

Master of Arts in the field of ICT Policy and Regulation

MOTIVATIONAL FACTORS, POLICY AND REGULATION WITH RESPECT TO ADOPTION OF e-HEALTH TECHNOLOGIES FOR ELDERLY PERSONS

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**A research report submitted to the Faculty of Humanities,
University of the Witwatersrand
in partial fulfilment of the requirements for the degree of
Master of Arts in the field of ICT Policy and Regulation**

Declaration

I, Evah Mthimunye, declare that:

- i. This research report is submitted in partial fulfilment of the requirements for the degree of Master of Arts in the field of ICT Policy and Regulation at the University of the Witwatersrand, Johannesburg.
- ii. This research report has not been submitted for any degree or examination at any other university.
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Evah Mthimunye

15 March 2019

Abstract

This research report investigates motivational factors, policy and regulation with respect to the adoption of e-health technologies by elderly persons in the context of rural South Africa. Digitisation in health, including digital devices such as fitness trackers which monitor daily activities and health patterns are being advocated by insurance companies as a solution to promote healthy living. Older people can monitor and improve their health using fitness tracking devices. There are extensive research studies on motivational factors to adopt e-health technologies, however literature reveals that there are few studies that have investigated the extent and motivational factors contributing to the adoption of health technology by older people explicitly focusing on rural area in developing countries. Also, in the context of the information and communication technologies (ICT) industry, there is limited research that addresses issues of motivational factors, benefits and challenges.

As a data collection approach, the study employs review of policy documents, in-depth individual interviews and a single focus group, conducted at the case study institution, Wisane retirement home in Hammanskraal in Northern Gauteng. The retirement home's vision and mission are to provide older people with a secure and affordable retirement environment. A qualitative analysis approach was adopted where inductive reasoning was used to compare emerging themes.

The promised benefit to improve quality of life, in particular, emerged as the primary motivator to adopt these technologies. The poor quality of public health service is a secondary factor contributing to the perceived need to adopt these technologies. Poor ICT infrastructure in rural health care institutions emerged as an inhibitor to diffusion of e-health technologies. Issues of security and privacy, social and economic factors such as affordability, and digital skills knowledge were also highlighted. The study proposes future research to investigate practice-oriented models relevant to the greater adoption of e-health technologies.

Keywords: e-Health technologies adoption, older people, perceived usefulness, perceived ease of use, policy.

Dedication

This study is dedicated to the fond memory of my grandmother, who passed on after she fell while living alone in her house. I can only imagine how things could have turned out if the sensor technology was available at the time. She could have received prompt medical attention, which could have saved her life.

Acknowledgements

In finalising this research report, I had to investigate critically the motivational factors hindering or promoting the adoption of e-health technologies by elderly rural people in South Africa and recommend appropriate solutions to drive the adoption. As a girl growing up in rural areas subjected to the poor health services provided through public health care, I developed a passion to contribute to the body of knowledge by analysing the contributory factors which government can utilise to draft policies to bridge the digital divide.

A huge thank you to my supervisor, mentor and colleague Dr Kiru Pillay for his tireless support, encouragement, hope and inspiration that he instilled in me to pursue this report. Most importantly to my husband, Charles Mthimunye, my daughters, and the rest of my family and friends for their support, perseverance and patience.

To the Wisane retirement home management, thank you for authorising my access to the retirement home and for participation in the success of this master's document.

I want to acknowledge the Director General of Department of Telecommunications and Postal Services, for permitting the Department to participate in the pilot study and allowing the officials to participate during data collection. Thank you to all the colleagues who participated in the individual interviews and pilot study.

List of acronyms

Acronym	Definition
A	Attitude
APP	Australian privacy principles
BI	Behavioural intention
CDC	Centres for Disease Control
DOH	Department of Health
DOI	Diffusion of innovation theory
DTPS	Department of Telecommunications and Postal Services
ECA	Electronic Communications Act No. 36 of 2005 as amended
e-Government	Electronic government
e-Health	Electronic health
e-Strategy	Electronic strategy
e-transformation	Electronic transformation
EU	European Union
GDP	Gross Domestic Product
GDPR	General Data Protection Regulation Act
GITR	Global Information Technology Report
HIV	Human immunodeficiency virus
ICASA	Independent Communications Authority of South Africa
ICT	Information and communications technologies
IoT	Internet of Things
IS	Information systems
IT	Information technology
ITU	International Telecommunications Union
MTEF	Medium Term Expenditure Framework
NCPF	National Cybersecurity Policy Framework
NDP	National Development Plan
NHI	National Health Insurance
OECD	Organisation for Economic Cooperation and Development
PBC	Perceived Behaviour Control
PEOU	Perceived Ease Of Use
POPI	Protection of Personal Information Act
PU	Perceived Usefulness
SA Connect	South Africa Connect
SASSA	South Africa Social Security Agency
SN	Subjective Norm
SWOT	Strength, Weaknesses, Opportunities and Threats
TAM	Technology Acceptance Models
TPB	Theory of Planned Behaviour

TRA	Theory of Reasoned Action
UTAUT	Unified Theory of Acceptance and Use of Technology
WEF	World Economic Forum
WHO	World Health Organisation

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Chapter One: An Overview of the e-Health Technologies

1.1 Introduction

Globally, the life expectancy of people has increased. As a result, countries with limited resources experience challenges maintaining the quality of health care for the elderly (DoH, 2012). It is, therefore, imperative for health policies and systems to adapt to this shifting environment. Electronic health (e-health) technologies appear to offer innovative solutions to address such shifts. Electronically connected health care systems such as health e-services in primary health care involve the convergence of health technology and digital technologies. This is increasingly seen as the integral part of the solution to many technologies facing health care, particularly in the rural setting communities of South Africa. According to Taylor (2015), the connected health system provides quality primary health care to communities and can empower patients and healthcare givers by giving them more control over their health and social care needs respectively.

Hanna and Summers (2014) argue that digital transformation accelerates transformation process with the power of new technologies. They further argue that ICT is a powerful and versatile transformative tool for all kinds of socio-economic development services such as healthcare, education, public services, financial services, media and entertainment, science and technology, manufacturing, transportation and logistics.

e-Health technologies include e-health technologies such as fitness trackers which monitor daily activities and health patterns which promote healthy living. Elderly persons can monitor and improve their health using fitness tracking devices, devices that can detect if a person has fallen, heart beat monitoring and sensory impairments. These digital tools can assist the health sector to deliver a range of health objectives, including establishing safe health environments, efficient resource planning and sustainable health care delivery systems. Digitisation in health, including

Various studies (Chung, Thompson, Joe, Hall, & Demiris, 2016; Wildenbos, Peute & Jaspers, 2018) have pointed out the progress made in the adoption of e-health technologies to support elderly people. The studies investigated design issues, benefits and barriers related to adoption of e-health technologies. While the beneficial

impact of e-health technologies is noticeable, previous research has suggested that there is limited awareness of the actual benefits of e-health technologies with respect to fall detection, heart beat monitoring, sensory impairments, and challenges to adoption by elderly persons.

A recent report by the Organisation for Economic Co-operation and Development (OECD) (2015), while recognising their societal impact, admits to the burden ICTs place on policymaking. ICT-led transformation should thus be guided by policy or strategy to realise its potential (Kane, Palmer, Phillips, Kiron, & Buckley, 2015). However, this pivotal role of policy in delivering e-transformation outcomes in key public sector environments, including finance, transport and public service, has been down played.

While research studies on the adoption of e-health technologies have been undertaken, research relating to the effectiveness of policies and regulation supporting adoption of these technologies in South African rural areas is limited. There are no prominent studies on how effective has policies and regulation supported the adoption and impact of motivational factors to adoption of the technology. Typically, there is less understanding of what motivates elderly persons to adopt and use these technologies, and what is required from policy makers and regulators.

The study aimed to investigate effectiveness of policy and regulation and motivational factors towards using of e-health technologies for elderly persons in South African rural settings.

The background and context of South Africa is explained in Section 1.2. Section 1.3 shares the global perspectives on e-health technologies, and Section 1.4 focuses on South African readiness for digital transformation and the world economic forum ranking. A summary of the research problem, research question, purpose, justification and significance is described below.

1.2 The South Africa Context to e-Health Technologies for Elderly Persons

This section provides an overview of South Africa elderly population above 65 years of age, health expenditure and current state of digital technology adoption. South Africa has a total population of 59.6 million, with 4.5 million elderly people (8.4 percent) (Stats South Africa, 2017). South Africa, similar to other African countries has a weak

public health service. The total expenditure on healthcare increased by 12% between 2018 and 2017 as reflected in Table 1 (Stats South Africa, 2017), but it is not known what proportion of the budget is spent on e-health technologies.

Table 1: South Africa Indicators

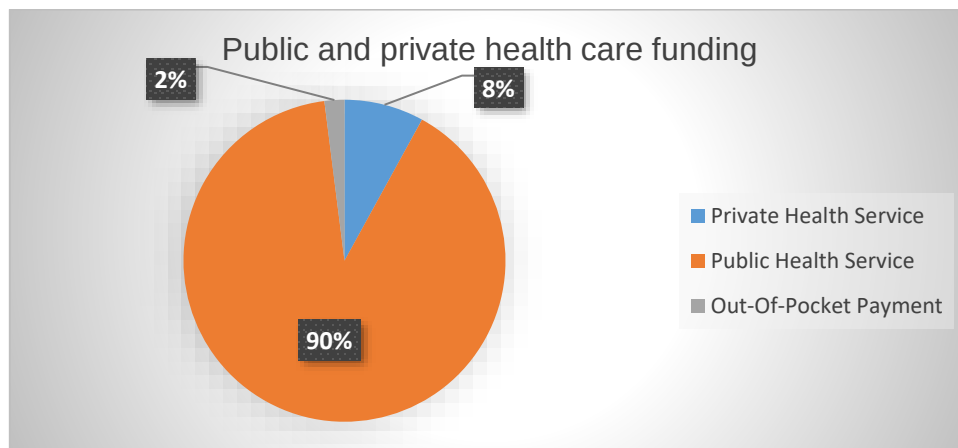
Indicator	2017	2018
Population(Million)	56.5	56.9
Total Health Expenditure (Rbillion)	182	204
%Allocation Change	12.3%	12%
GDP Growth rate (%)	1.4%	0.8%

Source: Statistics South Africa (2017) and National Treasury (2018)

A small portion of the population, sixteen percent (16%) or approximately 8 million, can afford private healthcare (DoH, 2012). For the majority of South Africans, private healthcare is expensive and relatively inaccessible as reflected in Figure 1. For example, health budget allocation based on 2017 MTEF was only R204 billion which is equivalent to R3642 per citizen per year calculating the figure based on a population of 59 million as presented in Table 1. This amount can invariably afford a small fraction of South Africa's population and prevents the government from offering a better quality of health care to citizens (National Treasury, 2018). To address the issue, in South Africa, e-health Strategy South Africa 2012-2017 was develop and it highlights the need to implement a national health insurance (NHI) nationwide to encourage long and healthy lives for all South Africans.

Furthermore, the World Health Organisation (WHO) (2015), reports a rapid change in terms of growth in the ageing of elderly persons, who needs sufficient health care systems. Life expectancy had increased over the years, and it is estimated at 65.2 years for males and 71.7 years for females as reflected in Table 2.

Figure 1: Public and Private health care funding



Source: DoH (2012)

Table 2: South Africa Assumed Life Expectancy Figures

Year	TFR	Male	Female
2008	2,72	63,2	70,4
2009	2,66	63,4	70,6
2010	2,61	63,8	70,7
2011	2,56	64,0	70,9
2012	2,54	64,2	71,0
2013	2,52	64,4	71,1
2014	2,50	64,6	71,2
2015	2,46	64,9	71,5
2016	2,43	65,2	71,6
2017	2,41	65,2	71,7

Source: Stats South Africa (2018)

Good health is centrally positioned within the 2030 agenda with one inclusive sustainable development goal (SDG3) which target major health priorities. Typically, poor health systems are a major obstacle in South Africa resulting in deficiencies in

universal health coverage. To address the concern of poor health systems, in 2005, the WHO made a call to all nations to develop e-Health strategy to drive e-health services to improve access to health services (WHO, 2005).

e-Health refers to the use of modern information and communication technologies (ICTs) for provision of healthcare services. It is about health services and information delivered through the Internet and related networks to improve healthcare locally, regionally, and worldwide using information and communication technology (Eysenbach, Boogerd, Arts, Engelen & Van de Belt, 2015). Furthermore, the essence of national e-health reforms is to affect the promotion of “equitable and more affordable health care” (DoH, 2012). Van Zyl (2016) affirms that the cost to afford treatment and medicine is a major barrier to healthcare access, because of the ongoing increase in the price of medication. The author further affirms that the historical perspective, financial, political disparities, health policies, social and economic conditions has affected the health sector. The government needs to reach, maintain and achieve the essential objectives of health, social, and environmental sustainability for all.

