in Chapter 5. The second objective of Chapter 5 was to identify the national best practices adopted for Internet management at South African Higher Education Institutions.

Chapter 5 concluded by identifying the most commonly adopted HEI Internet management practices that stem from the HEIIMS as identified during the Research Question (RQ$_4$) and Research Objective (RO$_4$) answering process. The commonly adopted HEI Internet management practices constitute the national best practices adopted for Internet management at South African Higher Education Institutions and are presented in the form of the business model canvas.

7.2.7. Research Question RQ$_6$ and Research Objective RO$_6$

The sixth research question (RQ$_6$) is defined as "*What are the staff and students within Nelson Mandela University using the Internet for?*" and is addressed in Chapter 6. The first objective of Chapter 6 was to conduct an evaluation of the staff and students' Internet usage at Nelson Mandela University.

Chapter 6 provided a comprehensive analysis of the collected NMUIUS empirical data groupings. This was achieved by conducting an empirical evaluation of the Internet usage practices at Nelson Mandela University by staff and students. The findings indicate that staff tend to be more aware of the policies and surrounding practices while students appeared somewhat unaware. The findings indicate that staff and students have different needs for the Internet and these needs also change slightly as per the time of day and day of the week. It was also clear that the staff received a pleasant Nelson Mandela University Internet experience while the students received a slightly degraded Nelson Mandela University Internet experience. The overall feedback from the majority of users was average and above.

7.2.8. Research Question RQ$_7$ and Research Objective RO$_7$

The seventh research question (RQ$_7$) asks, "*What are the staff and students within Nelson Mandela University using the Internet for, according to the Firewall log files?*" and is addressed in Chapter 6. The second objective of Chapter 6 was to conduct an evaluation of the staff and students' Internet usage as recorded in the Nelson Mandela University Firewall Log files.

Chapter 6 also provided a comprehensive analysis of the collected Nelson Mandela University Firewall Logs empirical data. The analysis found that the statements of some of the users' Internet practices were true whilst others were incorrect. This creates an imbalance in the Internet management practices and the business and users requirements. The majority of incorrect references indicated that Internet practices were focused on activities closely linked to cyberloafing content. In addition, these activities were undersold, meaning that respondents said that they access the content rarely while the Firewall data indicated that it was frequently being accessed by many users. Furthermore, it was clear that a large portion of the Nelson Mandela University Internet is used to access non-work/non-academic related content. The following sections present and discuss the proposed adaptive Internet Management Model for HEIs in SA.

7.3. Proposed Adaptive Internet Management Model for HEIs in SA

Figure 7.3 presents the Proposed Adaptive Internet Management Model for HEIs in SA. The model stems from the literature, drafted from selected IT governance practices and is re-aligned or shaped demanded by the results in Chapters 5 and 6. The model adopts a multi-layered model with top down approach. This ensures that the overall big picture is acknowledged when creating or updating the HEI Interment management model and that each layer and focus area is addressed fully before continuing with the sub-layers. This approach ensures that the overall vision, mission and values of the Internet and ISP are adhered to whilst incorporating the overall institutional objectives.

The Proposed Adaptive Internet Management Model for HEIs in SA starts at the top layer, as these goals are global and expand layer by layer downwards, until the bottom layer, the user Internet management layer, is reached. All layers and focus areas of the model are connected and are directly and indirectly influenced by forms of changes made by the surrounding layers and focus areas. Due to this, some push back or input from the direct layer or focus area below is experienced as the Internet is governed by the Multi-Stakeholder model and the fact that products and services are geared towards creating value for the clients. For these reasons, there is expected to be input provided from the layer below that will influence the layer or focus area above.

The first layer of the model focuses on the global goals. This layer acknowledged that the Internet is globally governed by the Internet governance structures and the ISP structures. The second layer of the model focuses on the South African goals. The global goals are now
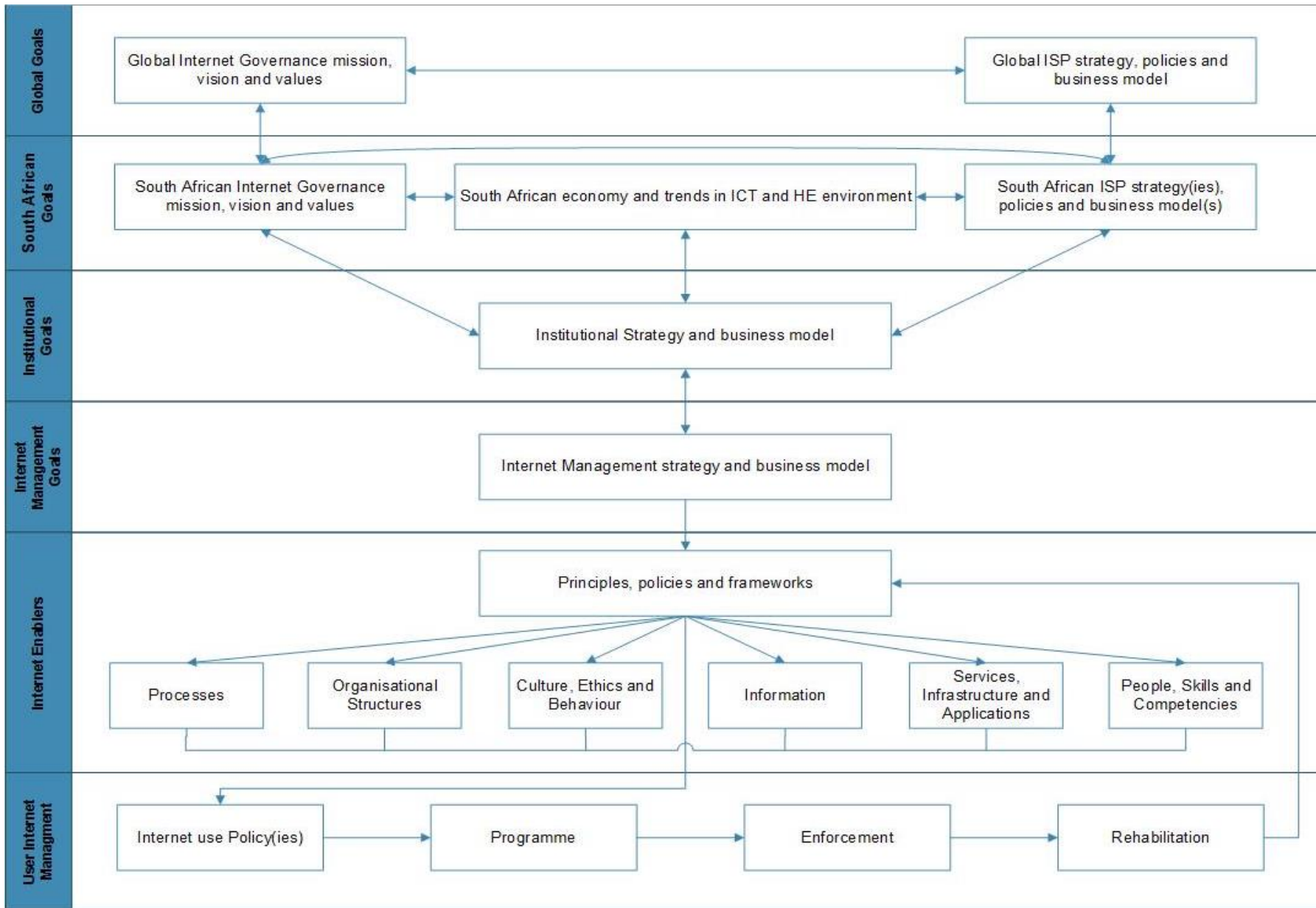
Figure 7.3: Proposed Adaptive Internet Management Model for HEIs in SA.

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pushed downwards to the national environment where they are incorporated and aligned with SA's unique national conditions. The national Internet governance structures, national ISP structures and national economy and trends in ICT and HE environment should then be reviewed and considered. The third layer of the model focuses on the institutional goals, which identify the overall institutional strategy and business model. The fourth layer focuses on the Internet management goals which identify how the Internet should be used within the HEI environment to support the overall institutional goals. The fifth layer of the model focuses on the Internet enablers as presented by COBIT 5 (2012). These enablers serve to support the set Internet management goals, which in turn enable the institutional strategy and business model. The last layer of the model focuses on managing the Internet user, which is adapted from the employee, Internet-abuse model as presented by Young (2010). Users are prone to use the Internet for non-work/non-academic related matters and therefore must be managed accordingly.

Lastly, each layer has a life cycle, meaning that all layers and focus areas will be planned, designed, build/acquired/created/implemented, used/operated, evaluated/monitored and ultimately updated/disposed of (COBIT 5, 2012). The top layers generally have a life cycle that spans years whilst the bottom layers would have a lifecycle that spans less than two years. The speed of the life cycle should be noted when creating or updating the HEI Internet Management Model. The following sub-sections discuss each layer of the proposed adaptive Internet Management Model for HEIs in SA in more detail (Figure 7.3).

7.3.1. Global Goals

The Global Goals layer of the proposed adaptive Internet Management Model for HEIs in SA focuses on identifying the global role-players and conditions that have a direct or indirect impact or influence on the HEI Internet. This layer therefore focuses primarily on the global Internet Governance mission, vision and values and global ISP strategy, policies and business model. The global Internet governance directs the global Internet direction for the entire Internet community while the global ISP directs the global Internet direction for HEI and research institutes, national and international Communities of Practice, etc. The two focus areas are elaborated on under the next headings.

- **Global Internet Governance mission, vision and values**

  Internet Governance encompasses the development and application of the evolving policies and mechanisms directed by the Internet community's many stakeholders to shape

the evolution and make the Internet accessible for all. These stakeholders, in their respective capacities address a wide range of areas which range from day-to-day operational and technical issues of the Internet to public policy issues such as cybercrime. In order to address this wide range of areas, the Multi-Stakeholder model was created, which covers elements of the general Internet Governance models as presented by Solum (2008) and Collins (2007). The MSM aims to improve access to information and communication infrastructure and technologies, including information and knowledge, develop and widen ICT applications, encourage international and regional cooperation, increase confidence and security in the use of the Internet, build capacity, create an enabling environment at all levels, recognise the role of the media, foster and respect cultural diversity and address the ethical dimensions of the Internet community (Stauffacher & Kleinwächter, 2005, p. 300). These aspects all directly and indirectly influence the HEI Internet environment and should be investigated.

- **Global ISP strategy, policies and business model**

The Global ISP strategy, policies and business model refers to the international ISP structures, currently NREN, that provide Internet services to the HEIs. The global ISP's primary objective is to provide advanced ICT Services by the means of critical network connectivity and network services to HEIs and research institutes and national and international Communities of Practice (GÉANT Limited, 2014). These ISPs therefore drive the global business strategies, create and implement policies and create and capture value from the global business model, whilst adhering to the MSM's Internet governance mission, vision and values. In addition, the core products, services, connections, infrastructure, relationships, etc. are created and managed by the global ISP. The local ISP then feeds into the global ISP, whist adhering to its local environment, conditions and clients' requirements. The following sub-section addresses the South African goals layer of the proposed adaptive Internet Management Model for HEIs in SA.

7.3.2. South African Goals

The South African Goals layer of the proposed adaptive Internet Management Model for HEIs in SA focuses on identifying the national role-players and conditions that have a direct or indirect impact or influence on the HEI Internet. This layer focuses primarily on the South African Internet Governance structures, the South African economy and the trends in the ICT and HEI environment and the adopted HEIs' ISP and their overall strategy, policies and business models. All three identified areas directly influence and direct the institutional

strategy and business model. The three focus areas are elaborated on under the next headings.

- **South African Internet Governance mission, vision and values**

The South African Internet Governance mission, vision and values focus area refers to the national Internet governance structures and their overall business plans and objectives. These national Internet governance structures are implemented to guide the future of the Internet and to ensure it adheres to the set global Internet governance structures while still following the national Internet governance requirement. Unfortunately, there are currently no South African Internet Governance forums available to promote the use of the Internet to innovate and advance economic growth (Moyo, 2014). Nonetheless, there is an Internet Society South African chapter available, which represents the interests of South African telecommunications users in policy discussions, in the media and in any other relevant forum (ISOC-ZA, 2017). It is imperative that HEIs take note of the South African Internet Governance mission, vision and values when creating or reviewing the proposed adaptive Internet Management Model for HEIs in SA.

- **South African economy and trends in ICT and HE environment**

The South African economy and trends in ICT and HE environment focus area of the proposed adaptive Internet Management Model for HEIs in SA refers the macro environment in the South African, ICT Sector and HEI environment. Key issues and trends must be identified in the South African political, economic, social, technological, environmental and legal areas that will influence Internet management. In the current environment, net neutrality, cyber-crime, privacy, digital divide, gender-based violence, sexual violence, high data costs, IoT, Mobile Internet, BYOD, Cloud technology, privately owned ICT Internet infrastructure and services, #feesmustfall movement, Film and Publications Amendment Bill and the draft Cybercrimes and Cyber Security Bill must all be considered (Freedom House, 2017a). In addition, the DHET and ASAUDIT's plans, as well as the National Development Plan 2030 directly influence the HEIs and ICT environment and must also be considered.

- **South African ISP strategy(ies), policies and business model(s)**

The South African ISP strategy(ies), policies and business model(s) focus area of the proposed adaptive Internet Management Model for HEI in SA refers to the South African HEI's ISP, currently being SANReN and TENET and their overall business direction.

Currently, SANReN is responsible for the planning and implementation of the South African HEI network infrastructure and TENET is responsible for maintaining it. Both NRENs deliver their network products and services to their clients, one core client being HEIs, as per their respective strategies, policies and finally, their business models. These overall business plans and rollout plans will influence what the network characteristics and capabilities would end up being. Ultimately, the HEI's traffic will traverse over the NREN network and consequently obey the implemented technologies and managed practices as installed and management by NREN. HEIs need to familiarise themselves with the ISP strategy(ies), policies and business model(s) as they will serve as the only Internet connection to the outside world. The following sub-section addresses the Institutional goals layer of the proposed adaptive Internet Management Model for HEIs in SA.

7.3.3. Institutional Goals

The Institutional Goals layer of the proposed adaptive Internet Management Model for HEI in SA focuses on identifying the institutional goals and the Internet requirements to achieve these goals. The focus area of Institutional strategy and the business model are covered in this layer and are elaborated on under the next headings.

- **Institutional strategy and business model**

The institutional strategy and business model focus area of the proposed adaptive Internet Management Model for HEIs in SA refers to the institution and its overall business direction and the plan to achieve the set goals. Accompanying the strategy is the business model, which identifies the four main business areas, being customers, value offer, infrastructure and financial viability. The Internet plays a pivotal role in both the strategy and business model due to the integral part the Internet plays in connecting users and systems. For example, if the institution would like to increase its research output, the Internet would be required to search for articles, stay connected with the supervisor or promoter, search for and publish articles at conferences or journal articles, etc. The majority of the identified goals, objectives, items and building blocks will therefore not materialise without top management's understanding and commitment to the importance of the Internet and the management thereof. In addition, top management needs to realise and understand how the overall business objectives are heavily dependent on the Internet-related outcomes and the fact that it serves as the foundation for many critical business outcomes. The following sub-section addresses the Internet Management goals layer of the proposed adaptive Internet Management Model for HEIs in SA.

7.3.4. Internet Management Goals

The Internet Management Goals layer of the proposed adaptive Internet Management Model for HEIs in SA focuses on identifying the overall Internet management objectives for HEIs, as per the institutional goals. This layer focuses on identifying the Internet plan or roadmap to ensure that the overall institutional strategy and business model are achieved. The focus area of Internet Management strategy and business model is covered in this layer and is elaborated on under the next headings.

- **Internet Management strategy and business model**

The Internet Management strategy and business model(s) focus area of the proposed adaptive Internet Management Model for HEIs in SA refers to the overall Internet management business direction adopted to better serve the institutional goals. Complementary to the strategy is the BMC, which identifies how the institution delivers value to customers, it gets them to pay for that value and converts those payments to profit. In this case, it identified the institutional purpose of the Internet, how it will deliver value to the institution and how it will be funded. The BMC therefore identifies the blueprints or architecture of the Internet business component through the use of the nine building blocks. For example, the strategy may be to expand the Wifi footprint due to the increased number of mobile devices being added to the network. This is accompanied with strict access control to ensure users do not connect multiple devices onto the same access point, which if not done will reduce the bandwidth for all connected users. The following sub-section addresses the Internet Enablers layer of the proposed adaptive Internet Management Model for HEIs in SA.

7.3.5. Internet Enablers

The Internet Enablers layer of the proposed adaptive Internet Management Model for HEIs in SA focuses on the sources or supply from which the Internet management goals can draw. This layer focuses on identifying the enablers that will help to establish the Internet management and consequently the overall institutional strategy, policies and business model (COBIT 5, 2012). The focus areas of principles, policies and frameworks, processes, organisational structures, culture, ethics and behaviour, information, services, infrastructure and applications and people, skills and competencies are covered in this layer and are elaborated on under the next headings.

- **Principles, policies and frameworks**

The principles, policies and frameworks focus area of the proposed adaptive Internet Management Model for HEIs in SA focuses on translating the desired behaviour into practical guidance for day-to-day management (COBIT 5, 2012). This comes in the form of Internet principles, policies and frameworks. Key areas that should be focused on are the establishment of the Internet policies, which cover the basic principles and related guidelines, which are created and enforced by the HEI to direct and limit its actions in the pursuit of the institutional goal. Examples of Internet policies that should be included are an Acceptable Use policy, General ICT policy, Bandwidth/Network policy, Email policy, BYOD policy, Information Security Policy and Privacy policy. Key elements from the Eduroam policy and NREN Policy (or NREN SLA) should reflect in these Internet policies. Internet principles or values as identified by the IG structure should be considered and aligned with the institutional goals. Internet principles to consider include privacy, freedom of expression, access and openness, gender equality, etc. Internet values to consider should include security, reliability, scalability, speed, etc. (Weber, 2015). The Internet frameworks are the essential supporting structures of the Internet. It is, however, found that the frameworks are enforced by the governance structures and cannot be easily altered, for example, TCP/IP, IPv4 and IPv6.