1.3 Global Studies on e-Health Technologies

As life expectancy increases, it poses challenges to government policies and regulations because maintaining the health and wellbeing of a population is a continuous requirement. Governments with limited resources would have to implement alternative solutions in the health sector to improve the quality of health services. Amsing (2015) put forth that there is an increasing challenge to meet with the current health care system, due to high costs and high load handled by the caregivers. Furthermore, Ehrenhard, Kijl; Nieuwenhuis (2014); and Demir, Hensel, Skubic, and Rantz (2008), argue that the public and private sector inclusive of ageing community in developing and developed economies need to prepare for associated high cost of health care. Ehrenhard et al. (2014) and Amsing (2015) proposed the use of health technology to alleviate the problem and improve quality of life. The author further highlights the issue of security and privacy to promote adoption of e-health technologies such as infrared sensors to identify the high-risk behaviour such as heart malfunction, patient not being able to breathe properly, patient forgetting to take medication, which could result in an impact on health.

The findings in Cisco (2015) and Brown (2015) qualifies that e-health technologies could alleviate incidents related to health issues such as sensory impairments, immobility, fall detection, and isolation. For example, systems such as infrared sensors to identify the high-risk behaviour. This is motivated by the fact that e-health technologies collect a comprehensive set of data, which could be sent to the medical professional for further analysis. Furthermore, this motivation is substantiated by Demiris et al. (2008), Vemasana and Vermeir (2014) who assert that the technology replaces the necessity for active data collection, which is more expensive.

e-Health technologies according to Caron, Bosua, Mayrand and Ahmad (2016) form part of digital transformation where health sensors are utilised to remotely collect and analyse health data. In 2014, the Gartner research group forecasted that 26 billion Internet of things (IoT) devices would be deployed by 2020, which is a 40% increment from the 15.7 billion (Cisco, 2015).

For this research, Brown's (2015) definition which he has adapted from the International Telecommunication Union (ITU-T) is adopted. According to the ITU-T definition, IoT is defined as an "ecosystem for information society which enables device interconnection of advanced services by physical and virtual connection through the use of existing and evolution of interoperable Information and Communication Technology" (ICT) (ITU & Cisco, 2015). Vermesan and Friess (2014) define e-health technologies as a wireless solution that collects the patient's health data from a variety of sensors by applying algorithms to analyse the data, and the collected data could be shared with the healthcare practitioner for further diagnostic analysis.

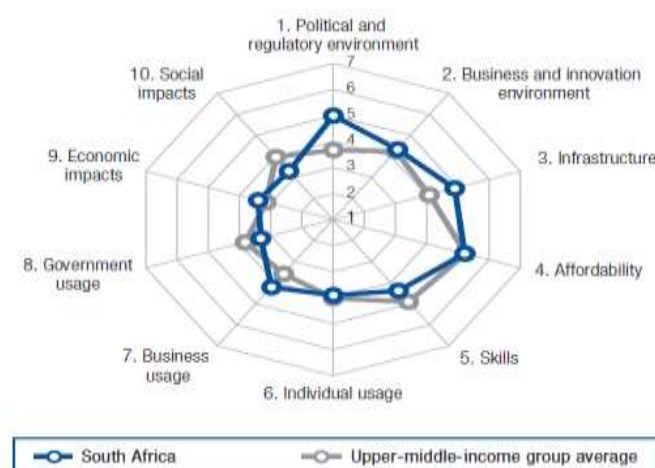
Furthermore, Cisco (2015) reports that vaccine distributions in developed and developing countries have been successfully monitored through the applications of internet protocol (IP) connected thermometers. Subsequently, out of hospital patients have been monitored off-site by the use of sensors and the collected data was sent to the hospital for daily recording purposes by the healthcare practitioners for diagnosis. Invariably, assistive technologies can contribute to the delivery of sustainable development goals by advancing living standards of elderly persons in retirement or private homes (Balta-Ozkan, Davidson, Bicket & Whitmarsh, 2013).

In the case of France, data was successfully collected and monitored on patient's daily activities using systems such as infrared sensors to identify the high-risk behaviour (Balta-Ozkan, 2013). In Australia, a project called “hospital without walls” was implemented which focused on the installation of wireless fall monitoring systems. Elderly persons were fitted with small sensors that measure heart rate and body movement (Dadd, Doyle & Gunaratnam, 2002). This wireless fall monitoring systems detect the incident and inform the health care professional in real time to avoid significant injuries or death.

1.4 South Africa's Readiness for Digital Transformation

According to Martin (2018), South Africa's ranking has declined with respect to the development of ICT infrastructure. Currently, South Africa is ranked 44 out of 139 countries in terms of ICT infrastructure and 105 in terms of digital skills usage by the government. Government level of digital skills adoption is low compared to other countries. Awareness to digital transformation is necessary to ensure South Africa readiness for fourth industrial revolution.

Figure 2: South Africa Network Readiness Index 2018



Source: Martin (2018)

In Martin's (2018) report, Australia was ranked eighth for both their government and public sector as leaders compared to similar economy in providing online services and permitting citizens to participate in e-participation. Australia has also been in the forefront in promoting digital transformation, and the government established a Digital

Transformation Office in 2015 to “transform government services, make services available digitally from start to finish” (Prime Minister of Australia, 2015).

Figure 3 is a photograph of an electronic pharmacy – or ePharmacy - facility deployed at the Alexandra Plaza Shopping Centre, Johannesburg, which has been described as an ‘ATM dispensary’. ePharmacy is one of the e-transformation innovations driven by artificial intelligence (AI). The innovation’s aim is to enhance health services delivery and to address barriers to accessing medicine in rural areas. The ePharmacy is a dispensary solution available in the residential areas 24 hours, which allows communities to collect medication at their convenience.

Figure 3: ePharmacy Facility in South Africa



Source: Timeslive (2018)

According to Martin (2018), in addition to broader plans such as the World Health Organisation and the National Development Plan (NDP) Vision 2030, the country has witnessed the publication of various ICT policies such as the e-strategy, Electronic Communications Act, and South Africa connect (2012). The NDP 2030 has identified ICT infrastructure as a “critical enabler of socio and economic development: (NDP, 2012) and it further incorporates a vision “that spans the entire ICT ecosystem from supply to demand stimulation quite extensively, with a specific focus on e-health” (NDP, 2012). Singapore continues to lead in terms of digital transformation, and the success was due to policies such as e-Singapore, prioritisation of electronic Government Action Inas (eGAP) and iGOV2010 and eGov2015 master plans (Martin, 2018).

1.5 Statement of the Research Problem

Various studies have eloquently investigated the effectiveness of policies and regulation, and motivational factors promoting adoption of e-health technologies. This innovations focus, in particular, on e-health and health services as a driver to improve quality of healthcare. One significant consequence of these technology innovations, in particular e-health technologies, has been the ability to improve the quality of life of elderly persons living in retirement homes. Hanna (2016a) argues for the need to understand the human, technology, infrastructure, services and policy aspects of e-transformation.

There are limited studies that investigate the security, privacy and motivational factors to adopt e-health technologies by elderly persons living in rural settings in developing countries. This gap in knowledge includes the absence of extensive literature on personal motivational factors, and on the policies and regulations needed to promote adoption of e-health technologies.

This study investigates the effectiveness of policies and regulations to promote adoption of assistive technologies. It is therefore necessary to gain a deep insight into the strengths and weaknesses of existing policies, including the impact to ensure the said policy is effectively implemented and sustained. The study further investigates the motivational factors to adopt e-health technologies.

1.6 Purpose, Justification and Significance of Study

The study investigated the effectiveness of policy and regulations as a tool in facilitating e-health technologies and motivational factors contributing to the adoption of e-health technologies in South Africa by elderly persons. In particular, the study focuses on understanding the perception of elderly persons to adopt and effectively use e-health applications to improve lives. The study further aims to understand the challenges and requirements for policy and regulation.

The specific study recommendations are significant for numerous stakeholders, including future researchers, policy-makers, relevant regulatory bodies, industry players and ordinary citizens. The data was gathered by conducting qualitative exploratory research to understand the technological context, individual context, and

the policy and regulatory contexts, which affect adoption of e-health technologies for elderly persons.

1.7 Research Questions

To investigate the research problem, this study sought to answer the question:

1. How effective are policies and regulations in promoting e-health technology adoption
2. Which motivational factors will promote adoption of e-health technologies in South Africa for elderly persons in retirement homes?

In order to answer this question, the study posed three sub-questions:

Sub-question 1

How effective are South African policies and regulation to promote adoption of e-health technologies?

Sub-question 2

Which policies and regulations could encourage the adoption of e-health technologies?

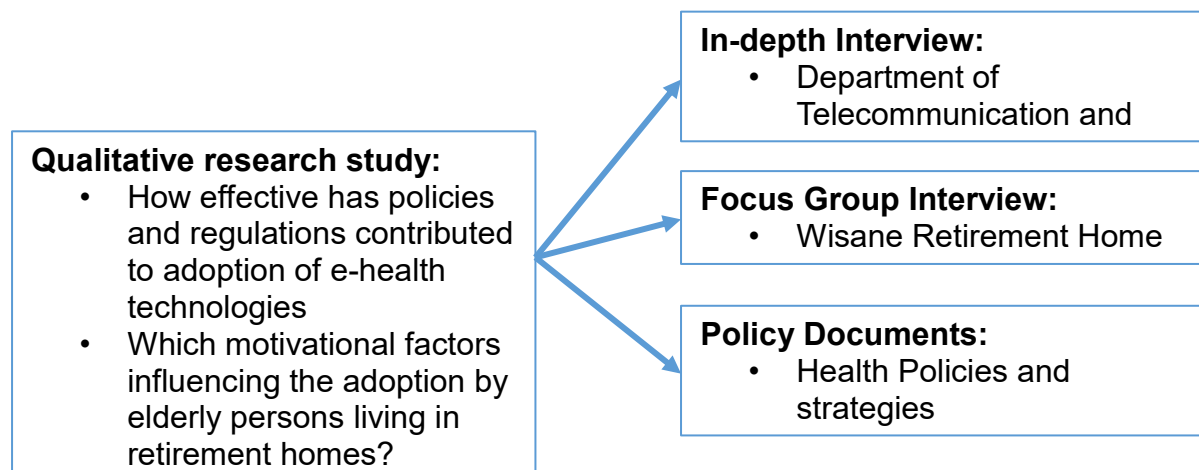
Sub-question 3

What are the individual motivational factors that influence adoption of e-health technologies?

1.8 Methodology Approach

This study applied qualitative methodology with in-depth individual and focus group interviews as depicted in Figure 4. A qualitative research design allows for in-depth probing of matters and detailed responses (Denzin & Lincoln, 2011). It also enables interaction with the participants because they are able to share their experiences as they lived it.

Figure 4: Research Setting



Source: Researcher (2019)

1.9 Research Theoretical Framework

This study investigates the adoption of e-health technologies as a strategy to improve health services and improve quality of life, and it employs constructs from the technology acceptance model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT) and the diffusion of innovation model.

Diffusion of innovation is an amalgamation of a number of different theories, which is applied to understanding technological innovation. Rogers (1983) describes the framework as a combination of four different categories, “innovators, early adopters, early majority, late majority and laggards”. The adopted frameworks initially investigate the motivational factors contributing to adoption of e-health technologies for elderly persons, and provides recommendations to policy-makers, regulators and industry.

1.10 Chapter Conclusion and Report Structure

WHO (2005) advocated that e-health technologies have become the pervasive contributor to people’s quality of life. This chapter provided a background to the study, motivation, and an overview of the methodology that has been adopted. The chapter 2 is a detailed literature review on the theoretical frameworks and the chapter details an integrated analytical framework to investigate policy and regulations and the motivational factors towards adoption of e-health technologies. Chapter 3 discusses the qualitative research methodology, the data collection approach, focus group interview, ethical clearance and concludes with the study’s limitations. Chapter 4

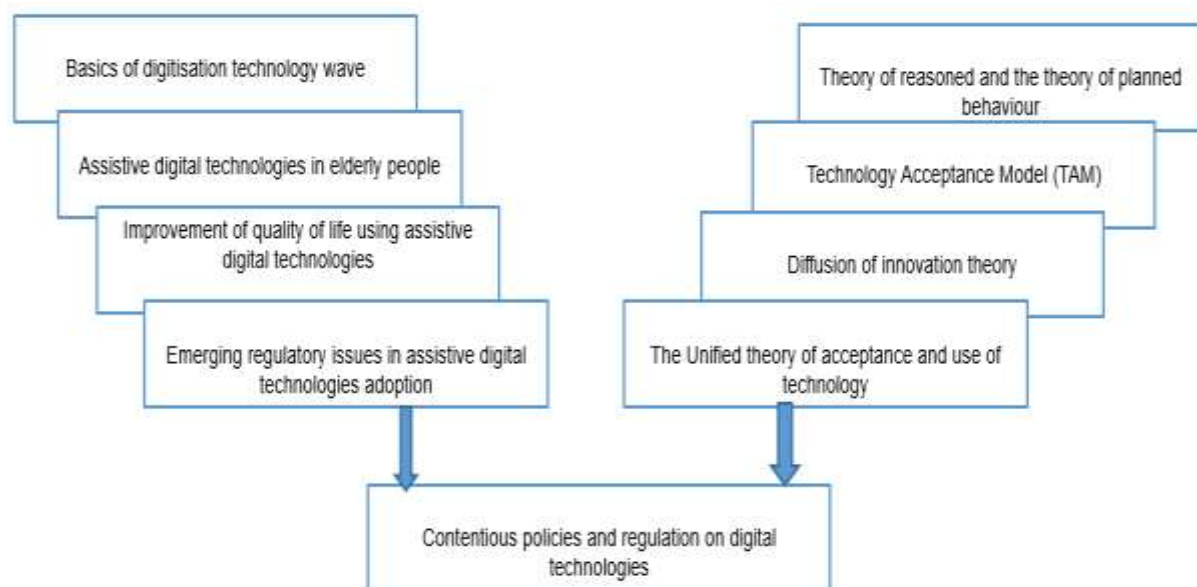
presents the individual and focus group interview findings. Chapter 5 details the analysis of the results linking them to the literature. Chapter 6 concludes the research study by reflecting on the recommendations, future study, and reflecting on the study contribution to the body of knowledge.