- **Processes**

The processes focus area of the proposed adaptive Internet Management Model for HEIs in SA focuses on creating and managing the set of activities and practices to achieve the objectives by producing a set of outputs, which are aligned with the overall Internet management goals (COBIT 5, 2012). Processes that should be considered include, amongst others, request for additional Internet funding, change controls, reporting structures, authorisations levels, procurement process, policy reviews, Internet assistance, incident response, various 'How to' documents and reporting Internet abuse.

- **Organisational structures**

The organisational structures focus area of the proposed adaptive Internet Management Model for HEIs in SA focuses on the different Internet role-players as well as the key Internet management decision-making entities in the institution. The different Internet users should be grouped into customer segments or profiles and aligned according to their respective business and personal Internet requirements. User groups should include at least staff and students with the remaining Internet users classified as guests. If more

granularity is required, the groups could constitute academic staff, administrative staff, undergraduate students and postgraduate students with the remaining Internet users classified as guests.

Likewise, the Internet management organisational structures should identify the Internet approval authorities, the Internet managers, Internet support team, who are the Internet owners and who are the Internet custodians. Their roles and responsibilities must be clearly highlighted and documented.

- **Culture, ethics and behaviour**

The culture, ethics and behaviour focus area of the proposed adaptive Internet Management Model for HEIs in SA focuses on creating and instilling the required culture, ethics and behaviour for both the institution as well as the Internet community. The ideal shared assumptions, values and beliefs of the HEI Internet community should be identified and documented. This would dictate how the institutional Internet resources should be used to better serve the Internet management goals and consequently the institutional goals. Key factors that should be considered are what influences the users most, their Internet business and personal requirements and the Internet values. Internet principles or values as discussed previously under the Principles, policies and frameworks focus area will form part of instilling the required Internet culture.

Ethics in the context of Internet means acceptable Internet behaviour. The acceptable use of the Internet should therefore be covered in the Acceptable Use policy and enforced. In addition, key elements such as what Internet resource the Internet user groups require, at what time of day when do they require it and what purpose do they require it for (work/academic or personal) should be considered. Unacceptable Internet behaviour should not be tolerated and must be addressed. This will be covered in greater detail in the User Internet management layer.

- **Information**

The information focus area of the proposed adaptive Internet Management Model for HEIs in SA focuses on the information that is produced and used concerning the Institution's Internet. This information is required to keep the institution's Internet running and well governed. Information that could help with key decisions includes Internet management reports, Internet business-decision reports, business purpose of Internet use, personal

purpose for Internet use, Internet values, processed Internet logs, Internet metrics, SLAs, Internet statistics, capacity planning, fault detection and reporting, Internet and firewall audits, network usage, number of devices on network, Internet anomaly detection and report, etc.

- **Services, infrastructure and applications**

The services, infrastructure and applications focus area of the proposed adaptive Internet Management Model for HEIs in SA focuses on the Internet technology, infrastructure and applications (COBIT 5, 2012). Services includes providing an active Internet connection to all approved Internet enabled devices and support thereof to the Internet community. Physical infrastructure includes the installation and management of the network cables (copper, coaxial, fiber), antennas, switches, point-of-presence, data centres, routers, access points, etc. Applications include Internet management applications, monitoring and analysing applications and basically any business and personal applications that require an Internet connection such as Email, E-learning sites, World Wide Web, Facebook, Youtube, etc. Also included is the management application, which manages the Internet controls, these include throttling, shaping, traffic prioritising and website management, which allow the institution to manage, amongst other things, access to websites and website categories.

- **People, skills and competencies**

The people, skills and competencies focus area of the proposed adaptive Internet Management Model for HEIs in SA focuses on the people and their required skills and competencies to govern, manage and use the HEI Internet to best serve the institution. The key people included are the Internet support team, Internet managers team, suppliers, vendors and the Internet community. The Internet support team requires the necessary skills and competencies to provide superior services to the Internet community. The Internet management team requires the needed skills and competencies to make the correct decisions regarding the management of the Internet. The suppliers and vendors are the companies that supply the products and services to enhance the HEI's Internet products and services. The Internet community requires the basic skills and competencies to use the Internet as defined in the Internet policy(ies). The following sub-section addresses the User Internet Management layer of the proposed adaptive Internet Management Model for HEIs in SA.

7.3.6. User Internet Management

The user Internet management layer of the proposed adaptive Internet Management Model for HEIs in SA focuses on helping the Institution deal with Internet abuse. This layer is therefore focused primarily on the user and their Internet practices, with emphasis on abuse. Furthermore, this layer is meant to support and enhance the already implemented Internet enablers. The user Internet management layer consists of four management approaches or focuses as provided by Young, (2010), however, this model is modified slightly to adhere to the HEI environment. These are Internet Policies, Programme, Enforcement and Rehabilitation and are elaborated on under the next headings.

- **Internet Use Policy(ies)**

The Internet Use policy or policies are the formal institutional policies that establish the permissible workplace, labs, lecture venues, study spaces, open spaces, etc. uses of the HEI Internet. In many institutions, this will come in the form of an Acceptable Use policy, although the scope should include any policy that covers Internet usage. According to the South African National Standards (SANS) Institute (2013), an Internet usage policy should cover resource usage, allowed usage, personal usage, prohibited usage, software licence, review of public information, expectation of privacy, maintaining corporate image and periodic reviews. In addition, there should be a section dedicated to compliance measures, exceptions and non-compliance with this policy. The policy document should then be signed by each Internet user to indicate acknowledgement of the policy, which will then be kept on the staff or student's record as a legal binding document (SANS Institute, 2013; Young, 2010). This policy should be reviewed periodically, approved by the formal governance structures and thereafter distributed to all stakeholders as per their preferred communication channels. Once the Internet policy is created, approved, signed and filed, the Internet community must then be trained in its proper use.

- **Programme**

The Programme-focus area deals with the implementation of a staff and student Internet usage awareness and training programme. The Internet usage awareness and training programme serves as a proactive method to effectively communicate and update the Internet community on the Internet policy(ies) (Young, 2010). The purpose of the awareness level would be to focus the user's attention on the content of the Internet usage policy(ies). The user is considered a recipient and does not have an active role. The focus would be on the *what* the policy entails, *what* is allowed and *what* is not allowed. Good

examples of awareness material would be login notifications, posters, slogans, videos, etc. in labs or common areas. The purpose of training is to produce the required and applicable competencies and skills needed for proper Internet usage. The focus shifts away from focusing attention on Internet usage but rather to instil the necessary skills as required by the Internet usage policy(ies). The focus would now be on *how* to use the Internet as stipulated in the Internet policy(ies). Good opportunities for training would be during inductions, during the first computer laboratory lecture, as part of a formal Human Resources training programmes, etc. (NIST 800-16, 1998).

The Internet usage awareness and training programmes should co-exist. Awareness material should be continuously distributed to focus the user's attention and should be reinforced with the set Internet training programmes schedule. As the findings show, it is clear that almost half of the Internet community is not aware of the Internet policies. In addition, although some knew about them, it was found that there were still some who had not read and understood them and do not agree with them. Internet usage awareness and training should therefore be implemented to help increase the users' accountability and ethical integrity when on the HEI's Internet. In addition, this will enhance their interdependency with HEI technologies and reduce institutional risk and liability to the institution when policy violations happen.

- **Enforcement**

The Internet community should be aware of and trained on the usage policy(ies) regarding the HEI's Internet, so now it is time to enforce the policy(ies). Many HEIs use their implemented boundary firewall, FortiGuard Firewall already in place at the Nelson Mandela University, to monitor and manage access to Internet content (Boshoff, 2016). The web categories are prime indicators of the type of Internet activities available. Rules can be built into these categories. For example, the Security Risk category can be set to automatically deny access to any of the websites found in these categories. A more granular approach can also be used where the HEI can block or allow a specific website site group. For example, the Adult/mature content group can be allowed, but the pornography subgroup can be blocked. It is, however, imperative that the Internet usage policy should be aligned with the enforcement rules. These enforcement rules should also be aligned with the user or profile group requirements and the environment they work/study in.

In some cases, additional hardware and software may enhance the monitoring functionality, especially if it is to be automated to automatically warn of prohibited Internet activities and initiate action where necessary. A cost-benefit analysis must be conducted beforehand to determine if it is worth investing in the additional Internet monitoring technologies (Young, 2010). Nonetheless, the findings indicate that a large portion of the Internet activities were absorbed in cyberloafing activities. Furthermore, a large portion of these activities were geared toward deviant activities and sometime unethical or illegal activities. In addition, the staff and students underplayed these activities. This could stem from a lack of knowledge of the Internet usage policies, which will be addressed through the proper awareness and training management approach.

- **Rehabilitation**

The staff and students who do not adhere to the HEI's Internet usage policy(ies) should be sent for rehabilitation, much in the same manner as alcohol and drug abusers are sent for rehabilitation (Young, 2010). The rehabilitation process will help the Internet users to use the Internet as it was intended, which can lead to a more productive and healthy business/educational environment. This method is preferred over termination of staff as there are various hidden costs such as recruitment and retraining expenses as well as increased turnover rates and possible brand damage. In addition, the termination of employees creates a climate of fear (Young, 2010). Furthermore, students are not employees and therefore they cannot be terminated in the same sense. In most cases where students abuse the Internet, a formal legal process must be followed, which leads to disciplinary processes. If successful, the student may be expelled, which means a loss of income as the students are classified as clients. For these reasons, it is better to rehabilitate the Internet users. With the rehabilitation management approach, the key cause of the Internet abuse should be documented, which, if any, should be used to re-align and enhance the Internet management goals level. The following section presents the recommendations and considerations.

7.4. Recommendations and Considerations

Based on the empirical study conducted, it is evident that there are various misalignments in the current IG environment, NREN environment, HEI environment and Internet community's requirements that must be addressed. This will assist HEIs to achieve their set business goals and objectives by delivering optimal value through the effective and efficient governance and management of their Internet resources. The researcher therefore proposes the following

recommendations and considerations to the HEIs to ensure the successful re-alignment of the Internet management resources:

- The MSM focuses on Internet values such as support, privacy, security, neutrality, transparency, freedom of expression and competition. HEIs should therefore incorporate all Internet values into their Internet management resources. A balance must be maintained between the business purpose for the HEI Internet and the Internet community's human right to being connected.

- The drive towards *net neutrality* and privacy must be adhered to whilst ensuring that the primary purposes of the Internet for the HEI, being for business, are maintained. These trending Internet values must therefore be considered when introducing content control mechanisms.

- HEIs should take note of what is happening in the South African government, civil society and the private sector space regarding Internet management. These private and public role-players have a tremendous influence on the future of the Internet, specifically in the South African environment. HEIs can piggy-back onto the advancement of access to quality and relatively affordable Internet access in SA projects, which are specially aimed at the low income communities. This can assist HEIs to bridge the digital divide and help reduce costs concerning physical infrastructure rollout projects.

- New regulations, national ICT strategies, HEI sector strategies, etc. and their influence on the HEI environment must be scrutinised. As previously discussed, the Film and Publications Amendment Bill and the draft Cybercrimes and Cyber Security Bill, Protection of Personal Information Act as well as the National Development Plan 2030, ASAUDIT plans, Higher Education South Africa plans national ICT Strategy, etc. will all influence how HEIs manage their Internet.

- According to the majority of HEIs, the Internet management resources are standard to all the Internet community. Yet, throughout the HEI Internet Management Business Model and the results at the Nelson Mandela University it is clear that the two main groups, being staff and students have different requirements and are being treated differently. It is recommended that the profile groups be split and the Internet resources aligned as per the overall respective business (work and academic) requirements of each.

- The NREN (TENET) policy must be considered and incorporated into the overall ICT Policies. In the case of Nelson Mandela University, it must be incorporated into the ICT

General Policy and Acceptable Use Policy. The *eduroam* policy must also be incorporated at those institutions that make use of it.

- Currently the majority of HEIs only focus on using the NREN infrastructure for Internet connection. Alternative or added ISP solutions may assist in increasing the value provided to the Internet community. For example, many cell phone providers have dedicated packages to assist students to connect to the Internet. HEIs should leverage these special offerings to assist with increasing their Internet footprint at a reduced cost. Key areas to investigate could include connections to be used as a backup medium, used to extend coverage in wifi dead spots and zero-rated websites to be used for students who want to access HEI resources but have no Internet.

- NREN offers a wide range of middleware services that HEIs can incorporate into their existing portfolio of Internet services. HEIs should accept these offerings and incorporate those that fit their business requirements.

- IG and HEIs highlighted security as a core Internet value. Security must therefore be encapsulated in all elements of the HEI Internet Management Business Model including all Internet management resources, specifically mobile users. Key consideration must be the security vs usability vs cost model. The same must be done for Speed, Availability (connectivity), Reliability, Trust, Anonymity (Privacy), etc. In some areas these Internet values are highlighted as important and in others not. A review and re-alignment is required.

- There are two different age groups. These age groupings are students aged 18 - 29 and staff aged 30+. These different groups have different requirements and are influenced by different things.

- An Internet-enabled device is required to access the Internet. The majority of staff are assigned a Council-funded device whereas students are not. Students need to share a computer in a laboratory to be able to complete their academic requirements. The HEIs must ensure that the computer per student ratio is sufficient on all their sites as to ensure that HEIs close the gaps where there are insufficient digital devices. The same strategy must be followed with the insourcing of staff where the currently insourced staff do not have access to computers.

- HEIs should take note of the preferred device for the different Internet community groups. It was found that HEIs are geared towards assisting with Council-funded devices. There is a lack of resources dedicated to assist with Non-Council funded devices, specifically mobile devices. Proper mobile device management solutions, such

as 'How to' documents, best practice documents and trained ICT staff especially mobile technologies would assist HEIs to leverage from BYOD, save costs by not buying dedicated devices for these users and in turn use these costs to enhance the BYOD and wifi coverage areas.

- The distribution of policies and other related communication must be aligned with the interests of each respective user group and made in the preferred communication channel/method as identified by the Internet community. In addition, it must be received in the format that best suits the Internet user. It is clear that students lack policy related knowledge as the communication method is geared towards a business environment and not a student environment.

- Each target audience (age groupings, generations) must be made aware of policies and must be instructed on a non-technical level. Input from all stakeholders must be received during the review process and must be in line with the NREN policy. In addition, input should be requested from those Internet users who do not agree with the respective policies.

- The controls implemented for each group must match the scope of their work and personal requirements as well as their Internet requirements for the specific period of day or week. Business requirements must receive priority over all. This will ensure the optimal use of the Internet resources.

- The HEI ICT Policies and HEI Internet Management Business Models must be reviewed annually or when changes in the ICT micro and macro environment are detected. The HEI ICT Policies and HEI Internet Management Business Models must be approved by the implemented governance structures and must include input from all stakeholders.

- HEIs should follow a set strategy and incorporate proper project management principles during the Internet expansion processes. A balance should be maintained in the rollout of a fixed vs wifi network while focusing on business/academic requirements. The rollout of physical infrastructure is considered the most expensive Internet resource and must therefore be done efficiently and effectively. Consideration should be given to the fixed Internet requirement for staff and wireless requirement for students.

- Internet resources (human-, physical-, financial- and organisational resources) must be geared towards the size of the Internet community group as well as their respective function in the HEI. It is clear that a 50/50 split ratio or free for all distribution of Internet resources is not working as one user group is being favoured whilst the other is experiencing hardship.

- HEIs tend to be more in touch with the staff than with students. It was clear from the findings that the Internet is very much geared towards staff and their needs rather than students and their needs.

- An active technical control to regulate Internet traffic is key in ensuring all traffic receives the priority as required. It is clear that the affiliation, Internet group and time of day play a critical role in what websites would be accessed. The Internet technical controls must therefore take this into account and link the controls to the level of business and personal requirements to ensure a balance is maintained amongst all users and requirements. Key considerations should include business vs personal, richness of content, frequency of access and type of content being accessed.

- Internet resources should be monitored and any abuse detected should be communicated and acted against as is documented in the policies and procedures. Priority must be given to work/academic Internet use (specifically in Computer Laboratories) whilst ensuring that some personal use is accepted. Special consideration should be given to address Internet use during lectures (students) and during work hours (staff).

- A Risk Control strategy should be adopted for Internet outages caused by NREN network failures or internal (between campuses or inside campuses) network failures. Any downtime will thus not cause Internet failure and will ensure that business continues as usual. This could be combined with approaching ISPs for alternative or backup Internet solutions, especially in cases where the HEIs only have one connection to NREN.

- The HEIs must regularly capture, process and review the top 20 Internet uses and realign their Internet resources accordingly. The feedback from the users, specifically the students indicates that there is room for improvement. This could be due to the HEI requesting that some content be opened up but in fact, the content they are actually accessing is not what they think and the content is captured under another firewall category and thus another set of rules.

- The firewall log data (Freeware and Software Download category) indicated that staff are accessing and downloading Third Party security tools but not students. These roles should be reversed as staff should not be accessing Third Party security tools as they are protected by the HEI's security tools but students have their own devices which are outside the control of the HEI. The HEI must use the staff willingness to secure their devices to enhance their security posture. The HEI should catalogue approved HEI

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security tools and guide both user groups to what is available. Also, downloading these tools and keeping them inhouse will reduce the multiple downloads taking place by multiple users. This will ensure that the HEI stays in control of the security tools being used in the HEI environment.

- There is a vast amount of Information Technology content being accessed by both user groups. This means that they are actively updating their systems to remove known vulnerabilities. The HEI must inspect ways to reduce these individual downloads to ensure that the update or patch is downloaded once and then accessed internally (off the Internet) by all. This will save valuable Internet bandwidth capacity.

- There are misalignments between the content that is being accessed and what the users say they are accessing. This directly influences the implemented HEI Internet controls which are largely built around the firewall default settings and the users' input. It was clear from the findings that Business, Information and Computer Security, Information Technology, Secure Websites, Web-Based Applications, Web Hosting, Entertainment, Advertising, Games, Instant Messaging, Social Networking, Personal Emails, Content Servers, Personal Vehicles, Personal Websites and Blogs, Shopping and Auction, Society and Lifestyle, Meaningless Content, Dynamic Content, Travel, Health and Wellness, Global Religion, Restaurant and Dining and Real Estate, File Sharing and Storage, Internet Radio and TV, Peer-To-Peer File Sharing, Streaming Media and Download, Pornography and Unrated are either under- or over-used as the users' reported. A review is required in these categories.

- The firewall logs indicated that the majority of the HEI Internet is used to access non-work/non-academic related content. HEIs must take note of this and ensure that this does not influence the primary business purpose of the Internet.

- There is a large portion of Internet content being processed under the category 'Empty'. The content in this category could, for example, range from legitimate business information to child pornography to sensitive corporate information being sent to China. Therefore, the largest part of the Internet does not adhere to the set Internet values as the HEI has no clue what it is being used for. HEIs are urged to investigate and activate the decryption/inspection feature on the firewall that will allow for all traffic to be inspected, correctly classified and consequently managed correctly as per the institutional organisational goals.

- The Fortiguard categories default to capture and classify content as per the configured global content categories. These global categories are suitable for home/families, schools and enterprises. It is imperative that HEIs opt for the school category

classification scheme. Alternatively, HEIs are requested to review these categories and reclassify those best suited to the HEI sector's requirements.

- Instant messaging was considered to be one of the top reasons for students to use the Internet. It is found that most firewalls block specific components of instant messaging by default. HEIs are requested to take note of this default block and if approved, open these ports so that staff and students can experience the full extent which comes with the instant messaging feature. For example, WhatsApp calls are automatically blocked by the Firewall.

- Internet and network support for staff and students should be allocated according to the campus size and staff to student ratio for that site.

- Controls must be installed to monitor users' use as well as bandwidth use. Caution should be taken not to infringe on the users' privacy and therefore only action outliers when they are identified.

- HEIs must maintain a balance between the number of devices introduced by BYOD and IoT and the HEI network or Internet growth strategy. At the current growth rate of device, the Internet resources will not be able to handle the load in a few years' time. Alternatively, emphasis should be placed on adding additional restrictions to control unwanted Internet usage and only focus on business and research Internet usage.

The following section identifies the limitations of the study.

7.5. Limitations of the Study

Limitations are influences, shortcomings or conditions that the researcher has no control over and may place restrictions on the research study (Collis & Hussey, 2014). The following are limitations that have been identified in this research study:

- There is a shortage of Internet Governance and Internet management literature which focused on the specific research topic. This meant that the research had to rely on other forms of secondary data sources to complete those focus areas.

- There is a lack of South Africa-related Internet resources, specifically statistics. Those that were found tend to be dated one or two years behind current literature and statistics.

- It was communicated to the researcher that both the HEIIMS and NMUIUS were extremely long and discouraged some respondents. For example, 1 536 started the NMUIUS but only 690 completed it. That is a dropout rate of 55 percent (n = 846).

- It would have been ideal to use only open-ended questions in the HEIIMS business model sections. However, it was found that some respondents lacked business model knowledge and skills and it was therefore opted to provide a more structured approached in the form of Likert Scales and tick boxes.

- Some HEIs struggled to complete the HEIIMS and requested assistance from the researcher. Therefore, a lack of business model knowledge and skills could be why some did not return the HEIIMS.

- The HEIIMS was created by using MS Word and the accompanying development features. This meant that many of the built-in best practice survey features were not available as are found in Questionpro. This meant that the creation and distribution of the HEIIMS had to be done manually.

- The NMUIUS was short on open-ended questions which meant that there was a lack of measuring tools to measure some of the respondents' true attitudes.

- It was found that disabled users, specifically blind students, were not able to complete the NMUIUS. The implemented computer software used to assist these users to complete the 'Drag and Drop' or 'ranking' type questions were not able to adequately translate the function required to answer the question type.

- The NMUIUS contained various categories of possible Internet content that stems from the Fortiguard firewall categories. The Fortiguard firewall works by categorising the content found on the website as per its main category. The respondents may not always know what these Fortiguard firewall categories are and if the categories are classified a congruent with their line of thought.

- Due to the sensitivity of some of the questions in the NMUIUS, some respondents may have selected the more appropriate answer and not the true answer.

- Due to the immense length of the NMUIUS, the full extent of the Fortiguard firewall categories topics (content) could not be listed. The researcher therefore had to use his own judgement and remove certainty topics (content) from the survey and only keep those that appeared to be more relevant.

- Some questions in the NMUIUS could not be used for statistical analyses to the full extent when compared to the other questions. These were the 'Drag and Drop' or 'ranking' type questions.

- The Fortiguard firewall categories are considered a living list and are changed regularly as new content categories become known. Due to the timeframe of this study, multiple

categories were added while others were removed. This meant that the researcher had to alter the findings but used best effort to keep up with comparing results.

- Fortiguard firewall categories are created by using international business best practices and are suitable for enterprises, schools and home/families. These Fortiguard firewall categories are not necessarily aligned with the environment of the HEI sector.

- In both surveys the response rate was adequate, however, a higher response rate would have been more favourable.

- The cross-sectional study only includes the current state of affairs at the time of the set timeframe. Anything before and after the snapshot is excluded.

- The firewall logs was collected from 01 January 2014 to 29 February 2016. A longer period that ran until the end of the 2017 period would have been ideal. However, due to ICT system changes the last part of the data were lost.

- Some websites can be used for personal and business. An example is www.YouTube.com, which can be used to, for example watch cat videos to waste time or watch 'How to create a business model' videos to assist with an exam. The main purpose of the website as captured by the firewall was used to interpret the results.

- Due to time constraints, some areas may not have received the researcher's full and undivided attention as was intended.

- The study focused on the HEI Internet usage only. Some users may be using their mobile data, thinking they are using the HEI's Internet bandwidth.

7.6. Future Research

During the course of this thesis a number of future research possibilities were identified. These will assist future research to strengthen the findings as previously presented. These future research possibilities include:

- Extend the HEIIMS to include all sizes and variations of HEIs within SA;
- The business model questions in the HEIIMS should be open-ended questions;
- Extend the NMUIUS to all HEIs within SA, not only universities; and
- Split the different Internet user groups (undergraduate students, postgraduate students, academic staff and administrative staff) within the HEI and determine the usage patterns and requirements for each.

7.7. Summary

The main objective of this research study was to develop a proposed adaptive Internet Management Model for the effective management of the Internet ICT resources at Higher Education Institutions in South Africa. The deliverables set to achieve the main objective included:

- Identify the national and international governance structures that influence the management of the Internet;
- Develop and evaluate the business model canvas for NREN, SANReN and TENET.
- Identify the research methodology to be applied in this research study;
- Conduct an empirical evaluation of Internet Management practices at Higher Education Institutions in South Africa;
- Identify the national best practices adopted for Internet management at South African Higher Education Institutions;
- Conduct an evaluation of the staff and students' Internet usage at Nelson Mandela University; and
- Conduct an evaluation of the staff and students' Internet usage as recorded in the Nelson Mandela University Firewall Log files.

The research study concluded with the identification of a list of recommendations and considerations that stem from the HEIIMS and NMUIUS findings. In addition, a proposed adaptive Internet Management Model for HEIs in SA was presented. The purpose of the proposed adaptive Internet Management Model is to provide a high level understanding of each layer and focus area within the Internet landscape and to identify the basic relationships which join it all together. Therefore, the proposed adaptive Internet Management Model for HEI in SA provides a holistic view of the HEI Internet management and enabling landscape. The proposed Model for Internet Management will assist South African HEIs to re-align the Internet resources to ensure they meet both the institution and Internet community requirements whilst following the global Internet vision. The chapter concluded by listing the identified limitation of the study and future recommendations to enhance or improve on this study.

References

Abbott, P. & Taylor, S. J. E., 2015. *The Potential of National Research and Education Networks.* London: TANDEM.

Aegify, 2017. *ISO 27002 Compliance – Implementing Information Security.* [Online] Available at: https://www.aegify.com/security-overview/iso-27002-compliance-html/ [Accessed 29 October 2017].

Akbulut, Y., Donmez, O. & Dursun, O. O., 2017. Cyberloafing and Social Desirability Bias Among Atudents and Employees. *Computers in Human Behavior,* 72, pp. 87 - 95.

Almeida, V. A. F., 2014. The Evolution of Internet. *IEEE Computer Society,* September/October, pp. 65-69.

Almeida, V. A. F., Doneda, D. & Rossini, C., 2016. How Do App Stores Challenge the Global Internet Governance Ecosystem? *IEEE Computer Society,* 16, pp. 49-51.

Almeida, V., Getschko, D. & Afonso, C., 2015. The Origin and Evolution of Multistakeholder Models. *IEEE Computer Society,* 15, pp. 74-79.

Anderson, L., Gold, J., Stewart, J. & Thrope, R., 2015. *A Guide to Professional Doctorates in Business and Management.* London: SAGE.

Apăvăloaie, E.-I., 2014. The Impact of the Internet on the Business Environment. *Procedia Economics and Finance,* 15, pp. 951-958.

Appice, A., 2017. Towards Mining the Organizational Structure of a Dynamic Event Scenario. *Journal of Intelligent Information Systems, 48,* pp. 1-29.

B2B International Beyond Knowledge, 2017. *Business Models and Strategies for Competitive Advantage.* [Online] Available at: https://www.b2binternational.com/publications/competitive-advantage/ [Accessed 04 February 2017].

Baden-Fuller, C. & Haefliger, S., 2013. Business Models and Technological Innovation. *Long Range Planning,* 46, pp. 419–426.

Bailey, K., 1994. *Methods of Social Research.* 4th ed. New York: The Free Press.

Baloch, F. K. & Cusack, B., 2012. *A Discussion on Internet Governance.* Sao Carlos, pp. 1-7.

Banda, T. M. & Khomba, J. K., 2013. *Business Models for National Research and Education Networks in Eastern and Southern Africa: Lessons from Tertiary Education and Research Network of South Africa.* Mbeya.

Battistella, C., De Toni, A. F., De Zan, G. & Pessot, E., 2017. Cultivating Business Model Agility Through Focused Capabilities: A Multiple Case Study. *Journal of Business Research,* 73, pp. 65–82.

Baturay, M. H. & Toker, S., 2015. An Investigation of the Impact of Demographics on Cyberloafing from an Educational Setting Angle. *Computers in Human Behavior,* 50, pp. 358–366.

Bauer, J. M. & Dutton, W. H., 2015. *The New Cybersecurity Agenda: Economic and Social Challenges to a Secure Internet.* Lansing, Social Science Electronic Publishing.

Bendovschi, A., 2015. Cyber-Attacks – Trends, Patterns and Security Countermeasures. *Procedia Economics and Finance,* 28, pp. 24-31.

Berg, K. E. & Latin, R. W., 2008. *Essentials of Research Methods in Health, Physical Education, Exercise Science and Recreation.* 3rd ed. Philadelphia: Lippincott Williams & Wilkins.

Berg, M., 2011. *The Role of Inter- and NonGovernmental Organizations,* Convertions, Treaties and Other Responses to Global Issues, 2, pp. 1-9.

Blanchard, A. L. & Henle, C. A., 2008. Correlates of Different Forms of Cyberloafing: The Role of Norms and External Locus of Control. *Computers in Human Behavior,* 24, pp. 1067-1084.

Bock, W., Field, D., Zwillenberg, P. & Rogers, K., 2015. *The Growth of the Global Mobile Internet Econom.* Boston: Boston Consulting Group.

Boorstin, J., 2015. *What the Net Neutrality Battle is Really About.* [Online] Available at: http://www.cnbc.com/2015/02/26/what-the-net-neutrality-battle-is-really-about.html [Accessed 29 May 2017].

Boote, D. N. & Beile, P., 2009. Scholars Before Researchers: On the Centrality of the Dissertation Literature Review in Research Preparation. *Educational Researcher,* 34(6), pp. 3-15.

Boshoff, R., 2016. *A Model for Internet Management at a Higher Education Institution.* Port Elizabeth: NMMU.

Brocker, J., 2006. *TOGAF - Summary of the framework.* [Online] Available at: https://www.burst-digital.com/files/ebooks/togaf.pdf [Accessed 29 October 2017].

Brodkin, J., 2014. *Making the Internet a Utility—What's the Worst that Could Happen?* [Online] Available at: https://arstechnica.com/business/2014/12/worst-case-scenario-why-the-cable-lobby-is-scared-of-becoming-a-utility/ [Accessed 29 May 2017].

Broucek, V., Turner, P. & Zimmerli, M., 2011. Managing University Internet Access: Balancing the Need for Security, privacy and digital evidence. *Comput Virol,* 7, pp. 189-199.

Byrne, Z. S., Dvorak, K. J., Peters, J. M., Ray, I., Howe, A. & Sanchez, D., 2016. From the User's Perspective: Perceptions of Risk Relative to Benefit Associated with Using the Internet. *Computers in Human Behavior,* 59, pp. 456-468.

Campbell, D. T. & Stanley, J. C., 1966. *Experimental and Quasi-Experimental Designs for Research.* Chicago: Rand McNally.

Case, C. J. & Young, K. S., 2001. Employee Internet Misuse: An Epidemic in Need of a Research Framework. *Journal of Business and Information Technology,* 1(1), p. 30–36.

Case, C. J. & Young, K. S., 2002. Employee Internet Management: Current Business Practices and Outcomes. *CyberPsychology and Behavior,* pp. 355-361.

Case, C. J. & Young, K. S., 2004. Internet Abuse in the Workplace: New Trends in Risk Management. *Cyberpsychology and Behavior,* 7(1), pp. 105–111.

Cerf, V. G., 2015. Internet Governance and the Internet Governance Forum Redux. *IEEE Internet Computing,* 15, pp. 96-97.

Chen, L. & Nath, R., 2016. Understanding the Underlying Factors of Internet Addiction Across Cultures: A Comparison Study. *Electronic Commerce Research and Applications,* 17, pp. 38-48.

Cheshire, S. & Krochmal, M., 2013. *DNS-Based Service Discovery,* Internet Standards Track document. RFC 6763.

Chirkov, V., 2016. *Fundamentals of Research on Culture and Psychology: Theory and Methods.* New York: Routledge.

Cisco Mobile VNI, 2017. *Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2016–2021 White Paper.* [Online] Available at: https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/vni-forecast-qa.pdf [Accessed 23 October 2017].

Cisco, 2016. *Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2015–2020.* San Jose: Cisco.

COBIT 5, 2012. *COBIT 5: A Business Framework for the Governance and Management of Enterprise IT.* Meadows: ISACA.

Cohen, L., Manion, L. & Morrison, K., 2011. *Research Methods in Education.* London: Taylor & Francis.

Coker, B. L. S., 2013. Workplace Internet Leisure Browsing. *Human Performance,* 26, pp. 114-125.

Cole, S., 2015. *What The Net Neutrality Battle Means For Entrepreneurs.* [Online] Available at: https://www.fastcompany.com/3042787/what-a-net-neutrality-lose-would-mean-for-entrepreneurs [Accessed 13 July 2017].

Collins, R., 2007. Three Myths of Internet Governance Considered in the Context of the UK. *Prometheus: Critical Studies in Innovation,* 3(22), pp. 257-291.

Collis, J. & Hussey, R., 2014. *Business Research: A Practical Guide for Undergraduate and Postgraduate Students.* 4th ed. London: Palgrave Macmillan.

Computer Hope, 2016. *Who Invented the Internet?* [Online] Available at: http://www.computerhope.com/issues/ch001016.htm [Accessed 19 March 2016].

Corgnet, B., Hernán-González, R. & McCarter, M., 2015. The Role of the Decision-Making Regime on Cooperation in a Workgroup Social Dilemma: An Examination of Cyberloafing. *Games,* 6(4), pp. 588-603.

Crawford, K., 2017. *Cybercrimes and Cybersecurity Bill to be Tabled in Parliament.* [Online] Available at: http://www.financialinstitutionslegalsnapshot.com/2017/02/cybercrimes-and-cybersecurity-bill-to-be-tabled-in-parliament/ [Accessed 23 October 2017].

Creative Commons Attribution, 2013. *Who Runs the Internet?* [Online] Available at: http://xplanations.com/whorunstheinternet/ [Accessed 08 March 2015].

Creswell, J. W., 2007. *Qualitative Inquiry & Research Design: Choosing Among Five Approaches.* 2nd ed. London: SAGE.

Creswell, J. W., 2008. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches.* 3rd ed. London: SAGE.

Creswell, J. W., 2014. *Research Design.* 4th ed. London: SAGE.

D'Abate, C. P., 2005. Working Hard or Hardly Working: A Study of Individuals Engaging in Personal Business on the Job. *Human Relations,* 58, pp. 1009-1032.

Dean, D., DiGrande, S., Field, D., Lundmark, A., O'Day, J., Pineda, J. & Zwillenberg, P., 2012. *The Internet Economy in the G-20,* Boston: Boston Consulting Group.