Chapter Two: Literature on e-Health Technologies Acceptance and Adoption

2.1 Introduction

The literature review employs an approach – illustrated in Figure 5 – where the main concepts are first introduced and described, leading logically into a discussion where the previously described concepts are analysed with respect to the objectives of the research.

Figure 5: Strategic approach to literature review



Source: Researcher (2019)

The rest of the chapter provides an introduction, critique, weaknesses, discussions, arguments with respect to three technology acceptance theoretical frameworks. Section 2.3 discusses the concept of digital technology wave and establishes the meaning in South Africa. The understanding of emerging e-health technologies, its services and application in elderly persons are introduced, discussed and different use cases and implication of e-health technology among elderly persons are examined in Section 2.4. Section 2.5 provides understanding of e-health technology and how the technology can be leveraged to improve the quality of life. It then provides an analysis of the emerging regulatory issues that enables or hinders the development of e-health technologies, which include security and privacy, current trends, legal frameworks and

developments of e-health technologies. Section 2.6 outlines the theoretical framework governing the research study and the review of prior studies. Finally, Section 2.7 concludes the literature review section with the review of prior studies and discussions around the theoretical frameworks.

2.2 Creating an Analytical Framework for e-Health Adoption, Policy and Regulation

The literature review was conducted to identify the theoretical framework applicable to acceptance of new technology and to source the literature relating to the adoption of e-health technologies. The outcomes of the literature review indicate that e-health technologies adoption is an extensively researched topic in the context of a digital solution to improve health care service and quality of life. Publication of empirical data and scientific outcomes are found in the literature documentation reviewed.

The search targeted sources such as academic journals, conference proceedings and conference papers, publications by research firms and research centres, books and databases. The literature search included literature published between 2012 and 2019 related to technologies that support elderly persons. Search terms included words such as 'technology acceptance model', 'e-health technologies', 'theory of reasoned action', 'smart health', 'e-health', 'smart home', 'assisted living', 'senior', 'elderly persons', 'telemonitoring', 'ICT', 'monitoring'.

2.3 Basics of Digitisation Technology Wave

Terra (2015) described digital transformation as

The process of shifting your organisation from a legacy approach to new ways of working and thinking using digital, social, mobile and emerging technologies. It involves a change in leadership, different thinking, the encouragement of innovation and new business models, incorporating digitisation of assets and an increased use of technology to improve the experience of your organisation's employees, customers, suppliers, partners and stakeholders.

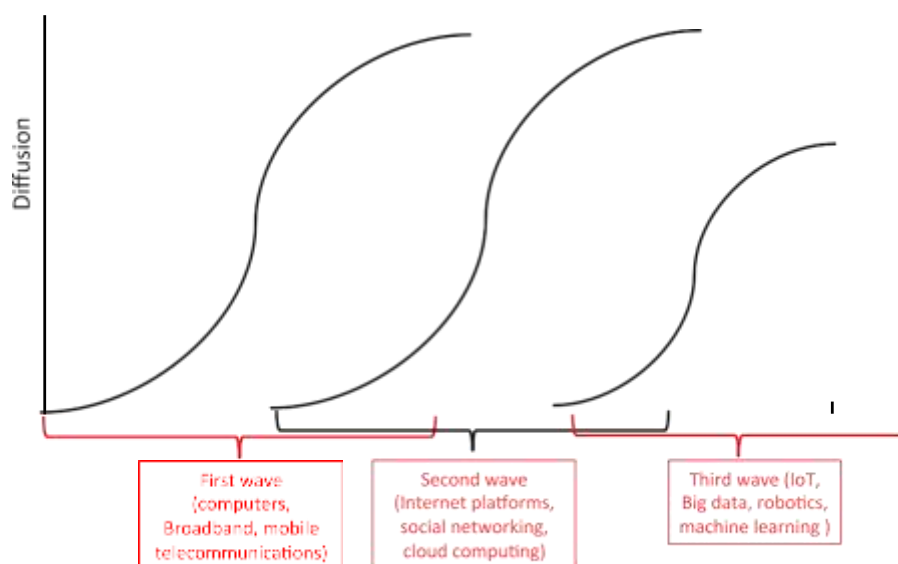
Policies, such as e-government, could drive the digital transformation in the health sector. Hanna (2010) argues that e-government policy should be embraced in the public sector as a media towards digital transformation, not "for superficial changes in public service delivery".

There are three waves of digitisation as advocated by Brown (2015)**Error! Reference source not found.** The first wave of digitisation is associated with the introduction and adoption of what today are considered “mature” technologies, such as management information systems aimed at automating data processing and applied to monitoring and reporting of business performance, telecommunications technologies such as broadband (fixed and mobile) and voice telecommunications (fixed and mobile) which allow the remote access of information.

The second wave of digitisation entails the diffusion of the Internet and its corresponding platforms (search engines, marketplaces), which enable the networking of enterprises to consumers and enterprises among themselves for purchasing of supplies, and distribution of output.

The third wave of digitisation entails the adoption of a range of advanced technologies, including big data collection and analytics, robotics, sensors, and artificial intelligence, and is aimed at enhancing information processing and the quality of decision-making, while further automating routine tasks within business enterprises and governments.

Figure 6: Digitisation Technology Wave



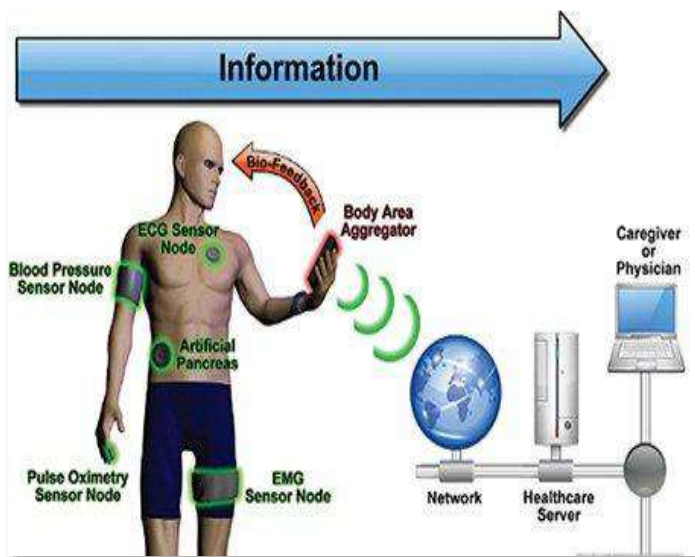
Source: Brown (2015)

2.4 Understanding e-Health Technologies in Elderly Persons

The World Health Assembly resolution WHA58.28 was adopted and e-health technology adoption became a high priority of WHO from 2005. The definition of e-health technology in this study is adopted from World Health Assembly resolution

WHA58.28 as “the cost effective and secure use of information communication technologies (ICT) in health related fields, healthcare services, knowledge and research” (WHO, 2005). Figure 7 reflects an example of e-health technology use. This is in line with the Sustainable Development Goals (SDGs) goal 3 to ensure healthy lives and promote well-being for all at all ages. WHO embraces the overarching objectives presented by ICT for e-health to promote good quality of health, rational approach to health, and encourage integrated health services for all.

Figure 7: Example of e-health technologies Use



Source: Suruthi and Nivetha (2016)

2.5 Benefits and Challenges Associated with e-Health Technologies

2.5.1 Improvement of Quality of Life Using e-Health Technologies

A review of the available literature provides rich examples of authors advocating benefits of e-health as essential technology to improve quality of life. Amsing (2015) proposes that there is an increasing challenge to provide good quality of service to users because of poor health care systems, lack of funding, high care cost, and high load handled by the caregivers. In South Africa the ratio of nurses to patients is 1 to 20 and the issue can be ascribed mainly to staff shortage and disparities of human capital in the public health sector (Van Rensburg, 2014). Furthermore, Ehrenhard et al (2014) and Demir et al (2008) points out that developed and developing economies with an increasingly aging population need to prepare for associated high

care cost. The author contends that there is a gap in the literature on how economies can provide quality of health care to the older population.

The studies conducted by Ehrenhard et al (2014) and Amsing (2015) suggest that the adoption and usage of smart health-care monitoring technologies can alleviate high care costs while improving quality of life. These solutions provide patients with independence, while limiting dependence on caregivers and family members. Examples of health care monitoring technologies include sensors that track a person's movement and location; sensors that measure a patient's physical health and track daily activities, such as recording their pulse; and sensors that alert a manager when a patient or caregiver forgot to act.

The digital transformation research conducted by the Gartner research group in 2014 forecasts that 26 billion IoT devices with sensors would be deployed by 2020 (Cisco, 2015), a significant proportion of which will be health monitoring technologies. Digital transformation in health, including digital devices such as fitness trackers which monitor daily activities and health patterns are being advocated by insurance companies as a solution to promote healthy living. Elderly persons can monitor and improve their health using fitness tracking devices. Malwade, et al. (2018), advocate that mobile wearable technologies can improve quality of life. They highlighted the barriers which could be linked to elderly persons diminished capability of the motor skills, limited memory, chronic conditions related to aging as affecting the intention to use the technology. Ehrenhard et al (2014) argues that smart home technology has been mostly successfully adopted in the affluent market. Equally so, it is important to examine contributing factors to user perception and preference for e-health technology in a diverse population living in South Africa.

2.5.2 Emerging Regulatory Issues in e-Health Technologies Adoption

Despite the extent of interest in health monitoring technologies, cybersecurity challenges to the adoption and use of these technologies exist. The design and configuration of some of the technologies is dependent on the internet infrastructure, which invariably is susceptible to cyber-attacks. The issue is further impaired by the fact that communication networks could be remotely attacked from anywhere in the world (Boyer & McBride, 2009). For example, in 2016, Standard Bank computer system was hacked from Japan where R300million was lost as a result. Unauthorised

access was used to gain access to the system and 3000 sets of personal data were used to generate new cards (Van Zyl, 2016). These attacks pose a threat to adoption and furthermore, result in a decrease in confidence and trust in the online environment by elderly persons.

According to Jacobson, Boldt and Carlson (2016) referencing Liu, Stroulia, Nikolaidis, Miguel-Cruz, and Rincon, (2016), security is defined as a platform which meets the “end-user requirements such as “honesty, accessibility and confidentiality”. Furthermore, Komninos (2013) affirms that application of the health monitoring technologies is reliant upon earlier technological advancements such as the Internet and wireless communication systems, which are vulnerable to cyber security challenge. The fact that communications systems historically are vulnerable to cyber-attacks makes cyber-threats almost inevitable in e-health technologies (Brown, 2015; Cisco, 2015).

In the study by Komninos (2013), advice is provided that security enhancements must be incorporated during the production of the technology to mitigate the risk of malicious software and hacking, which in turn could advance the adoption of the health monitoring technologies. Lee, Zappaterra, Choi and Choi (2014) provide a different perspective to the issue related to security, arguing that the devices implemented in the smart home environment do not support the standard security solutions and will be vulnerable to cyber-attack if the resource-constrained nature of the device is not addressed.

The Cisco (2015) report maintains that third-party organisations working on network infrastructure are entitled to access the stored data thus compromising the privacy of the end user. Even though legislation such as the Protection of Personal Information (POPI) Act protects the consumers there is still a concern on the storage of big data collected from the end-users devices and cross border data storage (The Presidency, 2013). In Europe, the European Union (EU) law regulation, General Data Protection Regulation (GDPR) Act 2018 (The European Parliament and the Council of the European Union, 2016) deals with data protection and privacy. The Act introduces strict consent to personal data collection such as the right to deletion of personal data, and the right to object or disagree to sharing of data. The government has further introduced fines for failure to comply if organisations do not put measures and controls

in place to safeguard collected data (The European Parliament and the Council of the European Union, 2016).

Balta-Ozkan, Boteler and Amerighi (2014) researched smart home adoption in three European countries, which have different policies and socio-economic contexts. In all three countries, privacy concerns, costs and reliability of smart home technology emerged as the barriers to adoption. In the study the question arose why the technology has barely been adopted despite its promised benefits to elderly persons. To respond to the question Ehrenhard et al (2014) conducted interviews and reviewed a case study of smart home implementation in the Netherlands. The issue of privacy was recorded as a significant concern (Ehrenhard et al, 2014). Amsing, Haan, Hoeymans and Khalesi (2014) examined privacy concerns with respect to the adoption of e-health technologies by using focus groups containing populations of different ages. The results concluded that elderly persons are more concerned about privacy of health monitoring technologies compared to the younger generation.

Amsing (2015) adopted a model to test the perception of health monitoring technologies in their homes by Dutch people. The model applied three main constructs, namely information control, perceived risk and subjective norm. The results showed that age had a direct correlation to privacy concerns with respect to data generated by sensors. The limitation to the model is that it did not test the security, usability and reliability of the technology. Furthermore, the study confirms that privacy and training are the main hindrances to the adoption of the technology and this study is also supported by Yusif, Soar and Hafeez-Baig (2016) in their study that privacy continues to be the barrier to adoption. Although the studies confirmed privacy as a hindrance to diffusion of the monitoring technologies, less is known in relation to South African elderly persons.

Although research has been conducted on the risks associated with health monitoring technology, there is still a gap in the literature to investigate how effective policy and regulatory with respect to privacy and security threats arising from e-health monitoring technologies.

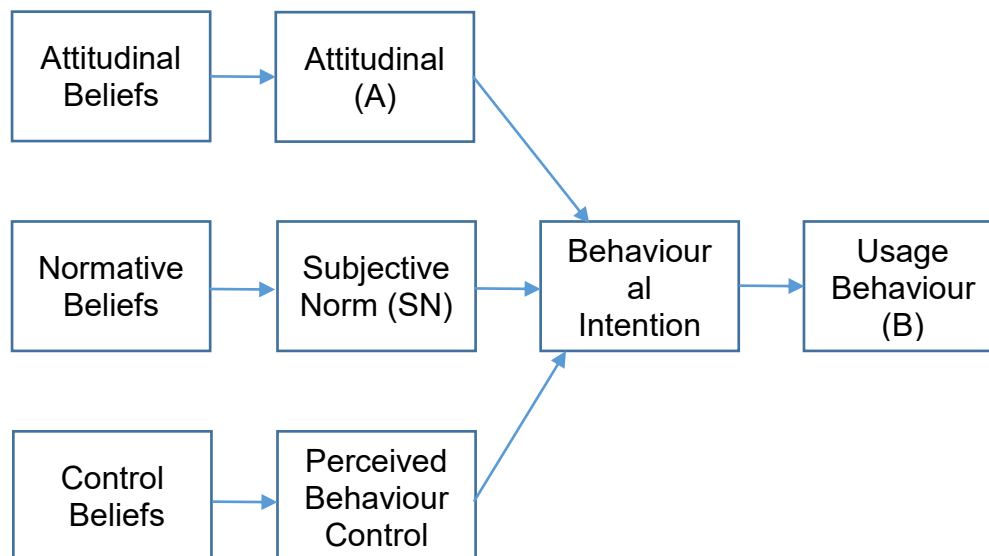
2.6 Theoretical Framework

The Unified Theory of Acceptance and Use of Technology (UTAUT) informed the research design, noting that the Theory of Reasoned Action, the Theory of Planned Behaviour, the Technology Acceptance Model (TAM), and the diffusion of innovation theory are all building blocks for UTAUT. The study adapts TAM and UTAUT to investigate the motivational factors with respect to the adoption of e-health technologies. The theoretical framework also includes emerging policy and regulatory issues.

2.6.1 The Theory of Reasoned Action and the Theory of Planned Behaviour

The Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975) consciously explains the determinants of intended behaviour and intention to adopt new technology. Moreover, Fishbein and Ajzen (1975) argue that an individual will attempt to perform a specific behaviour based on the perception of an assumed specific outcome because of performing the behaviour. The TRA did not consider factors outside individual control. TRA was reviewed and adjustments were made by Ajzen (1991) to create the theory of planned behaviour (TPB) by expanding the TRA to include an additional component, perceived behavioural control. The motivation was to include the factors that are outside a person's control that has a bearing in his or her intentions and behaviour. Several studies Ajzen (1991) and Fishbein and Ajzen (1975) have confirmed that TPB is suitable in the health-related field to predict the usability of health technologies as presented in figure 8. In the case of TPB, behavioural intention and usage behaviour is a summation of three variables, namely attitude (motivation), subjective norm and perceived behaviour control.

Figure 8: Theory of Planned Behaviour



Source: Ajzen (1991)

In this study, an example of perceived behaviour control would be a case where the health practitioner, the elderly persons person or family members, act to encourage the use of e-health technology to reduce the possibility of high risk incidents occurring. Such incidents could include falls, or high blood pressure. Even though TRA and TPB were applied in many IS applications, authors such as Davis (1985); Davis et al. (1989), Venkatesh, Morris, Davis, & Davis (2003) developed improved models, hence we discuss the Venkatesh et al (2003) TAM model and the UTAUT below.

2.6.2 Technology Acceptance Model (TAM)

User acceptance of advanced technologies remains a stimulating topic of study. Chuttur and Bradley (2009) emphasised that even though there have been many developments and advanced theoretical models, the TAM developed by Davis (1985) is still the most applied theoretical framework to “predict and describe intention to accept a technology” as depicted on Figure 9. Firstly, this section explains the contextual history by detailing the evolution of TAM, additions, applications and limitations. Secondly, it describes the variables, concepts and processes of the TAM.

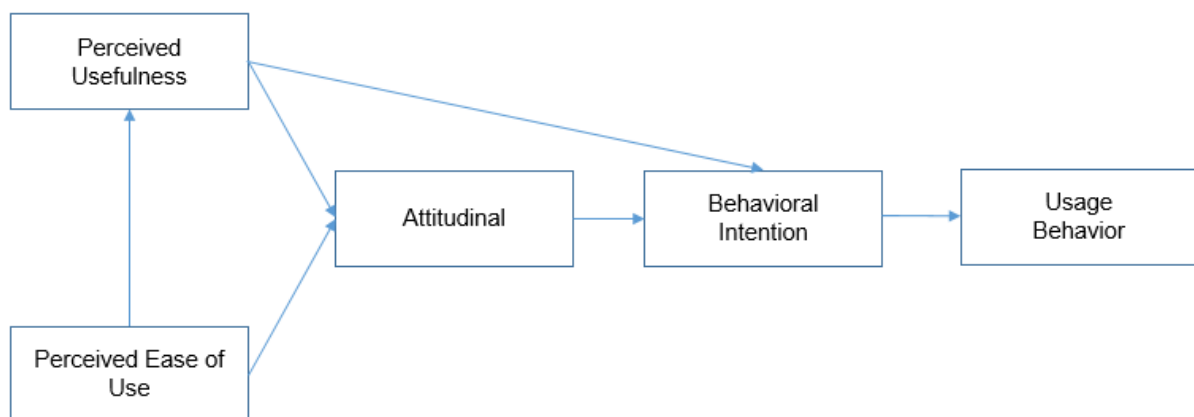
The Technology Acceptance Model is one of the models that evolved from the TRA, with the goal to

explain the determinants of computer acceptance. It is, generally, capable of explaining user behaviour across a broad range of end-user computing technology and

user populations. Meanwhile at the same time being theoretically acceptable (Davis et al., 1989, p.985).

On the initial model the author eliminated certain constructs such as “subjective norm”, because it is not easy to “separate direct effects of subjective norm on behavioural intention from indirect effects via attitude” (Davis, et al., 1989. Similarly to TRA, the model focuses on the relationships amongst behaviour intentions, actual usage, beliefs, attitudes, perceived usefulness and perceived ease of use. The TAM framework was extended to TAM2 in 2000, which included the end user output quality, demonstrability, job relevance, results and voluntariness (Venkatesh & Davis, 2000). The TAM framework does not take into consideration the technology-related concerns introduced by regulations, user characteristics and social influence. Since the TAM framework was developed in a different setting, it has limitations when applied directly to e-health monitoring technology acceptance (Chung et al. 2016).

Figure 9: Technology Acceptance Model



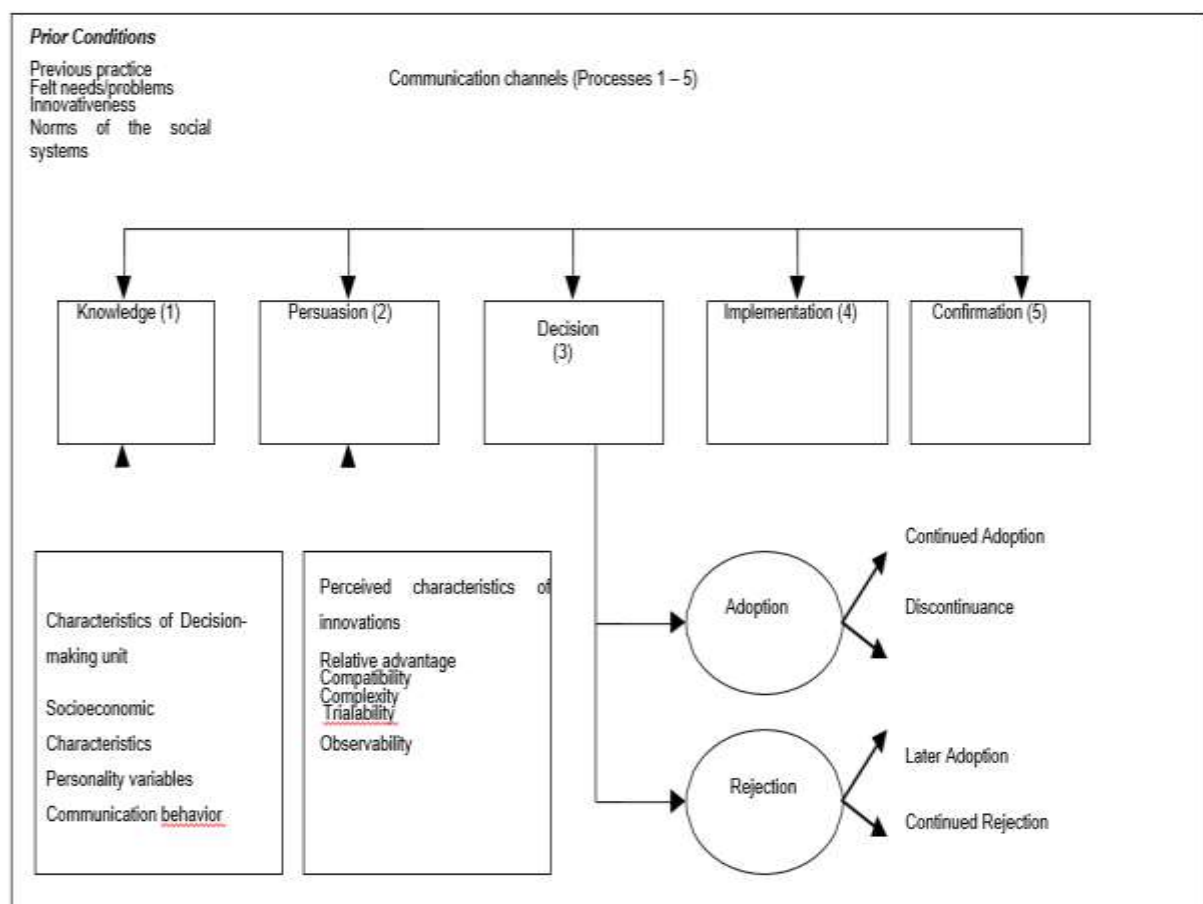
Source: Davis (1985)

2.6.3 Rogers Diffusion of Innovation Theory

In terms of understanding why end users accept the usage of a specific technology, various theoretical models have been used extensively in the field of information systems. Rogers (1983) developed a conceptual framework which analysed the diffusion of a new technology, known as the diffusion of innovation theory (DOI). It was found that three of the characteristics that had the most considerable influence were compatibility, complexity and relative advantage. According to Rogers (1983, p.267-299), individuals can be classified into four categories according to their adoption of

innovations, namely “innovators, early adopters, early majority, late majority and laggards”. Furthermore, he argues that individual’s attitude towards the innovation and its adoption is influenced by the following variables: “relative advantage, compatibility, complexity, trial ability, and observability” as depicted in Figure 10 below **Error! Reference source not found..** Although DOI was applied extensively in many studies, Dillon and Morris (1996) have cited that innovation diffusion theory alone cannot be used to examine the uptake and impact. To improve the study Dillon and Morris (1996), incorporated acceptance issues utilising the constructs and theoretical approaches omitted by Rogers (1983).