DeCusatis, C., 2014. *Handbook of Fiber Optic Data Communication: A Practical Guide to Optical Networking.* 4th ed. London: Elsevier.

Doganova, L. & Eyquem-Renaultb, M., 2009. What Do Business Models Do?: Innovation Devices in Technology Entrepreneurship. *Research Policy,* 38(10), pp. 1559–1570.

Dorogovtsev, S. N. & Mendes, J. F., 2013. *Evolution of Networks: From Biological Nets to the Internet and WWW.* Oxford: Oxford University Press.

Downes, L., 2016. *Why Treating the Internet as a Public Utility is Bad for Consumers.* [Online] Available at: https://www.washingtonpost.com/news/innovations/wp/2016/07/07/why-treating-the-internet-as-a-public-utility-is-bad-for-consumers/?utm_term=.52ebdb4065ad   [Accessed 29 May 2017].

Downes, L., 2017. *The Tangled Web of Net Neutrality and Regulation.* [Online] Available at: https://hbr.org/2017/03/the-tangled-web-of-net-neutrality-and-regulation [Accessed 29 May 2017].

Dyer, J., 2009. *The Case for National Research and Education Networks (NRENs),* Trans-European Research and Education Networking Association. Amsterdam:Terena.

Epstein, E. J., 2017. *How America Lost Its Secrets: Edward Snowden, the Man and the Theft.* New York: E.J.E. Publications Ltd.

Fall, K. R. & Stevens, R. W., 2012. *TCP/IP Illustrated, 1: The Protocols.* 2nd ed. New York: Pearson Education, Inc.

Fleck, R. A. & McQueen, T., 1999. Internet Access, Usage, and Policies in Colleges and Universities. *First Monday,* 4(11). Available at: http://journals.uic.edu/ojs/index.php/fm/article/view/701/611 [Accessed 16 March 2016].

Foley, M., 2016. *The Role and Status of National Research and Education Networks (NRENs) in Africa.* SABER-ICT Technical Paper Series. Washington DC:World Bank.

Fortinet, Inc., 2017. *High Performance Firewall / VPN.* [Online] Available at: https://www.fortinet.com/products/next-generation-firewall.html [Accessed 04 September 2017].

Fortinet, 2017. *Web Filter Categories.* [Online] Available at: https://fortiguard.com/webfilter/categories [Accessed 18 November 2017].

França, C. L., Broman, G., Robert, K., Basile, G. & Trygg, L., 2017. An Approach to Business Model Innovation and Design for Strategic Sustainable Development. *Journal of Cleaner Production,* 140, pp. 155-166.

Freedom House, 2017a. *South Africa Country Profile.* [Online] Available at: https://freedomhouse.org/report/freedom-net/2016/south-africa [Accessed 23 August 2016].

Freedom House, 2017b. *United States Country Profile.* [Online] Available at: https://freedomhouse.org/report/freedom-net/2016/united-states [Accessed 23 August 2016].

Garrett, R. K. & Danziger, J. N., 2008. On Cyberslacking: Workplace Status and Personal Internet Use at Work. *CyberPsychology & Behavior,* 11, p. 287–292.

Gartner, 2017. *IT Governance (ITG).* [Online] Available at: https://www.gartner.com/it-glossary/it-governance [Accessed 29 October 2017].

GÉANT Association, 2014. *GÉANT Association Compendium of National Research and Education Networks in Europe.* Amsterdam: GÉANT Association.

GÉANT Limited, 2014. *The Case for NRENs.* [Online] Available at: http://www.casefornrens.org/Pages/Home.aspx [Accessed 23 August 2016].

Gerrard, M., 2010. *IT Governance: Key Initiative Overview.* Stampford: Gartner.

Giles, J., 2016. *King IV Code and IT Governance.* [Online] Available at: https://www.michalsons.com/blog/king-iv-code-and-it-governance/18691 [Accessed 29 October 2017].

Gliem, J. A. & Gliem, R. R., 2003. *Calculating, Interpreting, and Reporting Cronbach's Alpha Reliability Coefficient for Likert-Type Scales.* Columbus, Midwest Research-to-Practice Conference.

Global Internet Cooperation and Governance, 2014. *Towards a Collaborative, Decentralized Internet Governance Ecosystem.* [Online] Available at: http://www.internetsociety.org/sites/default/files/Internet%20Governance%20Report%20iPDF.pdf [Accessed 03 March 2015].

Goldstuck, A., 2012. *Internet Matters: The Quiet Engine of the South African Economy,* Johannesburg: World Wide Worx.

Gravetter, F. J. & Wallnau, L. B., 2009. *Statistics for the Behavioral Sciences.* 8th ed. Belmont: Cengage Learning.

Greaves, D., 2013. *REN Service Agreement.* Cape Town: TENET.

Greaves, D. & Jonathan, R., 2016. *TENET business model* [Interview] (28 September 2016).

Gurstein, M., 2014. The Multistakeholder Model, Neo-liberalism and Global (Internet) Governance. *The Journal of Community Informatics,* 10(2). Available at: http://ci-journal.net/index.php/ciej/article/view/1125 [Accessed 25 March 2017].

Hair, J. F., Celsi, M. W., Money, A. H., Samouel, P. & Page, M. J., 2015. *Essentials of Business Research Methods.* 2nd ed. New York: M.E. Sharpe.

Hargittai, E. & Shafer, S., 2006. Differences in Actual and Perceived Online Skills: The Role of Gender. *Social Science Quarterly,* 87(2), p. 432–448.

Harwell, M. R., 2011. Research Design in Qualitative/Quantitative/Mixed Methods. In: C. F. Conrad & R. C. Serlin (tds), *Research Methods, Statistics, & Evaluation.* 2nd ed. pp. 147-182. Thousand Oaks: SAGE.

Hassan, A., 2005. *Reforming Internet Governance: Perspectives from the Working Group on Internet Governance (WGIG).* New York: The United Nations Information and Communication Technology Task Force.

Hirschey, M., 2009. *Managerial Economics.* 12th ed. Fresno: South-Western Cengage Learning.

Hofstee, E., 2006. *Constructing a Good Dissertation: A Practical Guide to Finishing a Master's, MBA or PhD on Schedule.* Johannesburg: EPE.

Holcombe, R. G., 1997. A Theory of the Theory of Public Goods. *Review of Austrian Economics,10(1)* pp. 1-22.

ICANN Multimedia, 2015. *Three Layers of Digital Governance Infographic (English).* [Online] Available at: https://www.icann.org/news/multimedia/1563 [Accessed 19 March 2017].

ICC's Commission on E-Business, IT and Telecoms, 2004. *Internet Governance.* [Online] Available at: http://www.itu.int/wsis/docs2/wgig/contributions/icc.pdf [Accessed 14 February 2015].

International Organization for Standardization, 2017. *About ISO.* [Online] Available at: http://www.iso.org/iso/home.html [Accessed 25 March 2017].

International Telecommunication Union, 2010. *World Telecommunication/ICT Development Report 2010 Monitoring the WSIS Targets: A Mid-Term Review.,* Geneva: ITU.

International Telecommunication Union, 2013. *Supporting Multi-stakeholderism in Internet Governance.* Geneva, World Telecommunication/ICT Policy Form.

Internet Architecture Board, 2017. *Internet Architecture Board: Description.* [Online] Available at: https://www.iab.org/about/description/ [Accessed 25 March 2017].

Internet Corporation for Assigned Names and Numbers, 2013. *Beginner's Guide to Participating in ICANN.* [Online] Available at: https://www.icann.org/resources/files/participating-2013-11-08-en [Accessed 25 March 2017].

Internet Corporation for Assigned Names and Numbers, 2016a. *Criteria for Establishment of New Regional Internet Registries.* [Online] Available at: https://www.icann.org/resources/pages/new-rirs-criteria-2012-02-25-en [Accessed 25 March 2017].

Internet Corporation for Assigned Names and Numbers, 2016b. *Welcome to ICANN!.* [Online] Available at: https://www.icann.org/resources/pages/welcome-2012-02-25-en [Accessed 25 March 2017].

Internet Engineering Task Force, 2017. *About the IETF.* [Online] Available at: https://www.ietf.org/about/ [Accessed 25 March 2017].

Internet Governance Forum, 2016. *About the Internet Governance Forum.* [Online] Available at: http://www.intgovforum.org/cms/aboutigf [Accessed 25 March 2017].

Internet Research Task Force, 2017. *Internet Research Task Force (IRTF).* [Online] Available at: https://irtf.org/ [Accessed 25 March 2017].

Internet Society, 2017. *The Internet Ecosystem.* Reston: Internet Society.

ISO/IEC 27001, 2015. *Information Technology - Security Techniques - Information Security Management Systems - Requirements.* Geneva: ISO.

ISO/IEC 27002, 2005. *Information Technology - Security Techniques - Code of Practice for Information Security Management,* Geneva: ISO.

ISO/IEC, 2017. *ISO/IEC 27000 Family - Information Security Management Systems.* [Online] Available at: https://www.iso.org/isoiec-27001-information-security.html [Accessed 29 October 2017].

ISOC-ZA, 2017. *Internet Society of South Africa.* [Online] Available at: http://www.isoc.org.za/?page_id=2 [Accessed 29 October 2017].

Jackson, L. A., Ervin, K. S., Gardner, P. D. & Schmitt, N., 2001. Gender and the Internet: Women Communicating and Men Searching. *Sex Roles,* 44(5-6), pp. 363–379.

Janz, R., 2013. *The NREN Business Model.* Rwanda, pp. 69-71. GÉANT Publish.

Johnson, D. R. & Post, D. G., 1996. Law And Borders: The Rise of Law in Cyberspace. *Stanford Law Review,* 48(1367), pp. 1-25.

Jonathan, R., 2017. *TENET Client Base* [Interview] (24 October 2017).

Kalayci, E., 2010. *The Investigation of Relationship Between Cyberloafing and Self-regulated Learning Strategies Among Undergraduate Students*. Hacettepe Üniversitesi.

Kang, C., 2016. *Court Backs Rules Treating Internet as Utility, Not Luxury.* [Online] Available at: https://www.nytimes.com/2016/06/15/technology/net-neutrality-fcc-appeals-court-ruling.html?_r=0 [Accessed 29 May 2017].

Kim, S. & Choi, I., 2005. A Case Study on the Development of Employee Internet Management System. *Computational Science and Its Applications,* 3482, pp. 1229-1238.

King IV, 2016. *King IV: Report of Corporate Governance for South Africa,* Johannesburg: The Institution of Directors in South Africa.

Kleinrock, L., 1961. *Information Flow in Large Communication Nets.* Cambridge: Massachusetts Institute of Technology.

Kowack, G., 1997. *Internet Governance and the Emergence of Global Civil Society*. IEEE Communications Magazine. 35(5), pp. 52-57.

KPMG, 2016. *King IV: Summary Guide,* Johannesburg: KPMG.

Krippendorff, K. H., 2012. *Content Analysis: An Introduction to Its Methodology.* 3rd ed. London: SAGE.

Kumar, R., 2008. *Research Methodology.* New Delhi: APH Publishing Corporation.

Leedy, P. D. & Ormrod, J. E., 2015. *Practical Research: Planning and Design.* 11th ed. New York: Pearson.

Leiner, B. M., Cerf, V. G., Clark, D. D., Kahn, R. E., Kleinrock, L., Lynch, D. C., Postel, J., Roberts, L. G. & Wolff, S., 2012. *Brief History of the Internet.* [Online] Available at: https://www.internetsociety.org/sites/default/files/Brief_History_of_the_Internet.pdf [Accessed 18 March 2017].

Levin, K. A., 2006. Study Design III: Cross-sectional Studies. *Evidence-based Dentistry,* 7(1), pp. 24-25.

Licklider, J. C. R., 2010. *The Intergalactic Computer Network.* [Online] Available at: http://workingtropes.lmc.gatech.edu/wiki/index.php?title=The_Intergalactic_ Computer_Network&redirect=no [Accessed 16 June 2017].

Lim, V. & Chen, D., 2009. *Cyberloafing at the workplace: Gain or drain?, Behaviour and Information Technology.* 31(4), pp. 343-353.

Lund Research Ltd, 2012. *Criterion Validity.* [Online] Available at: http://dissertation.laerd.com/criterion-validity-concurrent-and-predictive-validity.php#first [Accessed 29 July 2015].

Majumdar, A., 2015. *Benefits Of Investing In Collaborative Tools.* [Online] Available at: https://elearningindustry.com/investing-in-collaborative-tools [Accessed 2 September 2016].

Makori, E. O. & Osebe, N. M., 2016. Digital Technology Acceptance in Transformation of University Libraries and Higher Education Institutions in Kenya. *Library Philosophy and Practice,* 1379, pp. 1-20.

Manyika, J. & Roxburgh, C., 2011. *The Great Transformation: The Impact of the Internet on Economic Growth and Prosperity.* San Francisco: McKinsey Global Institute.

Maree, K., Creswell, J. W., Ebersohn, L., Eloff, I., Ferreira, R., Ivankova, N. V., Jansen, J. D., Nieuwenhuis, J., Pietersen, J., Plano Clark, V. L. & van der Westhuizen, C., 2012. *First Steps in Research.* Pretoria: Van Schaik.

Mason, J., 2002. *Qualitative Researching.* 2nd ed. London: SAGE.

Maxwell, J. A., 2013. *Qualitative Research Design: An Interactive Approach.* 3rd ed. London: SAGE.

McGrath, R. G., 2010. Business Models: A Discovery Driven Approach. *Long Range Planning,* 43(2-3), pp. 247–261.

McKinsey Global Institute, 2013. *Disruptive Technologies: Advances that will Transform Life, Business, and the Global Economy,* San Francisco: McKinsey Global Institute.

Mcleod, D., 2016. *SA to enforce net neutrality rules.* [Online] Available at: https://techcentral.co.za/sa-to-enforce-net-neutrality-rules/68925/ [Accessed 13 July 2017].

Meerkerk, G. J., Van den Eijnden, R. J., Franken, I. H. & Garretsen, H. F., 2010. Is Compulsive Internet use Related to Sensitivity to Reward and Punishment, and Impulsivity? *Computers in Human Behavior,* 26(4), pp. 729–735.

Microsoft, 2014. *What is a Firewall?* [Online] Available at: https://www.microsoft.com/security/pc-security/firewalls-whatis.aspx [Accessed 26 July 2015].

Milligan, C. & Littlejohn, A., 2016. How Health Professionals Regulate Their Learning in Massive Open Online Courses. *Internet and Higher Education,* 31, pp. 113-121.

Miniwatts Marketing Group, 2017. *Internet Users Statistics for Africa.* [Online] Available at: http://www.internetworldstats.com/stats.htm [Accessed 19 March 2016].

Monsen, E. R. & Van Horn, L., 2008. *Research: Successful Approaches.* 3rd ed. Washington DC: Diana Faulhaber.

Mooi, R. & Botha, R. A., 2016. *Context for the SA NREN Computer Security Incident Response Team.* Durban: International Information Management Corporation.

Morgan, G. & Smircich, L., 1980. The Case for Qualitative Research. *Academy of Management Review,* 5(4), pp. 491-500.

Motulsky, H., 2014. *Intuitive Biostatistics: A Nonmathematical Guide to Statistical Thinking.* 3rd ed. New York: Oxford University Press.

Moyo, A., 2014. *Calls for SA Internet Governance Forum.* [Online] Available at: http://www.itweb.co.za/index.php?option=com_content&view=article&id=138794 [Accessed 29 October 2017].

NIST 800-16, 1998. *Information Technology Security Training Requirements: A Role- and Performance-Based ModeL.* Gaithersburg: National Institute of Standards.

Nonnecke, B., 2016. The Transformative Effects of Multistakeholderism in Internet Governance: A Case Study of the East Africa Internet Governance Forum. *Telecommunications Policy.* 40(4), pp. 343-352.

Nunnally, J. C., 1978. *Psychometric Theory.* 2nd ed. New York: McGraw-Hill.

O'Neill, T. A., Hambley, L. A. & Chatellier, G., 2014. Cyberslacking, Engagement, and Personality in Distributed Work Environments. *Computers in Human Behavior,* 40, pp. 152–160.

Olsson, U., 2016. Open Courses and MOOCs as Professional Development – Is the Openness a Hindrance? *Education + Training,* 2(58), pp. 229-243.

Osterwalder, A. & Pigneur, Y., 2010. *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers.* New York: Wiley.

Oxford Dictionaries, 2016. *Oxford Dictionaries Language Matters.* [Online] Available at: http://www.oxforddictionaries.com/definition/english/middleware [Accessed 28 August 2016].

Pabarskaite, Z. & Raudys, A., 2007. A Process of Knowledge Discovery from Web Log Data: Systematization and Critical Review. *Journal of Intelligent Information Systems,* 28(1), pp. 79-104.

Paulas, R., 2017. *Why American Internet should be a Public Utility.* [Online] Available at: https://psmag.com/news/why-american-internet-should-be-a-public-utility [Accessed 29 May 2017].

Pavan, E., Senges, M. & Komaitis, K., 2009. Towards a Humanistic Conception of Cyberspace. A Twofold Challenge for Netizens Mobilizing for a Democratic Internet Governance. *Economics and Applied Informatics.* 1, pp. 169-182.

Persson, J. & Wallin, A., 2012. *Why Internal Validity is not Prior to External Validity.* Geneva, PSA.

Pilane, P., 2016. *Three Reasons Why #FeesMustFall Protests will Continue.* [Online] Available at: http://mg.co.za/article/2016-01-13-three-reasons-why-feesmustfall-protests-will-continue [Accessed 01 April 2016].

Pramuk, J., 2015. *FCC Votes to Classify Internet as a Public Utility.* [Online] Available at: http://www.cnbc.com/2015/02/26/fcc-votes-to-classify-the-internet-as-a-public-utility.html [Accessed 29 May 2017].