Figure 10: Diffusion of Innovation Process



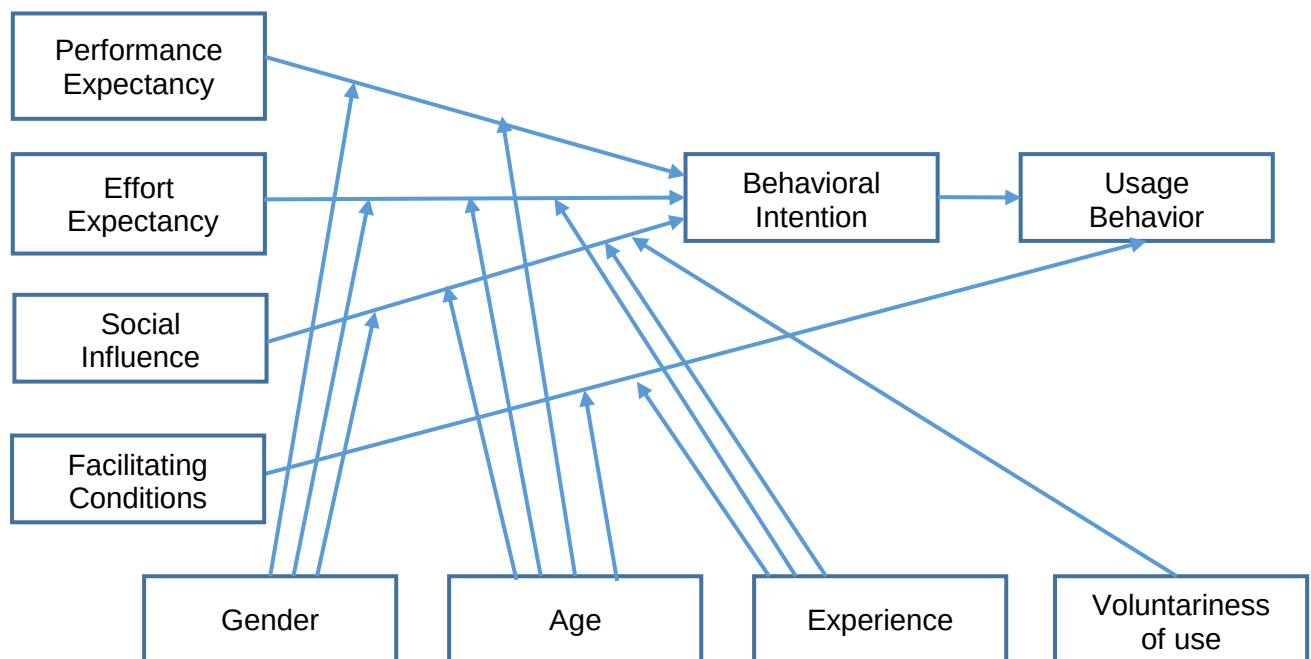
Source: Rogers (1983)

2.6.4 The Unified Theory of Acceptance and Use of Technology (UTAUT)

The Unified Theory of Acceptance and Use of Technology (UTAUT) was developed by Venkatesh, Morris, Davis, and Davis (2003) and presents a cohesive view of user acceptance and usage of new technology. The model was an initiative by Venkatesh

where he reviewed and integrated various theories into UTAUT which include TRA, TPB, TAM, TAM2, and DOI. UTAUT integrates four core determinants from eight prominent models of intention and usage with up to four moderators of key relationships. The four key “constructs, performance expectancy, effort expectancy, social influence, and facilitating conditions, affect intention to use...The key moderators can be classified as age of an individual, gender class, and experience” (Venkatesh et al. 2003).

Figure 11: UTAUT Theoretical Framework



Source: Venkatesh, Morris, Davis, & Davis (2003)

2.6.5 Analytical Framework for e-Health Technologies Acceptance in Elderly Persons

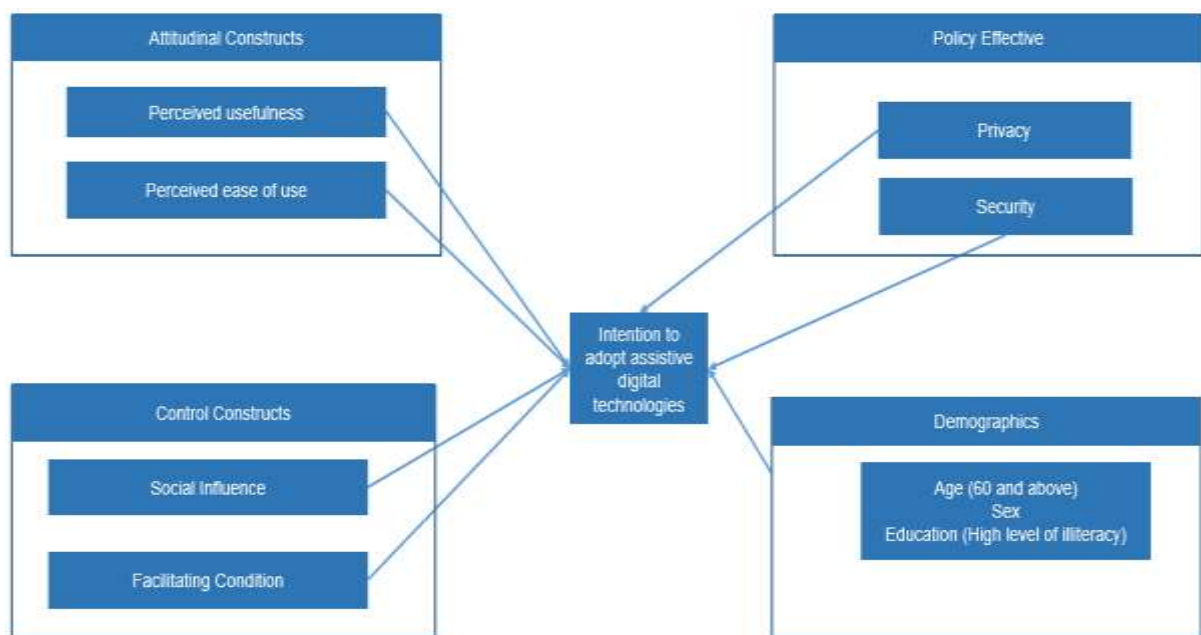
The analytical framework adopted for this study is an amalgamation of specific artefacts derived from UTAUT which incorporates all the other theories discussed above as depicted in Figure 11. These artefacts were selected based on the researcher’s view of their importance in the assistive technologies context for elderly persons, in relation to the research questions posed above:

- Firstly, the theoretical framework uses Intention to Adopt as its main focus, adopted from TAM and adapted to the context of e-health technologies;

- Secondly, the theoretical framework adopted constructs from TAM which are Perceived Usefulness and Perceived Ease of Use;
- Thirdly, Demographics, Social Influence and Facilitating Conditions were adopted from the UTAUT model;
- Lastly, Privacy and Security were adopted as constructs for the adapted framework, due to their importance in the literature on adoption, as discussed above.

The integrated theoretical analytical framework was developed based on previous models to guide the research and the research questions that are posed. The analytical framework will be used to analyse data and formulate emerging themes.

Figure 12 : Adapted Framework for e-health technologies acceptance for elderly persons



Source: Adapted from Davis (1985); Fishbein and Ajzen (1975); Venkatesh et al. (2003)

2.7 Chapter Conclusion

Evidence of research on the adoption of health monitoring technologies can be found in Chung et al. (2016) "Examining Korean and Korean American elderly persons perceived acceptability of home-based monitoring technologies in the context of culture"; Malwade, et al. (2018), "Mobile and wearable technologies in healthcare for

the ageing population”; Lee et.al. (2014) “Securing smart home technologies, security challenges, and security requirements”. This chapter presented key themes and ideas from the body of knowledge and the theoretical framework underpinning the study, adapting constructs from two generic frameworks to create a specific framework for e-health technologies acceptance for elderly persons.

Chapter Three: A Methodological Approach for Investigating e-Health Technologies Adoption

3.1 Introduction

This chapter discusses the research methodology employed in this study. It begins by contextualising the research problem in Section 3.2 and detailing the research purpose in Section 3.3. The research questions are posed, and the qualitative research approach then described and justified in Section 3.4 discusses the appropriateness of employing individual and focus group interviews to respond to the research questions and sampling methods and summarises the research design employed for data collection. Data collection approach including the pilot study and data analysis procedures are explained in Section 3.5. Approach to data analysis and transcript process is detailed in Sections 3.7 to 3.8. The chapter concludes with a discussion of the issue of data reliability, validity and ethical considerations in Section 3.9 and 3.10.

3.2 Research Problem Statement

Various studies have eloquently investigated the effectiveness of policies and regulation, and motivational factors promoting adoption of e-health technologies. This innovations focus, in particular, on e-health and health services as a driver to improve quality of healthcare. One significant consequence of these technology innovations, in particular e-health technologies, has been the ability to improve the quality of life of elderly persons living in retirement homes. Furthermore, substantial consequence of the emerging new technology is the societal impact where IoT is used on a large scale, supporting health practitioners in monitoring and managing individual health and wellbeing. The literature by Hanna (2016a) argue for the need to understand the human, technology, infrastructure, services and policy aspects of e-transformation.

There are limited prominent studies that investigate the security, privacy and motivational factors to adopt e-health technologies by elderly persons in rural settings in developing countries. This gap in knowledge includes the absence of extensive literature on personal motivational factors, and on the policies and regulations needed to promote adoption of e-health technologies.

This study investigates the effectiveness of policies and regulations to promote adoption of assistive technologies. It is therefore necessary to gain a deep insight into

the strengths and weaknesses of existing policies, including the impact to ensure the said policy is effectively implemented and sustained. The study further investigate the motivational factors to adopt e-health technologies.

3.3 Research Purpose Statement

The purpose of the research was to investigate and understand the motivating factors influencing adoption of e-health technology for elderly persons in a rural setting. The study also points out the motivational factors, policy and regulatory issues influencing diffusion of e-health technologies.

3.4 Research Questions

Given the context of the study and the theoretical frameworks that underpin the study, the research question posed was aimed at identifying determinants that contribute towards the adoption of e-health technologies for elderly persons. The literature review guided the formulation of the research questions, and as a result the research questions have been adapted, improved and finally developed from various studies including Chung et al. (2016); Brown, (2015); and Cisco (2015). As an outcome of this process the following questions, in respect of the central theme of adoption, benefits, challenges and emerging regulatory issues of e-health technologies in elderly persons are posed:

Research main question:

1. How effective are policies and regulations in promoting e-health technology adoption
2. Which motivational factors will promote adoption of e-health technologies in South Africa for elderly persons in retirement homes?

Research sub-questions:

- (1) How effective are South African policies and regulation to promote adoption of e-health technologies?
- (2) Which policies and regulations could encourage the adoption of e-health technologies?

- (3) What are the individual motivational factors that influence adoption e-health technologies?

3.5 The Rationale for Employing the Qualitative Research Approach

The study is broadly exploratory in nature, and this section outlines the qualitative methodology adopted to investigate motivational factors influencing adoption of e-health technologies. According to Cisco (2015), there is still a gap to extensively study technological and individual motivational factors that drives the adoption of e-health technologies for elderly persons in developing countries.

Bryman (2012) defines a research approach as an overall orientation to the conduct of social research and Creswell (2014) suggests that a research approach plays a fundamental role in social science studies. Creswell (2014) describes the research approach as a systematic procedure and plan for research, which provides action steps to detail methods of data collection, analysis and explanation.

The literature review provided a background and context with respect to what motivates the adoption of technology by elderly persons. Based on this ontological and epistemological perspective, the researcher decided to employ a qualitative methodology through individual and focus group interviews to gather empirical evidence to respond to the research question. At the outset of the literature, I was not sure about the position toward the phenomenon in which I was interested, but having done the literature review, it become clear on the methodology to use. The study applied qualitative research methodology because it tries to establish the understanding through in-depth interviews on particular people and events in specific social contexts. It provides perspective to understand why people do what they do or use the technology they use.