PRINCE2, 2017. *What is PRINCE2.* [Online] Available at: https://www.prince2.com/zar/what-is-prince2 [Accessed 29 October 2017].

PwC, 2017. *King IV - Steering point.* [Online] Available at: https://www.pwc.co.za/en/publications/king4.html [Accessed 29 October 2017].

QuestionPro, 2017. *QuestionPro Survey Software.* [Online] Available at: https://www.questionpro.com/ [Accessed 2 October 2017].

Quinones, C., Griffiths, M. D. & Kakabadse, N. K., 2016. Compulsive Internet Use and Workaholism: An Exploratory Two-Wave Longitudinal Study. *Computers in Human Behavior,* 60, pp. 492-499.

Raymond, M. & Gordon, S., 2013. *Reimaging the Internet: The Need for a High-level Strategic Vision for Internet Governance.* Ontario: The Centre for International Governance Innovation.

Razmerita, L., 2013. *Collaboration Using Social Media: The Case of Podio in a Voluntary Organization.* Wellington: Springer.

Robinson, M. T., 2017. *The Generations: Which Generation are You?* [Online] Available at: https://www.careerplanner.com/Career-Articles/Generations.cfm [Accessed 29 October 2017].

Rubin, A., 2013. *Statistics for Evidence-Based Practice and Evaluation.* 3rd ed. Belmont: Cengage Learning.

Sambuli, N., 2016. *Why the Internet should be seen as a public good.* [Online] Available at: http://www.nation.co.ke/oped/blogs/620-3408884-tduroh/ [Accessed 14 October 2017].

Sanou, B., 2016. *ICT Facts and Figures,* ITU. Available at: https://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2017.pdf [Accessed 14 October 2017].

SANReN, 2017. *South African National Research Network.* [Online] Available at: http://www.sanren.ac.za/backbone/ [Accessed 14 October 2017].

SANS Institute, 2013. *Internet Usage Policy,* SANS. Available at: https://www.sans.org/security-resources/policies/retired/pdf/internet-usage-policy [Accessed 14 October 2017].

Saunders, M., Lewis, P. & Thornhill, A., 2012. *Research Methods for Business Students.* 6th ed. Harrow: Pearson.

Saunders, M. & Tosey, P., 2013. *The Layers of Research Design.* pp. 58-59. Rapport: Winter

Savage, J. E. & McConnell, B. W., 2014. Exploring Multi-Stakeholder Internet Governance. *Cybersummit,* pp. 48-60. New York: East West Institute.

Sekaran, U. & Bougie, R. J., 2016. *Research Methods For Business: A Skill Building Approach.* 7th ed. Chichester: Wiley.

Senges, M. & Horner, L., 2009. *Values, Principles and Rights in Internet Governance,* Mountain View: The Freedom of Expression Project.

Shackelford, S. & Craig, A., 2014. Beyond the New 'Digital Divide': Analyzing the Evolving Role of National Governments in Internet Governance and Enhancing Cybersecurity. *Stanford Journal of International Law,* 50, pp. 119-183.

Shafer, S. M., Smith, H. J. & Linder, J. C., 2005. The Power of Business Models. *Business Horizons,* 48, pp. 199-207.

Shah, D., 2009. *Reliability and Validity.* [Online] Available at: http://www.journalism. wisc.edu/~dshah/J658/Reliability%20and%20Validity.pdf [Accessed 17 July 2015].

Shier, R., 2004. *Statistics: Paired t-tests.* [Online] Available at: http://www.statstutor.ac.uk/resources/uploaded/paired-t-test.pdf [Accessed 29 July 2015].

Shukla, S., Agarwal, S. & Shukla, A., 2012. Trends in Cloud-ERP for SMB's: A Review. *International Journal of New Innovations in Engineering and Technology.* 1(1), pp. 7-11.

Shuttleworth, M., 2009. *Definition of Reliability.* [Online] Available at: https://explorable.com/definition-of-reliability [Accessed 15 July 2015].

Solum, L. B., 2008. Models of Internet Governance. *Social Science Research Network,* 7(25), pp. 48-91.

Sonnentag, S., 2003. Recovery, Work Engagement, and Proactive Behavior: A New Look at the Interface Between Nonwork and Work. *Journal of Applied Psychology.* 83(3), pp. 518.

Staff Monitoring Solutions, 2015. *Office Slacker Stats.* [Online] Available at: http://www.staffmonitoring.com/P32/stats.htm [Accessed 15 February 2015].

Stanton, J. M., 2002. Company Profile of the Frequent Internet User. *Communications of the ACM.* 45, pp. 55–59.

Staphorst, L., 2016. *SANReN Business Mode* [Interview] (30 June 2016).

Stauffacher, D. & Kleinwächter, W., 2005. *The World Summit on the Information Society: Moving from the Past Into the Future.* New York: United Nations Publications.

Swinehart, T., 2007. *WSIS and Internet Governance.* [Online] Available at: https://www.icann.org/en/system/files/files/ig-aptld-05jun07-en.pdf [Accessed 14 February 2015].

TechTarget, 2016. *WhatIs.com.* [Online] Available at: http://whatis.techtarget.com/definition/ collaboration [Accessed 02 September 2016].

Teece, D. J., 2010. Business Models, Business Strategy, and Innovation. *Long Range Planning.* 43, pp. 172–194.

Tekeni, L., Thomson , K.-L. & Botha, R. A., 2014. *Concerns Regarding Service Authorization by IP Address Using eduroam.* Johannesburg: IEEE.

TENET, 2012. *Connection Policy.* Cape Town: TENET.

TENET, 2017. *Tertiary Education and Research Network of South Africa.* [Online] Available at: http://www.tenet.ac.za/ [Accessed 24 August 2017].

Thanasegaran, G., 2009. *Reliability and Validity Issues in Research.* Selangor: Universiti Putra Malaysia.

The Internet Society, 2017. *What We Do.* [Online] Available at: http://www.internetsociety.org/what-we-do [Accessed 25 March 2017].

The National Computing Centre, 2007. *IT Governance: Developing a Successful Governance Strategy,* Manchester: The National Computing Centre.

Trinkunas, H. & Wallace, I., 2015. *Converging on the Future of Global Internet Governance.* Washington DC: The Brookings Institute.

Trochim, W. M., 2006. *Deduction & Induction.* [Online] Available at: http://www.socialresearchmethods.net/kb/dedind.php [Accessed 13 July 2015].

UbuntuNet Alliance, 2016. *UbuntuNet Alliance: About Us.* [Online] Available at: https://www.ubuntunet.net/about [Accessed 10 October 2016].

Ugrin, J. C. & Pearson, M. J. J., 2013. The Effects of Sanctions and Stigmas on Cyberloafing. *Computers in Human Behavior.* 29(3), pp. 812–820.

UK Essays, 2015. *Characterizing Positivism Interpretivism and Realism Approaches Psychology Essay.* [Online] Available at: http://www.ukessays.com/essays/psychology/characterizing-positivism-interpretivism-and-realism-approaches-psychology-essay.php [Accessed 30 April 2017].

USA Today, 2014. *Top 10 Internet-Censored Countries.* [Online] Available at: http://www.usatoday.com/story/news/world/2014/02/05/top-ten-internet-censors/5222385/ [Accessed 20 March 2017].

Van Zyl, G., 2016. *Data Prices: How SA Compares to the Rest of the World.* [Online] Available at: http://www.fin24.com/Tech/Multimedia/data-prices-how-sa-compares-to-the-rest-of-the-world-20160930 [Accessed 25 August 2017].

Venter, R., 2016. *#FeesMustFall and the SA Economy.* Johannesburg: Focal Point.

Veretennikova, N., Pasichnyk, V., Kunanets, N. & Gats, B., 2015. *E-Science: New Paradigms, System Integration and Scientific Research Organization.* Ukriane: IEEE.

Verhulst, S. G., Noveck, B. S., Raines, J. & Declercq, A., 2014. *Innovations in Global Governance: Toward a Distributed Internet Governance Ecosystem.* London: Centre for International Governance Innovation and Chatham House.

Villalón, S. L. J. & Hermosa, C. C. L., 2016. The Role of National Research and Education Networks Providing Connectivity and Advanced Network Services to Virtual Communities in Collaborative R&E Projects. CUDI: The Mexican Case. *Communications in Computer and Information Science,* 595, pp. 24-47.

Vitak, J., Crouse, J. & LaRose, R., 2011. Personal Internet Use at Work: Understanding Cyberslacking. *Computers in Human Behavior,* 27, pp. 1751–1759.

Vuletić, P. & Sevasti, A., 2010. *A Network Management Architecture Proposal for the GÉANT-NREN Environment.* Vilnius: GÉANT.

W3C, 2017. *About W3C.* [Online] Available at: http://www.w3.org/Consortium/ [Accessed 25 March 2017].

Warner, R. M., 2013. *Applied Statistics: From Bivariate Through Multivariate Techniques.* 2nd ed. Los Angeles: SAGE.

Weber, R. H., 2015. *Principles for Governing the Internet.* [Online] Available at: http://unesdoc.unesco.org/images/0023/002344/234435e.pdf [Accessed 29 October 2017].

Wegner, T., 2012. *Applied Business Statistics: Methods and Excel-based Applications.* 3rd ed. Cape Town: JUTA.

Weis, A. H., 2010. Commercialization of the Internet. *Internet Research,* 20(4), pp. 420-435.

Weiser, E. B., 2000. Gender Differences in Internet Use Patterns and Internet Application Preferences: A Two-Sample Comparison. *CyberPsychology and Behavior,* 3(2), pp. 167–178.

Weisman, R., 2012. *An Overview of TOGAF Version 9.1.* [Online] Available at: http://www.opengroup.org/public/member/proceedings/q312/togaf_intro_weisman.pdf [Accessed 29 October 2017].

White, S. K. & Greiner, L., 2017. *What is ITIL? IT Infrastructure Library Definitions and Solutions.* [Online] Available at: https://www.cio.com/article/2439501/itil/infrastructure-it-infrastructure-library-itil-definition-and-solutions.html [Accessed 29 October 2017].

Williams, L. C., 2016. *Court Rules Internet is a Utility, Upholds Net Neutrality Rules.* [Online] Available at: https://thinkprogress.org/court-rules-internet-is-a-utility-upholds-net-neutrality-rules-c904ebe667c5 [Accessed 29 May 2017].

Wirtz, B. W., Pistoia, A., Ullrich, S. & Gottel, V., 2016. Business Models: Origin, Development and Future Research Perspectives. *Long Range Planning,* 49, pp. 36-54.

World Economic Forum, 2016. *South Africa Networked Readiness Index.* [Online] Available at: http://reports.weforum.org/global-information-technology-report-2015/economies/# economy= ZAF [Accessed 19 March 2016].

World Economic Forum, 2017. *The Global Risks Report.* Geneva: World Economic Forum.

Wright, C., 2012. *About SANReN.* Johannesburg: SANReN.

WSIS, 2005. *Tunis Agenda for the Information Society.* [Online] Available at: http://www.itu.int/wsis/docs2/tunis/off/6rev1.html [Accessed 14 February 2015].

WSIS, 2015. *Outcome Document of the High-Level Meeting of the General Assembly on the Overall Review of the Implementation of the Outcomes of the World Summit on the Information Society.* New York: United Nations General Assembly.

Xing, W., 2011. *Governments' Involvement in Internet Governance: A Literature Review.* London, IEEE.

Yaşar, S. & Yurdugül, H., 2013. The Investigation of Relation Between Cyberloafing Activities and Cyberloafing Behaviors In Higher Education. *Procedia - Social and Behavioral Sciences,* 83, pp. 600-604.

Yılmaz, F. G. K., Yılmaz, R., Öztürk, H. T., Sezer, B. & Karademir, T. 2015. Cyberloafing as a Barrier to the Successful Integration of Information and Communication Technologies into Teaching and Learning Environments. *Computers in Human Behavior,* 45, pp. 290–298.

Yılmaz, K., 2013. Comparison of Quantitative and Qualitative Research Traditions: Epistemological, Theoretical, and Methodological Differences. *European Journal of Education,* 48(2), pp. 311-325.

Yin, R. K., 2011. *Case Study Research: Design and Methods.* 3rd ed. London: SAGE.

Young, K., 2010. Policies and procedures to manage employee Internet abuse. *Computers in Human Behavior,* 26, pp. 1467-1471.

Appendix A – Research Alignment Plan

Title: An adaptive Internet Management Model for Higher Education Institutions in South Africa.

Research Problem: South African Higher Education Institutions have limited expertise, knowledge and guidance at their disposal to manage the Internet resources in their educational environment. Limited and costly Internet resources are generally misused by users (staff and students) for non-academic purposes.

Thesis Statement: An adaptive Internet Management Model will ensure the effective management of Internet ICT resources at Higher Education Institutions in South Africa.

Main Research Objective: To develop an adaptive Internet Management Model for the effective management of the Internet ICT resources at Higher Education Institutions in South Africa.

Main Research Question (RQ_M): What are the components of an adaptive Internet Management Model that will ensure the effective management of the Internet ICT resources at Higher Education Institutions in South Africa?

Secondary Research Questions		Research Objectives	Chapters	Deliverables
RQ_1	What national and international governance structures are available that influence the management of the Internet?	Identify the national and international governance structures that influence the management of the Internet.	Chapter 2 – **INTERNET GOVERNANCE PRACTICES** (Literature Study)	**Identified Governance Structures**
RQ_2	What is the current business model canvas for NREN, SANReN and TENET?	Develop and evaluate the business model canvas for NREN, SANReN and TENET.	Chapter 3 – **INTERNET RESOURCES MANAGEMENT** (Literature Study)	**Business model canvas for NREN, SANReN and TENET**
RQ_3	What research methodology can be used for this study?	Identify the research methodology to be applied in this research study.	Chapter 4 – **RESEARCH DESIGN AND METHODOLOGY** (Literature Study)	**Identified research methodology**
RQ_4	What are the current Internet Management practices at Higher	Conduct an empirical evaluation of Internet Management practices	Chapter 5 –	**Identified HEI Internet Management Practices**

	Education Institutions in South Africa?	at Higher Education Institutions in South Africa.	**RESULTS AND ANALYSIS OF THE HEI INTERNET MANAGEMENT SURVEY** (Literature Study)	
RQ₅	What are the national best practices adopted for Internet management at South African Higher Education Institutions?	Identify the national best practices adopted for Internet management at South African Higher Education Institutions.	Chapter 5 – **RESULTS AND ANALYSIS OF THE HEI INTERNET MANAGEMENT SURVEY** (Literature Study)	**Identified Internet management Best Practice**
RQ₆	What are the staff and students within Nelson Mandela University using the Internet for?	Conduct an evaluation of the staff and students' Internet usage at Nelson Mandela University.	Chapter 6 – **RESULTS AND ANALYSIS OF THE NMUIUS AND NELSON MANDELA UNIVERSITY FIREWALL LOG FILES** (Empirical Study)	**Comprehensive analysis of the collected empirical data.**
RQ₇	What are the staff and students within Nelson Mandela University using the Internet for, according to the Firewall log files?	Conduct an evaluation of the staff and students' Internet usage as recorded in the Nelson Mandela University Firewall Log files.	Chapter 6 – **RESULTS AND ANALYSIS OF THE NMUIUS AND NELSON MANDELA UNIVERSITY FIREWALL LOG FILES** (Empirical Study)	**Comprehensive analysis of the collected empirical data.**

RQ_M	What are the components of an adaptive Internet Management Model that will ensure the effective management of the Internet ICT resources at Higher Education Institutions in South Africa?	RO_M	Chapter 7 - **CONCLUSIONS, RECOMMENDATIONS AND FUTURE RESEARCH**	**Result**

Appendix B – Ethical Clearance Form E with Resolution Number

• PO Box 77000 • Nelson Mandela Metropolitan University
• Port Elizabeth • 6031 • South Africa • www.nmmu.ac.za

Chairperson: Research Ethics Committee (Human)
Tel: +27 (0)41 504-2235

Ref: [H16-BES-BUS-015/Approval]

Contact person: Mrs U Spies

15 August 2016

Prof A Calitz
Faculty: Science
South Campus

Dear Prof Calitz

AN ADAPTIVE INTERNET MANAGEMENT MODEL FOR HIGHER EDUCATION INSTITUTIONS IN SOUTH AFRICA

PRP: Prof A Calitz
PI: Mr R Boshoff

Your above-entitled application served at Research Ethics Committee (Human) for approval.

The ethics clearance reference number is **H16-BES-BUS-015** and is valid for three years. Please inform the REC-H, via your faculty representative, if any changes (particularly in the methodology) occur during this time. An annual affirmation to the effect that the protocols in use are still those for which approval was granted, will be required from you. You will be reminded timeously of this responsibility, and will receive the necessary documentation well in advance of any deadline.

We wish you well with the project. Please inform your co-investigators of the outcome, and convey our best wishes.

Yours sincerely

Prof C Cilliers
Chairperson: Research Ethics Committee (Human)

cc: Department of Research Capacity Development
        Faculty Officer: BES

Appendix C – Approval Letter from Nelson Mandela University DVC: Research and Engagement

Nelson Mandela Metropolitan University

for tomorrow

Office of DVC: Research & Engagement
Room 1706, Main Building
NMMU South Campus
Tel. +27 (0)41 504 2016/7 Fax. +27 (0)41 504 9591
Andrew.leitch@nmmu.ac.za

01 September 2016

(Institutional permission for conducting research)
H16-BES-BUS-015

Dear Mr R Boshoff

TITLE: AN ADAPTIVE INTERNET MANAGEMENT MODEL FOR HIGHER EDUCATION INSTITUTIONS IN SOUTH AFRICA

I **Professor Andrew Leitch, DVC: Research and Engagement** grant permission for the above mentioned study and will act in the capacity as gatekeeper for this institutional study.

SIGNATURE:

DATE: 01 September 2016

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Appendix D – HEIIMS

South African Higher Education Institution (HEI) Internet Management Survey

Thank you for taking the time to complete this survey. Your input will greatly assist the researcher to determine the current standard Internet Management Business Model at South African Universities. The expected time to complete the survey is 30 minutes.

Section 1 - 2 will capture your biographical information and the University's information whilst Section 3 will record your stance on ICT Governance. Section 4 - 12 follows the Business Model Canvas format. The purpose of the Business Model Canvas is to describe and communicate a for-profit or non-profit project and how it can be implemented. The Business Model Canvas therefore provides readers with an immediate visual portrait of the model. You are requested to keep you answers summarised (precise and to the point).

The Section 1: Biographical Information as well as name of University will be kept confidential and will not be shared with any other party. The information will only be used for authentication purposes and to communicate with you if needed e.g. you request a copy of the final results. The supporting university information will be used to determine if there is a correlation between the allocated size of the university, ICT Governance stance and the various adopted business model segments. The completion and submission of the survey constitutes consent for the data (excluding Section 1: Biographical Information and question 2.1: Name of University) to be used in the study as well as made available to other Universities who request access to the findings.

Once completed, please return the survey to me, Mr Ryno Boshoff, at the April 2017 ASAUDIT meeting and collect your 'thank you' gift. Alternatively, you may email the completed survey to ryno.boshoff@Mandela.ac.za.

REC-H Reference Number: H16-BES-BUS-015.

Thanking you in advance!

Section 1: Biographical Information

The Biographical Information section defines the participant's personal identifiable information. This information will only to use to validate the status of the participant.

1.1	Title	☐ Mr ☐ Ms ☐ Mrs ☐ Miss ☐ Dr ☐ Prof
1.2	Name and Surname	Type Name and Surname here
1.3	Email Address	Type Email Address here
1.4	Job Title	Type Job Title here
1.4	Faculty/Department	Type Faculty/Department here
1.6	Duration in this position?	Type Duration in this position here

1.7	Would you like to receive feedback on the findings of the survey?	☐ Yes | ☐ No
1.8	Would you like to receive feedback on the findings of the study titled 'An adaptive Internet Management Model for Higher Education Institutions in South Africa'?	☐ Yes | ☐ No

Section 2: General University Information

The General University Information section defines the University's personal identifiable information.

2.1	Name of University	Type Name of University here
2.2	Number of Registered Students	Type Number of Students here number of registered students
2.3	Is there a differentiation made between your full time and part time students regarding assigned Internet management resources?	☐ Yes | ☐ No
2.4	Is there a differentiation made between your undergraduate and postgraduate students regarding assigned Internet management resources?	☐ Yes | ☐ No
2.5	Number of Academic Staff	Type Number Academic Staff here number of academic staff
2.6	Do you differentiate between permanent and contract academic staff regarding assigned Internet management resources?	☐ Yes | ☐ No
2.7	Number of Administrative Staff	Type Number of Admin Staff here number of admin staff
2.8	Do you differentiate between permanent and contract administrative staff regarding assigned Internet management resources?	☐ Yes | ☐ No
2.9	Do you differentiate between academic and administrative staff regarding assigned Internet management resources?	☐ Yes | ☐ No

Section 3: ICT Governance

The ICT Governance section defines how the University align the ICT strategy with the institutional strategy to ensure the effective and efficient use of ICT in enabling the HEI to achieve its goals.

3.1	The ICT strategy is aligned with your Institutional strategy.	Strongly Disagree $\leftrightarrow$ Strongly Agree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
3.2	The Internet business model is aligned with the ICT strategy.	Strongly Disagree $\leftrightarrow$ Strongly Agree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
3.3	How often do you measure the performance of your Internet resources to ensure you are still moving towards meeting the overall objectives? Select the most appropriate answer.	☐ Never ☐ Continuously ☐ Monthly ☐ Quarterly ☐ Biannually ☐ Annually ☐ Biennially ☐ When there is a requirement (internal or external) ☐ Other *If Other, Type the Review Period here*
3.4	How often do you review/re-align your Internet business model (or Internet resources) to ensure they are still relevant? Select the most appropriate answer.	☐ Never ☐ Continuously ☐ Monthly ☐ Quarterly ☐ Biannually ☐ Annually ☐ Biennially ☐ When there is a requirement (internal or external) ☐ Other *If Other, Type the Review Period here*

Section 4: Customer Segments

The Customer (Internet users) Segments define the different groups of people who will be utilising the Higher Education Institution (HEI)'s Internet.

4.1	What is your HEI Internet users segment strategy? Select the most appropriate answer.	Mass market	☐
		Niche market	☐
		Segmented	☐

		Diversified	☐
		Multi-sided platform (or multi-sided markets)	☐
4.2	Who are your HEI Internet users? Select all that apply.	Academic Staff	☐
		Administrative Staff	☐
		Students	☐
		Contractors	☐
		Visitors	☐
		On Campus Residence	☐
		Other	☐

4.3	What influences your Internet users most? Select all that apply per customer group.	**Staff**	**Students**
	Cultural Factors:	☐ Culture and societal environment ☐ Sub-cultures ☐ Social classes ☐ Cultural trends	☐ Culture and societal environment ☐ Sub-cultures ☐ Social classes ☐ Cultural trends
	Social Factors:	☐ Reference groups and membership groups ☐ Family ☐ Social roles and status	☐ Reference groups and membership groups ☐ Family ☐ Social roles and status
	Personal Factors:	☐ Age and way of life ☐ Purchasing power and revenue ☐ Lifestyle ☐ Personality and self-concept	☐ Age and way of life ☐ Purchasing power and revenue ☐ Lifestyle ☐ Personality and self-concept
	Psychological Factors:	☐ Motivation ☐ Perception ☐ Learning ☐ Beliefs and attitudes	☐ Motivation ☐ Perception ☐ Learning ☐ Beliefs and attitudes

4.4		**Staff**	**Students**

What are your Internet users most important Internet usage habits? Select the top 5 answers that apply per customer group.	☐ Business emails ☐ Personal emails ☐ Research ☐ Web-based applications ☐ Education ☐ Business ☐ Search engines and portals ☐ Secure websites ☐ News and media ☐ Social networking ☐ Finance and Banking ☐ Instant messaging ☐ Entertainment ☐ Other	☐ Business emails ☐ Personal emails ☐ Research ☐ Web-based applications ☐ Education ☐ Business ☐ Search engines and portals ☐ Secure websites ☐ News and media ☐ Social networking ☐ Finance and Banking ☐ Instant messaging ☐ Entertainment ☐ Other	

Section 5: Value Proposition (what makes us different)

The Value Proposition section describes the bundle of Internet-related products and services that create value for each specific Internet user segment.

		Staff	Students
5.1	What Core Internet values does your HEI aim to deliver to its Internet users? Select the top 2 answers that apply per customer group.	☐ Privacy ☐ Security ☐ Trust ☐ Freedom of Expression ☐ Other	☐ Privacy ☐ Security ☐ Trust ☐ Freedom of Expression ☐ Other
5.2	Which Internet users' problems are the HEI helping to solve? Select the top 5 answers that apply per customer group.	☐ Slow connection ☐ Unavailability of connection ☐ Inconsistent connection ☐ Unreliability connection ☐ Not Trustworthy ☐ Expensive connection ☐ Lack of Privacy ☐ Unsafe and unsecure connection ☐ Unregulated connection ☐ Other	☐ Slow connection ☐ Unavailability of connection ☐ Inconsistent connection ☐ Unreliability connection ☐ Not Trustworthy ☐ Expensive connection ☐ Lack of Privacy ☐ Unsafe and unsecure connection ☐ Unregulated connection ☐ Other

5.3	Which Internet users' needs are the HEI satisfying?	**Staff**	**Students**
	Select the top 5 answers that apply per customer group.	☐ Slow connection ☐ Unavailability of connection ☐ Inconsistent connection ☐ Unreliability connection ☐ Not Trustworthy ☐ Expensive connection ☐ Lack of Privacy ☐ Unsafe and unsecure connection ☐ Unregulated connection ☐ Other	☐ Slow connection ☐ Unavailability of connection ☐ Inconsistent connection ☐ Unreliability connection ☐ Not Trustworthy ☐ Expensive connection ☐ Lack of Privacy ☐ Unsafe and unsecure connection ☐ Unregulated connection ☐ Other
5.4	What bundles of Internet-related products and services is your HEI offering to each Internet user segment?	**Staff**	**Students**
	Select the top 5 answers that apply per customer group.	☐ Speed ☐ Availability (connectivity) ☐ Consistency ☐ Reliability ☐ Trusted ☐ Price ☐ Anonymity (Privacy) ☐ Safe and Secure ☐ Other	☐ Speed ☐ Availability (connectivity) ☐ Consistency ☐ Reliability ☐ Trusted ☐ Price ☐ Anonymity (Privacy) ☐ Safe and Secure ☐ Other

Section 6: Distribution Channel

The Channels section describes how a company communicates with and reaches its Internet user segments to deliver a Value Proposition.

6.1	How does your HEI deliver a Value Proposition to Internet users? Though: Select the most appropriate answer.	Physical	☐
		Intellectual	☐
		Human	☐
		Financial	☐
6.2	How does your HEI raise awareness about your HEI Internet products and services?	**Staff**	**Students**
	Select the top 5 answers that apply per customer group.	☐ Email ☐ Intranet ☐ Posters/Banners ☐ Newsletters/Magazines	☐ Email ☐ Intranet ☐ Posters/Banners ☐ Newsletters/Magazines

		Staff	Students
		☐ Network Message (Computer Popup Message) ☐ Events ☐ Inductions ☐ Video Messages ☐ Social Media ☐ Public Address Systems ☐ Voicemail ☐ Text Messages ☐ Web Casts ☐ Other	☐ Network Message (Computer Popup Message) ☐ Events ☐ Inductions ☐ Video Messages ☐ Social Media ☐ Public Address Systems ☐ Voicemail ☐ Text Messages ☐ Web Casts ☐ Other
6.3	How does your HEI allow the Internet users to purchase the Internet products and services? Select all that apply per customer group..	**Staff**	**Students**
		☐ Cash ☐ Credit Cards ☐ Debit Cards ☐ Bank Transfer ☐ Online Banking ☐ Mobile Payments ☐ Internal Cost Centre Payments ☐ Prepaid ☐ Other	☐ Cash ☐ Credit Cards ☐ Debit Cards ☐ Bank Transfer ☐ Online Banking ☐ Mobile Payments ☐ Internal Cost Centre Payments ☐ Prepaid ☐ Other
6.4	How does your HEI provide Internet user support? Select all that apply per customer group.	**Staff**	**Students**
		☐ Phone ☐ Email ☐ Web Self-Service ☐ Automated Phone System ☐ Letter via Mail ☐ Web Chat ☐ Online Phone Call ☐ Social Media ☐ Other	☐ Phone ☐ Email ☐ Web Self-Service ☐ Automated Phone System ☐ Letter via Mail ☐ Web Chat ☐ Online Phone Call ☐ Social Media ☐ Other

Section 7: Customer Relationships

The Customer Relationships section describes the types of relationships a company establishes with specific Internet user segments.

7.1		Staff	Students

		Staff	Students
	What type of relationship does each of your Internet users <u>expect</u> your HEI to establish and maintain with them? Select all that apply per customer group.	☐ Personal Assistance ☐ Dedicated Personal Assistance ☐ Self-Service ☐ Automated Services ☐ Communities ☐ Co-creation ☐ Other	☐ Personal Assistance ☐ Dedicated Personal Assistance ☐ Self-Service ☐ Automated Services ☐ Communities ☐ Co-creation ☐ Other
7.2	What type of relationship has your HEI established? (currently implemented). Select all that apply per customer group.	**Staff** ☐ Personal Assistance ☐ Dedicated Personal Assistance ☐ Self-Service ☐ Automated Services ☐ Communities ☐ Co-creation	**Students** ☐ Personal Assistance ☐ Dedicated Personal Assistance ☐ Self-Service ☐ Automated Services ☐ Communities ☐ Co-creation
7.3	How is the relationship integrated with the rest of your Internet management business model? Select the most appropriate answer per customer group.	**Staff** ☐ To a Great Extent ☐ Somewhat ☐ Very Little ☐ Not at All	**Students** ☐ To a Great Extent ☐ Somewhat ☐ Very Little ☐ Not at All
7.4	How costly are the relationship to manage? Select the most appropriate answer per customer group.	**Staff** ☐ Extremely Inexpensive ☐ Somewhat Inexpensive ☐ Affordable/Neutral ☐ Somewhat Expensive ☐ Extremely Expensive	**Students** ☐ Extremely Inexpensive ☐ Somewhat Inexpensive ☐ Affordable/Neutral ☐ Somewhat Expensive ☐ Extremely Expensive

Section 8: Revenue Sources/Streams

The Revenue Sources/Streams section represent the cash an institution generates from each Internet user segment.

| 8.1 | What are the different types of Internet revenue sources?

Select all that apply per customer group. | **Staff**

☐ Asset Sale
☐ Usage Fee
☐ Subscription Fees
☐ Lending/Renting/Leasing
☐ Licensing | **Students**

☐ Asset Sale
☐ Usage Fee
☐ Subscription Fees
☐ Lending/Renting/Leasing
☐ Licensing |

		Staff	Students
		☐ Brokerage Fees ☐ Advertising ☐ Pricing Mechanisms ☐ Council Funds	☐ Brokerage Fees ☐ Advertising ☐ Pricing Mechanisms ☐ Council Funds
8.2	What is the current pricing model(s) for each of your Internet user segments?	**Staff**	**Students**
	During Working Hours	R Price per Unit	R Price per Unit
	During Non-Working Hours	R Price per Unit	R Price per Unit
8.3	How much are your Internet users willing to pay?	**Staff**	**Students**
	During Working Hours	R Price per Unit	R Price per Unit
	During Non-Working Hours	R Price per Unit	R Price per Unit
8.4	How much does each Revenue Stream contribute to overall Internet revenues? Select the most appropriate answer per customer group.	**Staff**	**Students**
		☐ 0% ☐ 1% - 19% ☐ 20% - 39% ☐ 40% - 59% ☐ 60% - 79% ☐ 80% - 99% ☐ 100%	☐ 0% ☐ 1% - 19% ☐ 20% - 39% ☐ 40% - 59% ☐ 60% - 79% ☐ 80% - 99% ☐ 100%

Section 9: Key Activities

The Key Activities section describes the most important things the HEI must do to make its Internet Management Business Model work.

9.1	What are the critical characteristics of your HEI's Internet? Select the most appropriate answer.	Speed Reliability Scalability Security	☐ ☐ ☐ ☐
9.2	What Key Activities do your Value Propositions require? Minimum 2 Key Activities required. **GUIDELINE**: Refer to your answer in 5.1. Then think about what activities	Key Activity 1 Key Activity 2 Key Activity 3 Key Activity 4	

	you must implement or execute to achieve these set Value Propositions.	Key Activity 5
9.3	What Key Activities does your Distribution Channel require? Minimum 2 Key Activities required. **GUIDELINE**: Refer to your answer in 6.1. Then think about what activities you must implement or execute to achieve these set Distribution Channel.	Key Activity 1 Key Activity 2 Key Activity 3 Key Activity 4 Key Activity 5
9.4	What Key Activities does your Customer Relationships require? Minimum 2 Key Activities required. **GUIDELINE**: Refer to your answer in 7.1. Then think about what activities you must implement or execute to achieve these set Customer Relationships.	Key Activity 1 Key Activity 2 Key Activity 3 Key Activity 4 Key Activity 5
9.5	What Key Activities does your Revenue streams require? Minimum 2 Key Activities required. **GUIDELINE**: Refer to your answer in 8.1. Then think about what activities you must implement or execute to achieve these set Revenue Sources/Streams.	Key Activity 1 Key Activity 2 Key Activity 3 Key Activity 4 Key Activity 5
9.6	Which activities should your HEI keep doing occasionally to keep in touch with reality? Minimum 2 Key Activities required.	Key Activity 1 Key Activity 2 Key Activity 3 Key Activity 4 Key Activity 5

Section 10: Key Resources

The Key Resources section describes the most important assets required to make a business model work.

10.1	What are your critical HEI's Internet resources? Select the most appropriate answer.	Physical	☐
		Intellectual	☐
		Human	☐
		Financial	☐

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10.2	How does your HEI commonly address Internet-related risks? Select all that apply.	Avoidance	☐
		Risk Control	☐
		Risk Transfer	☐
		Loss Reduction	☐
		Segregation of Exposures	☐
		Duplication of Resources	☐
		Self-Retention	☐

Section 11: Key Partnerships

The Key Partnerships section describes the network of suppliers and partners that make the business model work.

11.1	Who are your critical partners related to Internet Management? Minimum 2 critical partners required.	Partner 1
		Partner 2
		Partner 3
		Partner 4
		Partner 5
11.2	Who are your critical suppliers related to Internet Management? Minimum 2 critical suppliers required.	Supplier 1
		Supplier 2
		Supplier 3
		Supplier 4
		Supplier 5
11.3	Which Key Resources does your HEI acquire from suppliers and partners for Internet Management? Select the most appropriate answer.	Physical	☐
		Intellectual	☐
		Human	☐
		Financial	☐

11.4	Which Key Activities do your partners perform? Minimum 2 Key Activities required.	Key Activity 1	
		Key Activity 2	
		Key Activity 3	
		Key Activity 4	
		Key Activity 5	
11.5	What kind of partnerships should your HEI seek? Select the most appropriate answer.	General Partnership	☐
		Limited Partnerships	☐
		Limited Liability Partnerships	☐

Section 12: Cost Structure

The Cost Structure section describe all costs incurred to operate an Internet Management Business Model.