3.6 Case Study Research Design

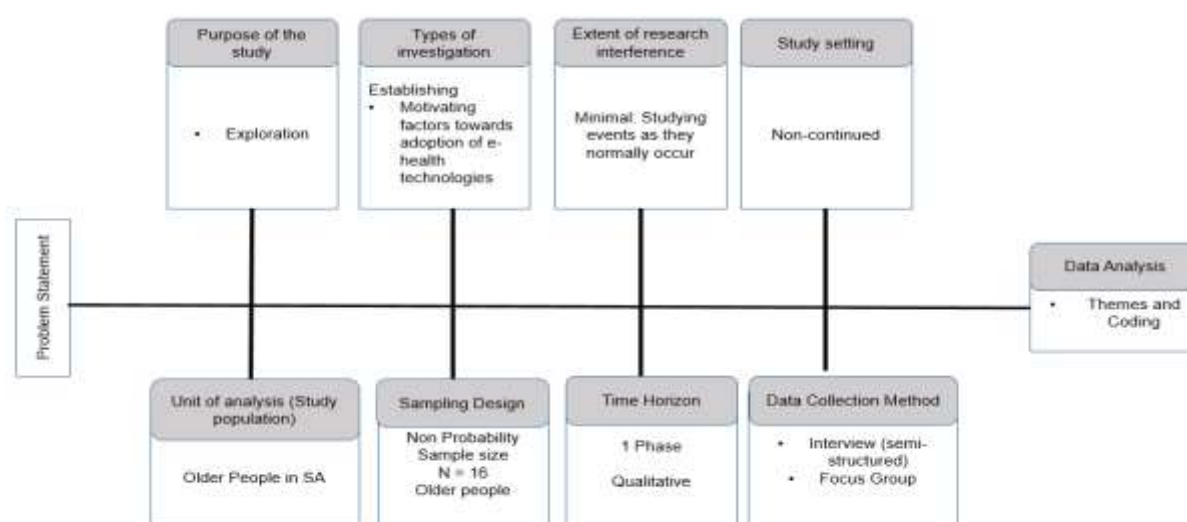
Research design, according to Bryman (2012), is an all-inclusive framework which the researcher utilises to collect and analyse data. A research design “is a logical blueprint that provides the linkage between the research questions, collection of data and the data analysis strategies” as affirmed by Yin (2011, p.7). The logic ensures the strengthening of the validity of the design and data accuracy. In other words, research design pronounces the kind of essential data, type of research methods to be used to

collect and analyse acquired data, and how the researcher responds to the research. According to Babbie (2013), research design is a detailed plan that involves all the steps of the successive research project. The purpose of the inquiry is also reflected in the research design.

By using the case study, the research was able to analyse the effective policy and regulatory perspectives in depth in health digital devices. Secondly, according to Bell (1987:6) the case study provided a prospect to the problem at hand to be studied at depth within a limited time frame. Lastly, it provide an in-depth picture of the policy development to promote the adoption of e-health technologies by elderly persons change taking place in higher education market with and analysis through multiple techniques to generate data from policy makers, elderly persons and document review, because a case study offers an opportunity to adopt ‘multiple methods’ (Yin, 1994)

Figure 13 illustrates the detailed research design applied for the study from the selection of the population to respond to the problem question. The research begins with defining the problem statement, followed by purpose of the research, research group, individual interviewees and finally analysis of data collected. The exploratory interview is used to extend the understanding of the motivational factors contributing to the adoption of e-health technologies in the light of the literature, theory investigated, and further research opportunities.

Figure 13: Research Design: e-health technologies Adoption for Elderly persons



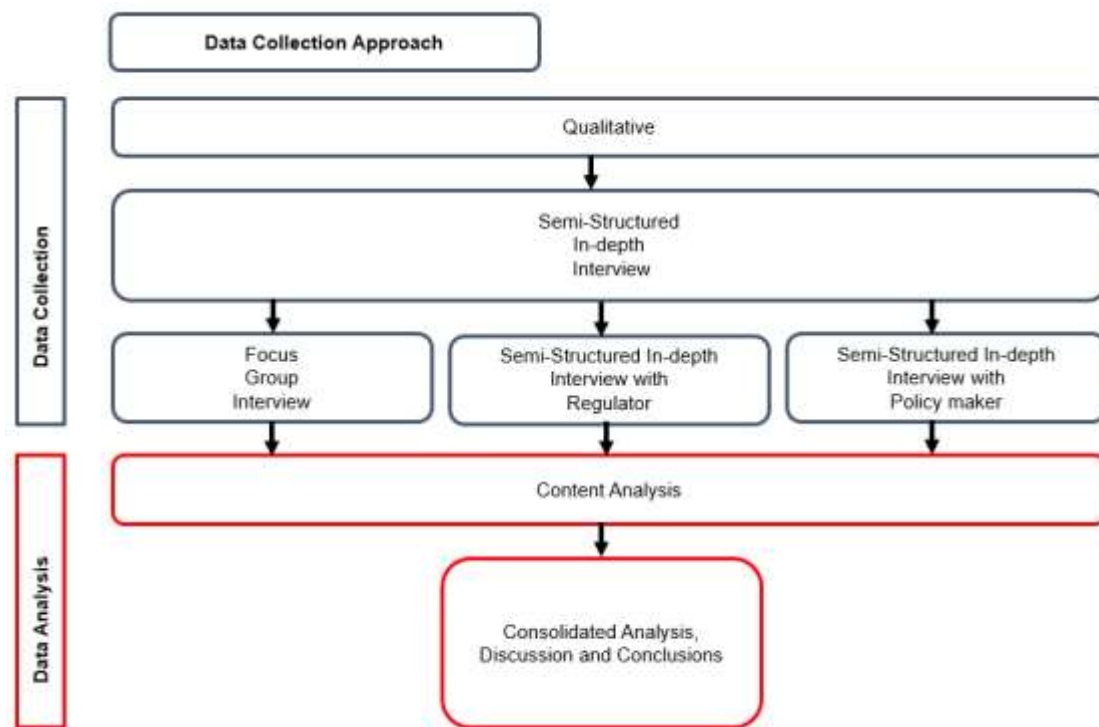
Source: Researcher (2019)

3.7 The Research Process and Data Collection

Approaches for gathering data ranged from in-depth interviews, document analysis and spending time in the rural retirement home setting to observe how elderly persons spend their day. An interview has the potential to yield data quickly in quantities, and it allows the researcher to understand the definition that day-to-day events represent for people (Marshall & Rossman, 2011). Yin (1994) holds the view that selecting the individual interview for the research has benefit. In this study, the participants are the actual adopters of the technology and they can provide perspective to the phenomena as they live it.

Parallel to interviews, the study reviewed policies, strategies and regulatory documents as outlined in Figure 14 which presents the data collection and data analysis process. Yin (2011) asserts that documents are a good source of evidence in that they are “constant, precise, unobtrusive, and have wide-ranging of coverage.” It was imperative to select the source of data collection, which will provide sufficient data. Adequate data was gathered from interviews and the policy documents were used to compare against the results from the interviews. Finally, the analysis of data relates to both sources of data and themes were generated to present study findings and conclusion.

Figure 14: Data Collection Approach



Source: Creswell (2014)

3.7.1 Development of the Interview Protocol

The literature review guided the design and development of the research questions and interview protocol. The interview protocol was designed to probe for the following central themes: technology perception, the benefits and barriers to adoption of technology and finally the policy and regulation around privacy and security (refer to Annexure C for sample interview protocol). Subsequently, a pilot study and peer review was used to test the interview protocol. The outcome of the pilot study is discussed below.

The study attempted to interview stakeholders for the national Regulator, however, the interview was not granted for reasons unknown to the author. Appendix G presents email from ICASA office.

3.7.2 Data from Policy-makers

Three semi-structured in-depth interviews were conducted with key policy makers from the Department of Telecommunication and Postal Services. The sample size determination of this category of people was based on the position held, officials who

are collectively responsible for internet strategy, implementation and usage monitoring, cyber security, and for the development, implementation and monitoring of the e-strategy.

3.7.3 Interviews with Elderly Persons Residing at the Wisane Retirement Home

Wisane retirement home was selected due to the economic environment, researcher familiarity with the area, limited access to broadband and health infrastructure deployed within the retirement home. Furthermore, residents are assumed to be direct adopters of emerging technologies. According to Yin (2011), “the focus groups are ‘focused’ because it gathers individuals who previously have had some common experience or presumably share some common views”. Data was collected from single focus group as Yin (2011) argues that for a “further variation, you may collect data from a number of focus groups, not just a single group”. The author further substantiates the argument that if one group can provide sufficient data, multiple groups will provide even more enhanced data.

An introductory letter was sent to the administrator at the retirement home to establish contact with participants (See Annexure D - interview protocol). A single focus group interview was conducted on 20 January 2018, and it took approximately one hour each. The focus group consisted of 16 respondents. The focus group interview was conducted in the local language (Setswana). Participants were given the opportunity to agree to the interviews and sign consent forms. During the interview the researcher used audio recording to allow easy transcription.

3.7.4 Summary of Timelines for Data Collection

Yin (1994) states that a pilot study provides conceptual clarification for the design. Initially, before the interviews, the researcher conducted a pilot study with departmental officials. In accordance with Yin’s (1994) proposal, the approach to select the participants was based on access and convenience since the reviewer was an employee at the Department. The formal individual interview followed upon receipt of acceptance of meeting requests from officials.

The interviews targeted officials from Department of Telecommunication and Postal Services responsible for strategy policy development, Internet access policy, and the cyber security bill. The in-depth individual interviews were held in person between 25

September and 13 October 2017. The interviews lasted approximately one hour and with the permission of the participants the interviews were recorded.

Focus group interviews were held with the elderly persons from the Wisane retirement home on 20 January 2018. Yin (2011) emphasises the need for a researcher to familiarise themselves with all aspects of the study. The researcher visited the retirement home twice to become familiar with facilities and people. The researcher started building relationship with the administrator to allow her to gain trust on me. The researcher interacted with the elderly persons during the first two visits and had conversations with the family members to understand the method of payments and subsidies.

Table 3: Summary of data collection process

Stages of data	When	Where	Why these institutions	What was done and how the data was collected
Stage1: Pilot Study	August 2017	Department of Telecommunication and Postal Services	• Familiarity • Geographic proximity • Convenience • Access and • Policy Perspective	• Pilot focus group interview with seven officials was conducted to review the questions and test the protocols. • Pilot in-depth individual interview with one official from policy-maker was done to test the in-depth interview protocol.
Stage2a: In-depth Individual Interview	September 2017	Department of Telecommunications and Postal Services	• Familiarity; • Geographic proximity • Easy access and convenience	• Access was provided by Director General since I was an employee of the department • Studied South Africa policy documents on technology, and websites; • Interviewed three officials
Stage2b: Focus group	20 January 2018	Wisane retirement home	• Rural retirement where I grew up.	• Contacted the owner of the facility to arrange access. • Access was provided by senior nurse • Interviewed 16 elderly persons and senior Nurse • I visited the retirement home twice to become familiar with the facility and environment and to prepare the setting before the interviews; • I interacted with elderly persons and the senior nurse to understand the operation model at the facility.

Source: Researcher (2019)

3.7.5 Mapping Research Questions to the Research Design and Theoretical Framework

In this section, research questions have been mapped out according to the research method adopted and to the theoretical frameworks employed as depicted in Table 4. **Error! Reference source not found.** The main research question employs interview criteria for the collection of data. The data is then interrogated and analysed using the constructs from the theoretical framework.

Table 4: Theoretical framework mapped with research questions

Research Question	Research Method	Research Instrument	Construct
Research Question: 1. How effective are policies and regulations in promoting e-health technology adoption 2. Which motivational factors will promote adoption of e-health technologies in South Africa for elderly persons in retirement homes?	Qualitative	In-depth interview and focus group	
1. How effective are South African policies and regulations to promote adoption of e-health technologies?			Privacy Concern Security Concern
2. Which policies and regulations could encourage the adoption of e-health technologies?			Privacy Concern Security Concern
3. What are the individual motivational factors that influence adoption of e-health technologies?			Perceived ease of use Perceived Usefulness

Source: Researcher (2019)

3.7.6 Pilot Study Interview

In August 2017, the researcher commenced with the pilot study with officials from the Department of Telecommunication and Postal Services to allow sufficient time to revise the questions before formal interviews. To prepare for the pilot interview, the relevant policies and regulations were studied. The interview protocol approved by the University ethics clearance process was applied during the interview. The pilot study interview lasted one hour and thirty minutes. The time constraints of the interview made it difficult to be prompt and probe questions consistently. Respondents were

permitted to talk without the guidance of the researcher, resulting in some irrelevant data. The pilot study assisted to develop confidence in the interview protocol and flow of the questions.

Lessons learned from the pilot study: The researcher monitored how far the questions provided insights and the responses. During the interview, the researcher learned to engage in a strategic interview with the participants. During the pilot interview, the researcher was able to establish at an early stage that the method used will not yield the desired results with the policy-makers. As such, the researcher was able to amend the approach before the interview with the formal focus group interview. The researcher's supervisor was available to observe and provide feedback to improve the interview approach. The supervisor cautioned that the interview should not be descriptive, however, it should ask for examples and probe for more clarity. The questions were semi-structured, and did not afford engagement, so to prepare for formal interviews the questions were rectified. The participants agreed to be recorded and the recording was used to improve the interviewer's skills.

3.7.7 Constructed In-depth Individual and Focus Group Interviews

The Department of Telecommunication and Postal Service was chosen because it is responsible for creating relevant policies and legislation for digital transformation in South Africa. The interviews were completed in September 2017. Yin (1994) argues that a sampling strategy is to use "key informants". The sampling of participants was based on two principles - the position, roles and responsibilities, most importantly those involved in policy related activities. Before the interviews with the officials, the reviewer arranged a meeting to explain the study objectives, request permission to interview and request for a convenient time for another meeting.