12.1	What are the most important costs inherent in your Internet business model? Select the most appropriate answer.	**Cost Driven** (leanest cost structure, low price value proposition, maximum automation, extensive outsourcing)	☐
		Value Driven (focused on value creation, premium value proposition)	☐
12.2	Which Internet management resources have the most impact on the costs? Select the most appropriate answer.	Physical	☐
		Intellectual	☐
		Human	☐
		Financial	☐
12.3	Which Key Resources are the most expensive? Select the most appropriate answer.	Physical	☐
		Intellectual	☐
		Human	☐
		Financial	☐
12.4	Which Key Activities are the most expensive?	Speed	☐
		Reliability	☐

	Select the most appropriate answer.		
		Scalability	☐
		Security	☐

Thank you for your participation!

Appendix E – HEIIMS Distribution Email

From: Boshoff, Ryno (Mr) (Summerstrand Campus North)
Sent: Friday, April 7, 2017 2:55 PM
To: 'Val Theron' <valtheron@asaudit.ac.za>
Cc: Charlene Isaacs <cisaacs@asaudit.ac.za>
Subject: South African Higher Education Institution (HEI) Internet Management Survey

Dear Ms Val Theron

I would like to request your assistance as gatekeeper to distribute my survey titled 'South African Higher Education Institution (HEI) Internet Management Survey' to all South African Higher Education Institutions' ICT Directors (ASAUDIT members) on my behalf. The survey forms the basis for my Doctorate in Business Administration (DBA) thesis.

The purpose of the thesis is to provide an adaptive Internet Management Model that will ensure the effective management of Internet ICT resources at Higher Education Institutions in South Africa. This will be created by firstly determining what is currently the common business model regarding Internet Management at HEIs. From the findings a draft adaptive Internet Management Model will be created. Secondly, a case study will be completed on Nelson Mandela University to validate and/or re-align the draft adaptive Internet Management Model. For this purpose, a holistic view of the Internet usage at Nelson Mandela University will be created. The new findings will then be used to validate and/or re-align the draft adaptive Internet Management Model for the HEI. The outcome is an adaptive Internet Management Model that will assist the HEIs as well as Nelson Mandela University to effectively utilise the ICT Internet resources, which in turn will ensure that the availability of the Internet to its users and systems becomes a reliable and pleasant experience.

I therefore request your assistance in distributing the survey titled 'South African Higher Education Institution (HEI) Internet Management Survey' to all South African Higher Education Institutions' ICT Directors (ASAUDIT members) on my behalf. I will provide a small 'thank you' gift to those who complete the survey at the next ASAUDIT meeting.

Yours sincerely

Yours Sincerely
Die Uwe

Ryno Boshoff

Senior Systems Engineer: Information Security and DBA student at Nelson Mandela University Business School

ICT Services: Operation and Development
Room 053, R Block
North Campus
NMU

Tel (041) 504 1065
Fax (041) 504 1691
Cell 072 632 1872
Email: ryno.boshoff@Mandela.ac.za
Skype: rynoboshoff

View Ryno Boshoff's profile

Appendix F – NMUIUS

Nelson Mandela University Internet Usage Survey

Thank you for taking the time out of your busy schedule to complete the survey. Your input will greatly assist the researcher to determine what Nelson Mandela University's Internet resources are being used for. This information will also assist the ICT Management Team to review their current Internet resources and align them accordingly. The expected time to complete this survey is 15 minutes. No personal identifiable information will be captured and used in this survey. Completion and submission of the survey constitute consent for the data to be used in the study. If you have any question regarding the survey, please feel free to contact me via email at ryno.boshoff@mandela.ac.za. REC-H Reference Number: H16-BES-BUS-015.

Section 1: Demographic Information

Gender
1. Female
2. Male

Age
1. Below 20
2. 21 - 29
3. 30 - 39
4. 40 - 49
5. 50 - 59
6. 60 +

Which Campus are you mainly situated on?
1. South Campus
2. North Campus
3. 2nd Ave Campus
4. Birdstreet Campus
5. Missionvale Campus
6. George Campus
7. Nelson Mandela University Business School

Are you administrative staff, academic staff or a student?
1. Academic Staff
2. Administrative Staff
3. Student

Do you have a personal fixed Internet connection (e.g. ADSL, Fibre, Satellite) which you use to access the Internet off campus?
1. Yes

2. No

Do you have a personal mobile Internet connection (e.g. data bundle) which you use to access the Internet off campus?
   1. Yes
   2. No

Section 2: Governance

Are you aware of the Nelson Mandela University General ICT Policy?
   1. Yes
   2. No

Have you read and understood it?
   1. Yes
   2. No

Do you agree with it?
   1. Yes
   2. No

Are you aware of the Acceptable Use Policy?
   1. Yes
   2. No

Have you read and understood it?
   1. Yes
   2. No

Do you agree with it?
   1. Yes
   2. No

How many devices do you use to connect to Nelson Mandela University's Internet on a day to day basis?
   1. 1
   2. 2
   3. 3
   4. 4
   5. 5 or more

What type of device do you mainly use to connect to Nelson Mandela University' Internet?
   1. Desktop Computer
   2. Laptop
   3. Tablet
   4. Smartphone
   5. Other _____

What are your top 4 primary Internet value requirements for the Nelson Mandela University Internet:
Choose exactly 4 choices to rank them

- Speed _____
- Availability (connectivity) _____
- Consistency _____
- Reliability _____
- Relevance _____
- Trusted _____
- Anonymity (Privacy) _____
- Safe and Secure _____
- Other _____

What method of communication would you prefer when receiving Internet user support?
1. Phone
2. Email
3. Web Self-Service
4. Automated Phone System
5. Letter via Mail
6. Web Chat
7. Online Phone Call
8. Social Media
9. Other _____

Section 3: Usage and Access Duration

Access to Nelson Mandela University's Internet can be done when inside the Nelson Mandela University environment (on Campus) and via VPN connection from off Campus. How many hours per day on average do you use Nelson Mandela University's Internet for:

	None	Less than 1 hour	1 - 3 hours	4 - 5 hours	More than 5 hours
WORK/ACADEMIC PURPOSES DURING OFFICE HOURS ON WEEKDAYS?	❏	❏	❏	❏	❏
WORK/ACADEMIC PURPOSES AFTER HOURS ON WEEKDAYS?	❏	❏	❏	❏	❏
WORK/ACADEMIC PURPOSES OVER WEEKENDS?	❏	❏	❏	❏	❏
NON-WORK/NON-ACADEMIC PURPOSES DURING OFFICE HOURS ON WEEKDAYS?	❏	❏	❏	❏	❏
NON-WORK/NON-ACADEMIC PURPOSES AFTER HOURS ON WEEKDAYS?	❏	❏	❏	❏	❏
NON-WORK/NON-ACADEMIC PURPOSES OVER WEEKENDS?	❏	❏	❏	❏	❏

Section 4: Content

How often do you use Nelson Mandela University's Internet to access the following GENERAL INTEREST - BUSINESS categories of websites?

	Daily	Weekly	Monthly	Less Often	Never
FINANCE AND BANKING	❏	❏	❏	❏	❏

	Daily	Weekly	Monthly	Less Often	Never
SEARCH ENGINES AND PORTALS	❏	❏	❏	❏	❏
BUSINESS	❏	❏	❏	❏	❏
INFORMATION AND COMPUTER SECURITY	❏	❏	❏	❏	❏
GOVERNMENT AND LEGAL ORGANISATIONS	❏	❏	❏	❏	❏
INFORMATION TECHNOLOGY	❏	❏	❏	❏	❏
SECURE WEBSITES	❏	❏	❏	❏	❏
WEB-BASED APPLICATIONS	❏	❏	❏	❏	❏
WEB-BASED EMAILS	❏	❏	❏	❏	❏
BUSINESS EMAILS	❏	❏	❏	❏	❏
RESEARCH	❏	❏	❏	❏	❏
WEB HOSTING	❏	❏	❏	❏	❏
WEBSITES RELATED TO BUSINESS CONTENT WHICH MAY INCLUDE ARMED FORCES AND GENERAL ORGANISATIONS	❏	❏	❏	❏	❏

How often do you use Nelson Mandela University's Internet to access the following GENERAL INTEREST - PERSONAL categories of websites?

	Daily	Weekly	Monthly	Less Often	Never
EDUCATION	❏	❏	❏	❏	❏
ENTERTAINMENT	❏	❏	❏	❏	❏
ADVERTISING	❏	❏	❏	❏	❏
GAMES	❏	❏	❏	❏	❏
INSTANT MESSAGING	❏	❏	❏	❏	❏
SOCIAL NETWORKING	❏	❏	❏	❏	❏
PERSONAL EMAILS	❏	❏	❏	❏	❏
CONTENT SERVERS	❏	❏	❏	❏	❏
PERSONAL VEHICLES	❏	❏	❏	❏	❏
PERSONAL WEBSITES AND BLOGS	❏	❏	❏	❏	❏
REFERENCE WEBSITES (LIBRARIES, WIKI ETC.)	❏	❏	❏	❏	❏

	Daily	Weekly	Monthly	Less Often	Never
SHOPPING AND AUCTION	❏	❏	❏	❏	❏
SPORTS	❏	❏	❏	❏	❏
SOCIETY AND LIFESTYLE	❏	❏	❏	❏	❏
JOB SEARCH	❏	❏	❏	❏	❏
MEANINGLESS CONTENT	❏	❏	❏	❏	❏
NEWS AND MEDIA	❏	❏	❏	❏	❏
ARTS AND CULTURE	❏	❏	❏	❏	❏
DYNAMIC CONTENT	❏	❏	❏	❏	❏
TRAVEL	❏	❏	❏	❏	❏
HEALTH AND WELLNESS	❏	❏	❏	❏	❏
WEBSITES RELATED TO PERSONAL/PRIVATE CONTENT WHICH MAY INCLUDE BROKERAGE AND TRADING, CHILD EDUCATION, FOLKLORE, GLOBAL RELIGION, MEDICINE, PERSONAL PRIVACY, REAL ESTATE, RESTAURANT AND DINING	❏	❏	❏	❏	❏

How often do you use Nelson Mandela University's Internet to access the following BANDWIDTH CONSUMING categories of websites?

	Daily	Weekly	Monthly	Less Often	Never
FILE SHARING AND STORAGE	❏	❏	❏	❏	❏
FREEWARE AND SOFTWARE DOWNLOADS	❏	❏	❏	❏	❏
INTERNET RADIO AND TV	❏	❏	❏	❏	❏
INTERNET TELEPHONY (VOIP)	❏	❏	❏	❏	❏
PEER-TO-PEER FILE SHARING	❏	❏	❏	❏	❏
STREAMING MEDIA AND DOWNLOAD	❏	❏	❏	❏	❏

How often do you use Nelson Mandela University's Internet to access the following SECURITY RISK categories of websites?

	Daily	Weekly	Monthly	Less Often	Never
MALICIOUS WEBSITES	❏	❏	❏	❏	❏
PHISHING	❏	❏	❏	❏	❏

	Daily	Weekly	Monthly	Less Often	Never
SPAM URLS (LINKS TO SPAM WEBSITES)	❏	❏	❏	❏	❏
DYNAMIC DNS	❏	❏	❏	❏	❏

How often do you use Nelson Mandela University's Internet to access the following POTENTIALLY LIABLE categories of websites?

	Daily	Weekly	Monthly	Less Often	Never
CHILD ABUSE	❏	❏	❏	❏	❏
DRUG ABUSE	❏	❏	❏	❏	❏
ILLEGAL OR UNETHICAL	❏	❏	❏	❏	❏
PLAGIARISM	❏	❏	❏	❏	❏
WEBSITES RELATED TO POTENTIALLY LIABLE CONTENT WHICH MAY INCLUDE EXPLICIT VIOLENCE, EXTREMIST GROUPS, HACKING, DISCRIMINATION AND PROXY AVOIDANCE	❏	❏	❏	❏	❏

How often do you use Nelson Mandela University's Internet to access the following ADULT/MATURE CONTENT categories of websites?

	Daily	Weekly	Monthly	Less Often	Never
ALCOHOL	❏	❏	❏	❏	❏
ALTERNATIVE BELIEFS	❏	❏	❏	❏	❏
DATING	❏	❏	❏	❏	❏
GAMBLING	❏	❏	❏	❏	❏
PORNOGRAPHY	❏	❏	❏	❏	❏
SPORTS HUNTING AND WAR GAMES	❏	❏	❏	❏	❏
TOBACCO AND WEAPONS (SALES)	❏	❏	❏	❏	❏
OTHER ADULT MATERIALS	❏	❏	❏	❏	❏
WEBSITES RELATED TO ADULT/MATURE CONTENT WHICH MAY INCLUDE ABORTION, ADVOCACY ORGANISATIONS, LINGERIE AND SWIMSUIT, MARIJUANA, NUDITY AND RISQUE AND SEX EDUCATION	❏	❏	❏	❏	❏

How often do you use Nelson Mandela University's Internet to access the following UNRATED categories of websites?

	Daily	Weekly	Monthly	Less Often	Never
WEBSITES THAT DO NOT FORM PART OF THE CATEGORIES AS LISTED ABOVE	❏	❏	❏	❏	❏

Section 5: Primary Purpose

What are your top 4 primary uses for Nelson Mandela University's Internet: DURING OFFICE HOURS ON WEEKDAY. Choose exactly 4 choices to rank them
- Blogs _____
- Chat rooms _____
- Online Gaming _____
- Instant Messenger (e.g. WhatsApp, WeChat, Facebook Messenger) _____
- Video Communication (e.g. Lync, Skype) _____
- Internet TV (e.g. DSTV Now, Netflix) _____
- Music (e.g. iTunes, Radio) _____
- News and Sports _____
- Research (e.g. Journals, Articles) _____
- Shopping and Auctions _____
- Social Networking (e.g. Facebook, Twitter, LinkedIn) _____
- Web Browsing (General) _____
- Work (Job Specific Content Search) _____
- Business Emails (Work and Research related) _____
- Personal Emails _____

What are your top 4 primary uses for Nelson Mandela University's Internet: AFTER HOURS ON WEEKDAYS. Choose exactly 4 choices to rank them
- Blogs _____
- Chat rooms _____
- Online Gaming _____
- Instant Messenger (e.g. WhatsApp, WeChat, Facebook Messenger) _____
- Video Communication (e.g. Lync, Skype) _____
- Internet TV (e.g. DSTV Now, Netflix) _____
- Music (e.g. iTunes, Radio) _____
- News and Sports _____
- Research (e.g. Journals, Articles) _____
- Shopping and Auctions _____
- Social Networking (e.g. Facebook, Twitter, LinkedIn) _____
- Web Browsing (General) _____
- Work (Job Specific Content Search) _____
- Business Emails (Work and Research related) _____
- Personal Emails _____

What are your top 4 primary uses for Nelson Mandela University's Internet: OVER WEEKENDS. Choose exactly 4 choices to rank them
- Blogs _____
- Chat rooms _____
- Online Gaming _____
- Instant Messenger (e.g. WhatsApp, WeChat, Facebook Messenger) _____
- Video Communication (e.g. Lync, Skype) _____
- Internet TV (e.g. DSTV Now, Netflix) _____
- Music (e.g. iTunes, Radio) _____
- News and Sports _____

- Research (e.g. Journals, Articles) _____
- Shopping and Auctions _____
- Social Networking (e.g. Facebook, Twitter, LinkedIn) _____
- Web Browsing (General) _____
- Work (Job Specific Content Search) _____
- Business Emails (Work and Research related) _____
- Personal Emails _____

Section 6: Management

Please rate the following aspects of Nelson Mandela University's Internet service:

	Very Poor	Below Average	Average	Above Average	Excellent
The Internet speed designated to me for work use is	❏	❏	❏	❏	❏
The Internet speed designated to me for personal use is	❏	❏	❏	❏	❏
The availability (connectivity) of the Internet in the Nelson Mandela University environment is	❏	❏	❏	❏	❏
The consistency of the Internet in the Nelson Mandela University environment is	❏	❏	❏	❏	❏
The reliability of the Internet in the Nelson Mandela University environment is	❏	❏	❏	❏	❏
The trustworthiness of the Internet in the Nelson Mandela University environment is	❏	❏	❏	❏	❏
The relevance (keeping up-to-date with my needs) of the Internet in the Nelson Mandela University environment is	❏	❏	❏	❏	❏
The anonymity (privacy) I receive when using the Internet in the Nelson Mandela University environment is	❏	❏	❏	❏	❏
The safety and security controls in place to protect me when using the Internet are	❏	❏	❏	❏	❏
The support I receive from ICT Services staff regarding the Internet services is	❏	❏	❏	❏	❏
My overall perception/feeling of the Internet at Nelson Mandela University is	❏	❏	❏	❏	❏

Appendix G – NMUIUS Distribution Email

From: Boshoff, Ryno (Mr) (Summestrand Campus North)
Sent: Tuesday, March 28, 2017 1:27 PM
To: MEMO MEMO@Mandela.ac.za>
Subject: REMINDER: #SURVEYS - Nelson Mandela University Internet Usage Survey

Dear Nelson Mandela University Internet user

You are invited to participate in a research study: "**An adaptive Internet Management Model for Higher Education Institutions in South Africa.**". The study will require you to complete a questionnaire related to your Internet usage patterns in the Nelson Mandela University environment. The completion of this survey is done on a voluntary basis. Completion and submission of the survey will constitute consent for the data to be used in the study. None of your personal information will be used or published in the study or in any scientific articles published. Participation in this study will not result in any additional cost to you. If at any stage you wish to remove yourself from the study, you may opt-out and your information will remain confidential.

The investigators are researching the users' Internet patterns to gain a better understanding of what the current Nelson Mandela University Internet landscape looks like. The data collected will assist the researchers to validate and/or re-align the adaptive Internet Management Model for South African Higher Education Institutions which will allow for the effective management of ICT Internet resources. The information will be used for research academic purposes.

You, as the participant, will be required to answer a series of questions related to the Nelson Mandela University Internet. These questions relates to your Internet usage patterns and your views of the current state of the Nelson Mandela University's Internet. Your responses will not be liked to your identity. The expected time to complete this survey is 15 minutes (current average is 12 minutes).

Please click on the link below to access the survey:

http://www.questionpro.com/t/AMbE6ZXtBt

REC-H Reference Number: H16-BES-BUS-015

Yours Sincerely

Ryno Boshoff
DBA student at Nelson Mandela University Business School
Email: ryno.boshoff@mandela.ac.za

Appendix H – Fortiguard Categorisation Criteria

Web Filtering categories are organised into 6 main groups:

Security Risk

- Malicious Websites

  Sites that host software that is covertly downloaded to a user's machine to collect information and monitor user activity, and sites that are infected with destructive or malicious software, specifically designed to damage, disrupt, attack or manipulate computer systems without the user's consent, such as virus or trojan horse.

- Phishing

  Counterfeit web pages that duplicate legitimate business web pages for the purpose of eliciting financial, personal or other private information from the users.

- Spam URLs

  Websites or webpages whose URLs are found in spam emails. These webpages often advertise sex sites, fraudulent wares, and other potentially offensive materials.

General Interest - Business

- Finance and Banking

  Financial Data and Services -- Sites that offer news and quotations on stocks, bonds, and other investment vehicles, investment advice, but not online trading. Includes banks, credit unions, credit cards, and insurance. Mortgage/insurance brokers apply here as opposed to Brokerage and Trading. Examples: paypal.com, alipay.com, bankofamerica.com, chase.com

- Search Engines and Portals

  Sites that support searching the Web, news groups, or indices/directories. Sites of search engines that provide info exclusively for shopping or comparing prices, however, fall in Shopping and Auction. Examples: google.com, yahoo.com, baidu.com, qq.com

- General Organizations

  Sites that cater to groups, clubs or organisations of individuals with similar interests, either professional, social, humanitarian or recreational in nature. Social and Affiliation Organizations: Sites sponsored by or that support or offer information about organizations devoted chiefly to socializing or common interests other than philanthropy or professional advancement. Not to be confused with Advocacy Groups and Political Groups. Examples: indiegogo.com, teespring.com, creativecommons.org, gofundme.com

Business

Sites sponsored by or devoted to business firms, business associations, industry groups, or business in general. Information Technology companies are excluded in this category and fall in Information Technology. Examples: linkedin.com, alibaba.com, m2newmedia.com, hootsuite.com

- Information and Computer Security

  Sites that provide information about or free downloadable tools for computer security, but not ordinary Freeware and Software downloading. Examples: siteadvisor.com, avast.com, avira.com, norton.com

- Government and Legal Organizations

  Government: Sites sponsored by branches, bureaus, or agencies of any level of government, except for the armed forces, including courts, police institutions, city-level government institutions. Legal Organizations: Sites that discuss or explain laws of various government entities. Examples: nih.gov, irs.gov, rednet.cn, gc.ca

- Information Technology

  Information Technology peripherals and services, cell phone services, cable TV/Internet suppliers. Examples: 360.cn, microsoft.com, apple.com, stackoverflow.com

- Armed Forces

  Websites related to organized military and armed forces, excluding civil and extreme military organizations. Examples: qianyan001.com, chinaiiss.com, xinjunshi.com, topwar.ru

- Web Hosting

  Sites of organizations that provide hosting services, or top-level domain pages of Web communities. Examples: godaddy.com, hostgator.com, weebly.com, bluehost.com

- Secure Websites

  Sites that institute security measures such as authentication, passwords, registration, etc. Examples: cpmterra.com, fhserve.com, huffingtonpost.de, adm918.com

- Web-based Applications

  Sites that mimic desktop applications such as word processing, spreadsheets, and slide-show presentations. Examples: evernote.com, appstorm.net, befunky.com, listchallenges.com

Adult/Mature Content

- Alternative Beliefs

Websites that provide information about or promote religions not specified in Traditional Religions or other unconventional, cultic, or folkloric beliefs and practices. Sites that promote or offer methods, means of instruction, or other resources to affect or influence real events through the use of spells, curses, magic powers, satanic or supernatural beings. Examples: creepyhollows.com, persianfal.com, ttufo.com, minghui.org

- Abortion

  Websites pertaining to abortion data, information, legal issues, and organizations. Examples: liuchanyao.cn, gire.org.mx, womenonwaves.org, jillstanek.com

- Other Adult Materials

  Mature content websites (18+ years and over) that feature or promote sexuality, strip clubs, sex shops, etc. excluding sex education, without the intent to sexually arouse. Examples: 9gag.com, eyny.com, urbandictionary.com, 9gag.tv

- Advocacy Organizations

  This category caters to organizations that campaign or lobby for a cause by building public awareness, raising support, influencing public policy, etc. Examples: change.org, avaaz.org, lewrockwell.com, thepetitionsite.com

- Gambling

  Sites that cater to gambling activities such as betting, lotteries, casinos, including gaming information, instruction, and statistics. Examples: bet365.com, freelotto.com, williamhill.com, betfair.com

- Nudity and Risque

  Mature content websites (18+ years and over) that depict the human body in full or partial nudity without the intent to sexually arouse. Examples: modelmayhem.com, egotastic.com, plotek.pl, wwtdd.com

- Pornography

  Mature content websites (18+ years and over) which present or display sexual acts with the intent to sexually arouse and excite. Examples: xvideos.com, xhamster.com, pornhub.com, xnxx.com

- Dating

  Websites that allow individuals to make contact and communicate with each other over the Internet, usually with the objective of developing a personal, romantic, or sexual relationship. Examples: badoo.com, youyuan.com, pof.com, okcupid.com

- Weapons (Sales)

Websites that feature the legal promotion or sale of weapons such as hand guns, knives, rifles, explosives, etc. Examples: cabelas.com, budsgunshop.com, gunbroker.com, ar15.com

- Marijuana

Sites that provide information about or promote the cultivation, preparation, or use of marijuana. Examples: hightimes.com, theweedblog.com, weedmaps.com, shroomery.org

- Sex Education

Educational websites that provide information or discuss sex and sexuality, without utilizing pornographic materials. Examples: izhufu.com, netgarmi.ir, gurl.com, noorclinic.com

- Alcohol

Websites which legally promote or sell alcohol products and accessories. Examples: wine-searcher.com, suntory.co.jp, beeradvocate.com, repai.com

- Tobacco

Websites which legally promote or sell tobacco products and accessories. Examples: v2cigs.com, grasscity.com, 16888.com.cn, forum-ecigarette.com

- Lingerie and Swimsuit

Websites that utilizes images of semi-nude models in lingerie, undergarments and swimwear for the purpose of selling or promoting such items. Examples: victoriassecret.com, ads8.com, moonbasa.com, cilory.com

- Sports Hunting and War Games

Web pages that feature sport hunting, war games, paintball facilities, etc. Includes all related clubs, organizations and groups. Examples: thetruthaboutguns.com, fieldandstream.com, outdoorlife.com, pbnation.com

Bandwidth Consuming

- Freeware and Software Downloads

Sites whose primary function is to provide freeware and software downloads. Cell phone ringtones/images/games, computer software updates for free downloads are all included in this category. Examples: softonic.com, eazel.com, sharelive.net, mysearchdial.com

- File Sharing and Storage

Websites that permit users to utilize Internet servers to store personal files or for sharing, such as with photos. Examples: instagram.com, imgur.com, flickr.com, dropbox.com

- Streaming Media and Download

  Websites that allow the downloading of MP3 or other multimedia files. Examples: youtube.com, vube.com, youku.com, dailymotion.com

  Websites that allow users to share files and data storage between each other. Examples: rutracker.org, qtrax.com, eztv.it, ppstream.com

- Internet Radio and TV

  Websites that broadcast radio or TV communications over the Internet. Examples: pandora.com, ustream.tv, tunein.com, last.fm

- Internet Telephony

  Websites that enable telephone communications over the Internet. Examples: skype.com, viber.com, universomlm.com, tango.m

Potentially Liable

- Drug Abuse

  Websites that feature information on illegal drug activities including: drug promotion, preparation, cultivation, trafficking, distribution, solicitation, etc.

- Hacking

  Websites that depict illicit activities surrounding the unauthorized modification or access to programs, computers, equipment and websites.

- Illegal or Unethical

  Websites that feature information, methods, or instructions on fraudulent actions or unlawful conduct (non-violent) such as scams, counterfeiting, tax evasion, petty theft, blackmail, etc.

- Discrimination

  Sites that promote the identification of racial groups, the denigration or subjection of groups, or the superiority of any group.

- Explicit Violence

  This category includes sites that depict offensive material on brutality, death, cruelty, acts of abuse, mutilation, etc.

- Extremist Groups

  Sites that feature radical militia groups or movements with aggressive anti-government convictions or beliefs.

- Proxy Avoidance

  Websites that provide information or tools on how to bypass Internet access controls and browse the Web anonymously, includes anonymous proxy servers.

- Plagiarism

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Websites that provide, distribute or sell school essays, projects, or diplomas.

- Child Abuse

  Websites that have been verified by the Internet Watch Foundation to contain or distribute images of non-adult children that are depicted in a state of abuse. Information on the Internet Watch Foundation is available at http://www.iwf.org.uk/.

General Interest - Personal

- Advertising

  Sites that provide advertising graphics or other ad content files, including ad servers (domain name often with 'ad', such as ad.yahoo.com). If a site is mainly for online transactions, it is rated as Shopping and Auctions. Includes pay-to-surf and affiliated advertising programs. Examples: adcash.com, neobux.com, clkmon.com, directrev.com

- Brokerage and Trading

  Sites that support active trading of securities and management of investments. Real estate broker does not apply here, and falls within Shopping and Auction. Sites that provide supplier and buyer info/ads do not apply here either since they do not provide trading activities. Examples: stockstar.com, 17ok.com, anyoption.com, etoro.com

- Games

  Sites that provide information about or promote electronic games, video games, computer games, role-playing games, or online games. Includes sweepstakes and giveaways. Sport games are not included in this category, but time consuming mathematic game sites that serve little education purpose are included in this category. Examples: gameforge.com, gamer.com.tw, goodgamestudios.com, twitch.tv

- Web-based Email

  Sites that allow users to utilize electronic mail services. Examples: mail.ru, outlook.com, mail.com, 126.com

- Entertainment

  Sites that provide information about or promote motion pictures, non-news radio and television, music and programming guides, books, humor, comics, movie theatres, galleries, artists or review on entertainment, and magazines. Includes book sites that have personal flavor or extra-material by authors to promote the books. Examples: imdb.com, douban.com, tmz.com, subscene.com

- Arts and Culture

  Websites that cater to fine arts, cultural behaviors and backgrounds including conventions, artwork and paintings, music, languages, customs, etc. Also includes

institutions such as museums, libraries and historic sites. Sites that promote historical, cultural heritage of certain area, but not purposely promoting travel. Examples: deviantart.com, goodreads.com, 500px.com, heftig.co

- Education

  Educational Institutions: Sites sponsored by schools, other educational facilities and non-academic research institutions, and sites that relate to educational events and activities. Educational Materials: Sites that provide information about, sell, or provide curriculum materials. Sites that direct instruction, as well as academic journals and similar publications where scholars and professors submit academic/research articles. Examples: wikia.com, nationalgeographic.com, mit.edu, bab.la

- Health and Wellness

  Sites that provide information or advice on personal health or medical services, procedures, or devices, but not drugs. Includes self-help groups. This category includes cosmetic surgery providers, children's hospitals, but not sites of medical care for pets, which fall in Society and Lifestyle. Examples: 39.net, webmd.com, xywy.com, pcbaby.com.cn

- Job Search

  Sites that offer information about or support the seeking of employment or employees. Includes career agents and consulting services that provide job postings. Examples: indeed.com, odesk.com, elance.com, freelancer.com

- Medicine

  Prescribed Medications: Sites that provide information about approved drugs and their medical use. Supplements and Unregulated Compounds: Sites that provide information about or promote the sale or use of chemicals not regulated by the FDA (such as naturally occurring compounds). This category includes sites of online shopping for medicine, as it is a sensitive category separated from regular shopping. Examples: cvs.com, iherb.com, drugs.com, vitacost.com

- News and Media

  Sites that offer current news and opinion, including those sponsored by newspapers, general-circulation magazines, or other media. This category includes TV and Radio sites, as long as they are not exclusively for entertainment purpose, but excludes academic journals. Alternative Journals: Online equivalents to supermarket tabloids and other fringe publications. Examples: cnn.com, gmw.cn, ifeng.com, bbc.co.uk

- Social Networking

  Includes websites that aid in the coordination of heterosexual relationships and companionship. Includes legal and non-sexual sites related to on-line dating, personal

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ads, dating services, clubs, etc. Examples: facebook.com, twitter.com, weibo.com, vk.com

- Political Organizations

  Sites that are sponsored by or provide information about political parties and interest groups focused on elections or legislation. This is not to be confused with Government and Legal Organizations, and Advocacy Groups. Examples: dailykos.com, aamaadmiparty.org, maduradas.com, egaliteetreconciliation.fr

- Reference

  Websites that provide general reference data in the form of libraries, dictionaries, thesauri, encyclopedias, maps, directories, standards, etc. Examples: wikipedia.org, about.com, wikimedia.org, yelp.com

- Global Religion

  Sites that provide information about or promote Buddhism, Bahai, Christianity, Christian Science, Hinduism, Islam, Judaism, Mormonism, Shinto, and Sikhism, as well as atheism. Examples: biblegateway.com, tebyan.net, watchtower.com, islamweb.net

- Shopping and Auction

  Websites that feature on-line promotion or sale of general goods and services such as electronics, flowers, jewelry, music, etc, excluding real estate. Also includes on-line auction services such as eBay, Amazon, Priceline. Examples: taobao.com, amazon.com, ebay.com, tmall.com

- Society and Lifestyles

  This category contains sites that deal with everyday life issues and preferences such as passive hobbies (gardening, stamp collecting, pets), journals, blogs, etc. Examples: yaolan.com, ci123.com, aili.com, lady8844.com

- Sports

  Includes sites that pertain to recreational sports and active hobbies such as fishing, hunting, jogging, canoeing, archery, chess, as well as organized, professional and competitive sports. Examples: espn.go.com, espncricinfo.com, bleacherreport.com, goal.com

- Travel

  Websites in this category feature travel related resources such as accommodations, transportation (rail, airlines, cruise ships), agencies, resort locations, tourist attractions, advisories, etc. Examples: booking.com, tripadvisor.com, irctc.co.in, expedia.com

- Personal Vehicles

Websites that contain information on private use or sale of autos, boats, planes, motorcycles, etc., including parts and accessories. Examples: xcar.com.cn, bitauto.com, xgo.com.cn, chexun.com

- Dynamic Content

  URLs that are generated dynamically by a Web server. Examples: dip.jp, uni.me, ath.cx, shistlbb.com

- Meaningless Content

  This category houses URLs that cannot be definitively categorized due to lack of or ambiguous content. Examples: loading-delivery1.com, 4dsply.com, gateable.com, 0427d7.se

- Folklore

  UFOs, fortune telling, horoscopes, fen shui, palm reading, tarot reading, and ghost stories. Examples: horoscopedays.com, tvoyauda4a.ru, astro.com, horoscope.com

- Web Chat

  Sites that host Web chat services, or that support or provide information about chat via HTTP or IRC. Examples: 6.cn, omegle.com, batepapo.uol.com.br, xat.com

- Instant Messaging

  Sites that allow users to communicate in real-time over the Internet. Examples: way2sms.com, whatsapp.com, camfrog.com, imvu.com

- Newsgroups and Message Boards

  Sites for online personal and business clubs, discussion groups, message boards, and list servers; includes 'blogs' and 'mail magazines.' Examples: reddit.com, buzzfeed.com, livejournal.com, tianya.cn

- Digital Postcards

  Sites for sending/viewing digital post cards. Examples: evite.com, someecards.com, 123greetings.com, paperlesspost.com

- Child Education

  Websites developed for children age 12 and under. Includes educational games, tools, organizations and schools. Note that children's hospitals are rated as Health. Examples: prezentacya.ru, pbskids.org, coolmath-games.com, nickjr.com

- Real Estate

  Websites that promote the sale or renting of real estate properties. Examples: zillow.com, trulia.com, realtor.com, immobilienscout24.de

- Restaurant and Dining

Websites related to restaurants and dining, includes locations, food reviews, recipes, catering services, etc. Examples: tabelog.com, allrecipes.com, foodnetwork.com, cookpad.com

- Personal Websites and Blogs

Private web pages that host personal information, opinions and ideas of the owners. Examples: blogspot.com, wordpress.com, pinterest.com, tumblr.com

- Content Servers

Websites that host servers that distribute content for subscribing websites. Includes image and Web servers. Examples: akamaihd.net, cloudfront.net, twimg.com, pinimg.com

- Domain Parking

Sites that simply are place holders of domains without meaningful content. Examples: slimspots.com, vpsdomain3.eu, vpsdomain4.eu, lol55.com

- Personal Privacy

Sites providing online banking, trading, health care, and others that contain personal privacy information. Examples: findcarinformation.com, kinorelax.com.