The focus group interview was carried out with elderly persons from the Wisane retirement home. Sixteen elderly persons and a senior nurse were interviewed. In preparation for the focus group interview, the researcher visited the retirement home, and sought the permission of the owner to interview participants. The consent forms and research information was shared with the owner during the first visit. Subsequently, the official interview documents were shared with the participants. The retirement homeowner assisted with the translation of the interview protocol to the local language.

3.8 Approach to Data Analysis

All audio recordings were analysed using the three-stage method of preparing the recordings for transcription, combining data into themes and data presentation (Creswell, 2007).

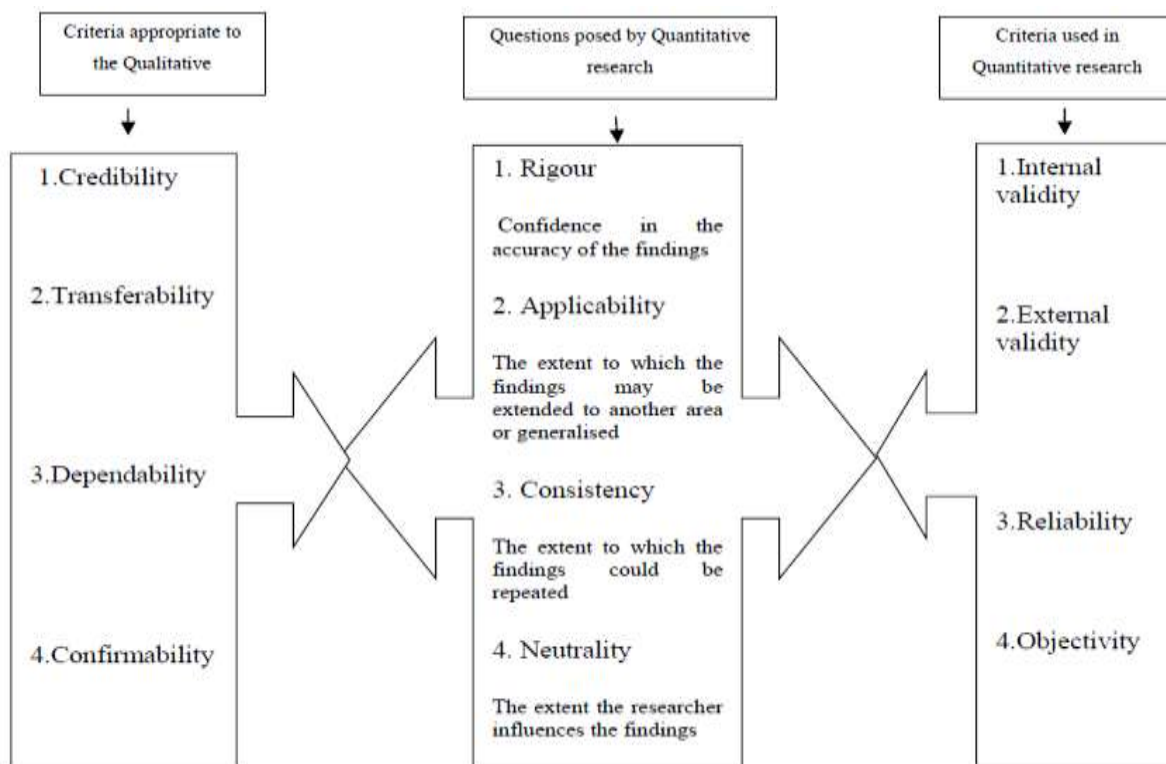
Firstly, the researcher listened to all five audio recordings a number of times to familiarise herself with the data while taking notes. All in-depth interviews were conducted in English, while the focus group was conducted in the local language, Setswana. Focus group audio recording was translated and transcribed in English. Secondly, the interview data were imported to the Microsoft Office and Excel to enable the researcher to generate codes and themes aligned to the research questions. A thorough check to ensure that the data corresponded to the research purpose and objectives was performed post transcription.

Lastly, secondary data were gathered from reports released from academic, public and private research organisations. The secondary data was used as corroborative evidence to support or disprove findings from the primary research, the literature review and the document analysis.

3.9 Data Trustworthiness

For the purpose of this study, the researcher followed the scholars Lincoln and Guba (1985) stand point whereby the term trustworthiness was applied to resemble the validity and credibility in qualitative research. Furthermore the authors propose four criteria to meet the term trustworthiness: “transferability, dependability, credibility and confirmability” (Lincoln & Guba, 1985) as depicted on Figure 15. The correlation of the criteria is further clarified with terminologies such as “internal validity, external validity, reliability and objectivity that have a link to the questions of rigour, applicability, consistency and neutrality” (Lincoln & Guba, 1985).

Figure 15: Trustworthiness process for the study



Source: Adapted from Lincoln & Guba, 1985

Based on Lincoln and Cuba (1985), to ensure credibility the researcher should engage the participants or have an “extended engagement”. In this research, the retirement home was visited three times before the day of the interview to ensure that the institution will provide valid and credible data.

Transferability is defined as an easy generalisability of the findings, which could be extended to another area. Lincoln and Guba (1985), encourages that validity cannot exist without reliability and therefore there is no credibility in the absence of dependability. Equally so, the qualitative research always seeks dependability that the results will be subject to change and instability. Furthermore, the authors concur, that dependability and confirmability are established through the auditing of the research process.

In order to strengthen the study credibility, transferability, dependability and confirmability the following three approaches or strategies as advocated by Hammersley (1993) are deployed “triangulation, facilitation and complementarity”. Triangulation relates to obtaining as many perspectives as possible in order to be in a

position grasp the elderly person's perception of e-health technologies. In this study, three types of triangulation were applicable, methodological triangulation, was obtained utilising various data sources such as policy documents, and interviews. Similarly, the study data collection was done through various sources including government officials, elderly persons and a senior nurse. Perspectives from different actors was analysed through theme comparisons. Creswell (2014) argue that qualitative research is conducted because of the objective to understand the complexity of the issue.

To achieve the facilitation process, qualitative research strategy was employed (Bryman, 2012). Complementary results were achieved through employing various methods and it helped to fill the gaps in data that were not accessible using the other approach (Bryman, 2012). Policy documents provided statements of the state policy, health strategies, priority goals and institutional values and ethics. Data from the interviews provided insights complementing policy documents into adoption of e-health technologies.

Before drawing conclusion, the reliability of data needed to be tested. In Chapter 3 the reliability of the applied instrument was described. To ensure reliability, data was grouped into specific categories to avoid arbitrary categories and furthermore, theoretical constructs were used to structure the findings. Peer review with colleagues was conducted to verify if the categories used were relevant to the research topic and the research question.

3.10 Ethical Considerations

The research followed the ethics compliance process for the University of Witwatersrand. It also complied with both Department of Telecommunication and Postal Services and the Wisane retirement home codes of ethics and principles. On initial contact with the target participants, it was established that permission was needed from the senior management for the interview to take place. Bogdan and Biklen (1992) contend that qualitative research imposes a "radically different relationship between researcher and interviewee, so much so that the process may actually require the drafting of a new code of ethics". The Department of Telecommunications has a code of ethics approved by the Minister for conducting social science research. The researcher entered into a formal written agreement with

the Department of Telecommunications, to ensure that the research is conducted ethically. The agreement had four points to adhere to, maintain anonymity, provide the Department with access to data if they were to request it and preserve data and audio recording for a period after the study. The signed confidentiality agreement was handed to the Deputy Director General's administration office for record keeping.

Because the respondents' names are not mentioned directly, it is not easy to identify the particular participants because the study indicated a collective role such as for officials. On the other hand, the retirement home did not have a specific requirement concerning the code of ethics.

The researcher adhered to the University's ethics requirements of maintaining the anonymity of the participants. At the beginning of the research, a proposal for internal ethical approval was submitted to the University. In order to get approval from the University ethics committee, a voluntary participation and consent form was included as part of the ethics approval process by the ethics committee. The University issued an approval for 24 months to allow the researcher access to the retirement home to conduct the study (refer to Annexure E). The interview process commenced immediately after the gatekeeper consent was obtained from the retirement home. Table 5 presents the compliance requirements per organisation.

Table 5: Requirements of Ethical Considerations

Requirements for Ethics Procedures	University of Witwatersrand	Wisane Retirement Home	Department of Telecommunication and Postal Service
Approval by Research Ethics Committee	Yes	No	Yes
Ethical issues always to be addressed in the proposal	Yes	No	Yes
Written informed consent	Yes	No	Yes
The confidentiality of information supplied by research participants	Yes	Yes	Yes
Research participants must participate in a voluntary way, free from any coercion	Yes	Yes	Yes
The anonymity of participants must be respected	Yes	Yes	Yes

Source: Researcher (2019)

Campbell (1997) emphasises that the researcher must treat all participants in the research process with respect. Furthermore, it is mandatory for the researcher to confirm that participants' agreement to participate in the research was both obtained and fully understood. This was done during the researcher's first visit and the official interview with the elderly persons at the retirement home; all potential participants were informed of the purpose of the research via the introductory letter. It was appropriate to offer confidentiality and anonymity to participants in the study to encourage openness and honest answers (Campbell, 1997). All data gathered was treated with confidentiality, and individual identities were replaced with codes, to avoid linking responses to specific individuals. The findings were presented in an aggregated form, which included the contribution of all the participants. According to Wiles (2013), the best method is to define the participants' names by providing "fictional names" or applying pseudonyms. In this study, I have given the participants a code name and numbered them as depicted in Table 6.

Table 6: Fictional Names

<u>Individual Interview</u>	<u>Policy-maker</u>
Policy-maker 1	PM1
Policy-maker 2	PM2
Policy-maker 3	PM3

Source: Research (2019)

It is noted that full confidentiality cannot be given with respect to focus group interviews, because the participants know each other. To my knowledge, the study complied with all relevant school guidelines and standards of research to ensure credibility, reliability and trustworthiness.

3.11 Chapter Conclusion

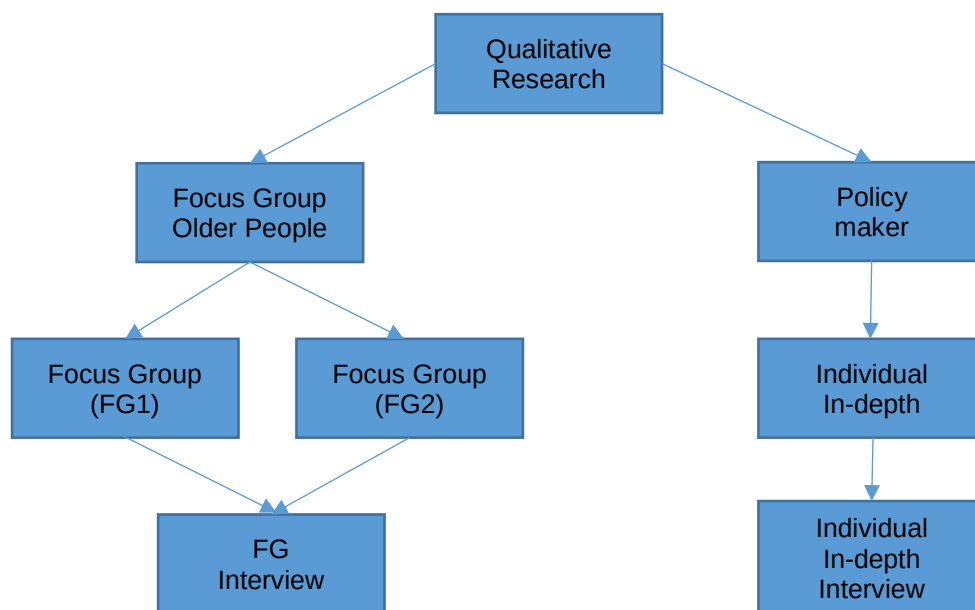
This chapter highlighted the case study methodology employed and the reasons for the approach.

Chapter Four: Presentation of Data on e-Health Technology Adoption Investigation

4.1 Introduction

This chapter presents the data gathered from sources identified in the methodology described in Chapter 3. The data will be analysed in chapter 5 to answer the question outlined in the problem statement that other researchers have not yet explained. This chapter is organised into two sections. The first section presents findings from the focus group interview with residents from the Wisane retirement home in Hammanskraal. The second section provides findings from individual interviews with the policy-maker.

Figure 16: Research Respondent



Source: Researcher (2019)

4.1.1 Sections Structure, Patterns and Interpretation

In these sections, to point out significance and explanation of findings, bar graphs, figures, diagrams and tables were used to present and interpret the outcome of the interviews. Since this is an exploratory, qualitative study, and noting the very small sample size, the graphs and percentages are merely indicative of respondent's views, not representative with respect to elderly persons in other retirement homes.

4.1.2 Theoretical Framework Discernments

The analysis of collected data was delineated by the theoretical framework presented in Chapter 2 which is an amalgamation of artefacts derived from UTAUT which incorporates all the other theories

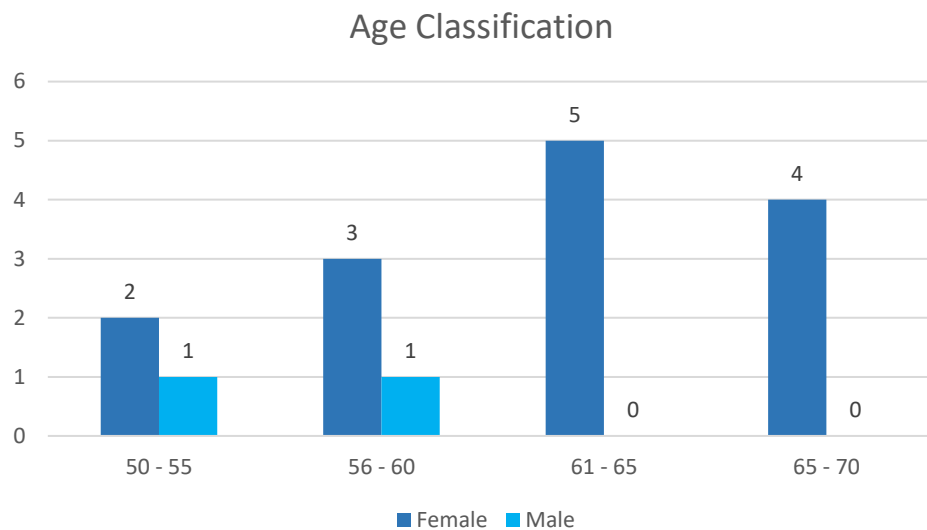
4.2 Profile of Participating Organisations

Since the study focused on a population with the following characteristics: previously disadvantaged group, limited financial resources, illiteracy, and dependency of government health care, Wisane retirement home from Hammanskraal rural community was nominated for the purpose of the study.

4.2.1 Demographic Information of Institution Under Study

Wisane retirement home is a self-funded institution managed by a former senior nurse. The owner of Wisane retirement home identified a gap in the market with respect to providing elderly persons with a safe and secure retirement home. The residents at Wisane are from different areas around the Tshwane district. The residents use their South African Social Security Agency (SASSA) benefits to pay for health services, accommodation and care received. Sixteen people over the age of 60 participated in the single focus group sessions. Twelve of the participants were female, and four were male. Figure 17 summarises the demographic information of the study participants.

Figure 17: Descriptive Population Sample



Source: Researcher (2019)

According to WHO (2005), an elderly persons person is classified as a person who is above the age of 60. The representation of participants was equitably distributed from age 60 and above. From a total of 16, only three participants were able to speak and articulate themselves. Five were able to speak, but the responses were not relevant to the study meaning they were not in a position to respond to the open-ended questions. As such, the operational questions had to be modified to enable participants to respond using body language and closed-questions which allowed a 'Yes', 'No' or 'Maybe' response.

4.3 Institutional Perspective and Insights Retirement Home

This section presents key data obtained from the interview with focus groups following the qualitative methodological approach discussed in Chapter 3. Additionally, participants were presented with pictures of different e-health technologies, an explanation on their functions, how data is transmitted, and technology usefulness. The objective of the approach was to present the technology features, facilitate the understanding of what the technology looks like, how the technology functions and how data is transmitted and stored. The interview protocol was developed to guide the interview process. For each research question, multiple operational questions were developed and furthermore linked to theoretical framework construct. During the interview stage, it was observed that the elderly persons were not in a position to

respond verbally or precisely to the questions. The interview approach was modified to accommodate limitations arising from elderly persons capabilities to express themselves and communication barriers to mitigate the risk of obtaining incorrect data. As such, a questionnaire approach was adopted to allow Yes or No responses. From the focus group, the session lasted on average fifty five minutes.

4.3.1 e-Health Technology Perceived Ease of Use and Usefulness

In their work, Venkatesh and Davis (2000) extended the TAM model to include external factors such as experience as one of the attributes to perceived usefulness of a new technology. In their study they found a high correlation between experience and perceived usefulness; they established experience has direct relation to perceived usefulness. Questions related to experience were structured to guide the responses.

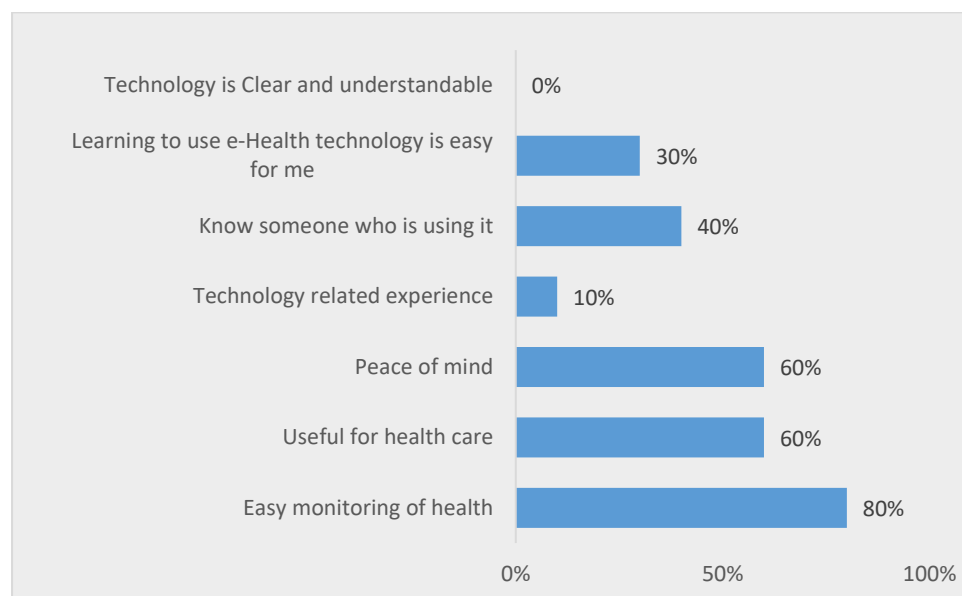
This section narrates the responses linked to perceived usefulness and ease of use of e-health technologies as presented in Figure 17. In relation to question 6 of the interview guide, this was the operational question asked, *How easy or difficult will it be for you to use e-health technologies?* “*Do you perceive it'll be easy to learn the new technology, e.g. alarms to caution care giver?*”

All respondents (100%) had no confidence in their ability to use e-health technologies. Meanwhile, 5 out of 16 (30%) indicated that it would be easy to learn how to use new technology and 11 out of 16 (70%) reported it would not be easy.

Typically, the results signifies that there was little experience of e-health technologies with 14 out of 16 (90%) participants indicating that they were unfamiliar with the technologies before showing the picture. After showing elderly persons pictures, of the 16 participants, only two (or 10%) indicated they had used sugar diabetes monitoring sensors, and they know about wrist belts. The technology that was indicated as unfamiliar were the sensors which are installed within the body of patients. When asked how useful the technology is or will be in their daily life, an operational question was asked *How do you feel about using e-health technologies, for example, sms notification of wellbeing?* Of the 16 elderly persons interviewed, 10 (60%) of the respondents perceived most of the technologies such as activity monitoring systems like alarms and sms notification to be useful in older care. Six respondents (40%) were not convinced that the technology would be useful in health care. Furthermore, 6 out

of 16 (40%) respondents indicated they would use the technology if they know someone who is using it.

Figure 18: Perceived ease of usage and Usefulness



Source: Researcher (2019)

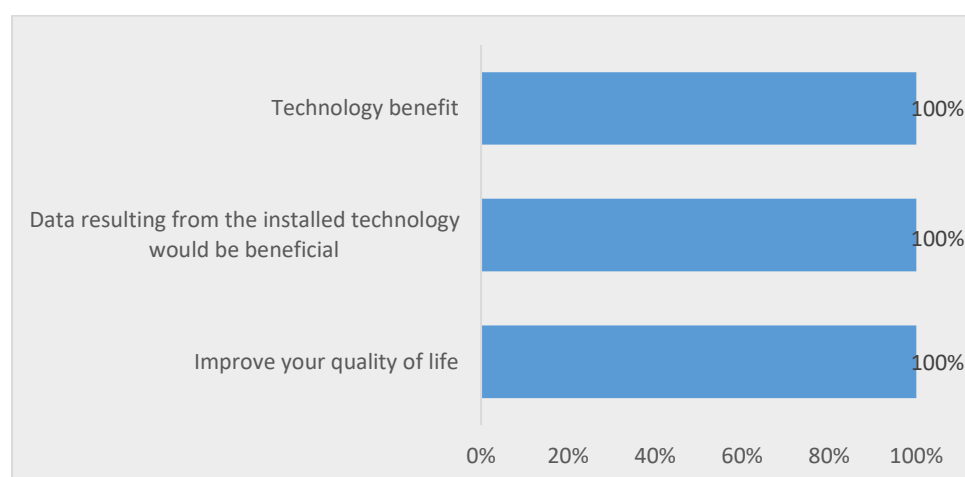
4.5 Benefits and Barriers to e-Health Technologies Adoption

Figure 19 depicts factors contributing to the adoption of e-health technology for elderly persons. To assist the respondents, the following lead question was asked, *What are the benefits and challenges that you would consider in adopting e-health technologies?*

4.5.1 Benefits e-Health Technologies Adoption

With respect to benefits, all respondents from Wisane retirement home agreed that data resulting from the installed technology that reflects how active they are would be beneficial. When asked a question whether the technology could help them if they fell, 16 respondents (100%) confirmed they believe the technology would help them because when they fall and are helpless, they could be detected in time. All respondents believed the technology would improve their quality of life as reflected in Figure 19.

Figure 19: Benefits of adopting e-health technologies



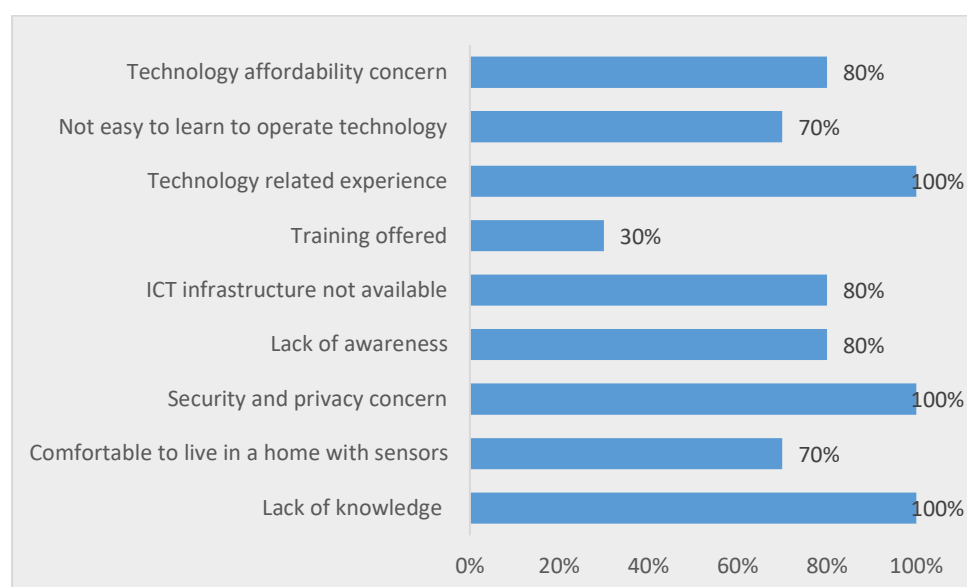
Source: Researcher (2019)

4.5.2 Barriers to e-Health Technologies Adoption

This section outlines factors categorised by respondents as barriers to the adoption of e-health technologies. To prompt responses from older participants the interview guide (see Annexure D) was applied and results are presented in Figure 20.

A large proportion of elderly persons 13 out of 16 respondents (80%) indicated a lack of awareness of the benefits of technology. However, when pictures of the sensors or applications (see Annexure J) were shown to participants, 6 out of 16 respondents (40%) indicated they have seen or were presented with the technology by family members or health practitioners. Sensors collecting health information of patients were relatively unknown, this was evident as represented by 3 out of 16 (80%) respondents indicating little knowledge of them or not being aware of any adopters of the technology. Furthermore, 13 out of 16 respondents (80%) indicated the cost of the technology as a barrier to adoption since they depended on a pension fund. Although all respondents indicated a willingness and perceived need to adopt the technology, the majority (100%) of the respondents were not comfortable with adopting the technology because of privacy and security concerns. The concern of privacy in terms of data being exposed and accessed by the third party appeared in all participants responses.

Figure 20: Barriers to adopting e-health technologies



Source: Researcher (2019)

None of the participants had indicated that e-health technologies are useful to them. Figure 20 shows that 13 out of 16 respondents (80%) reported a lack of infrastructure in rural health institutions as a concern. When asked if they will consider using the technology in the future, 30% responded positively, indicating if there is training provided or assistance they will adopt. However, 11 out of 16 (70%) respondents indicated that it will not be easy to learn to use the technology. A high proportion, 16 respondents (100%) perceive the Internet not to be user friendly and lack the knowledge to use it.

4.6 Institutional Perspective and Insights from Policy Makers

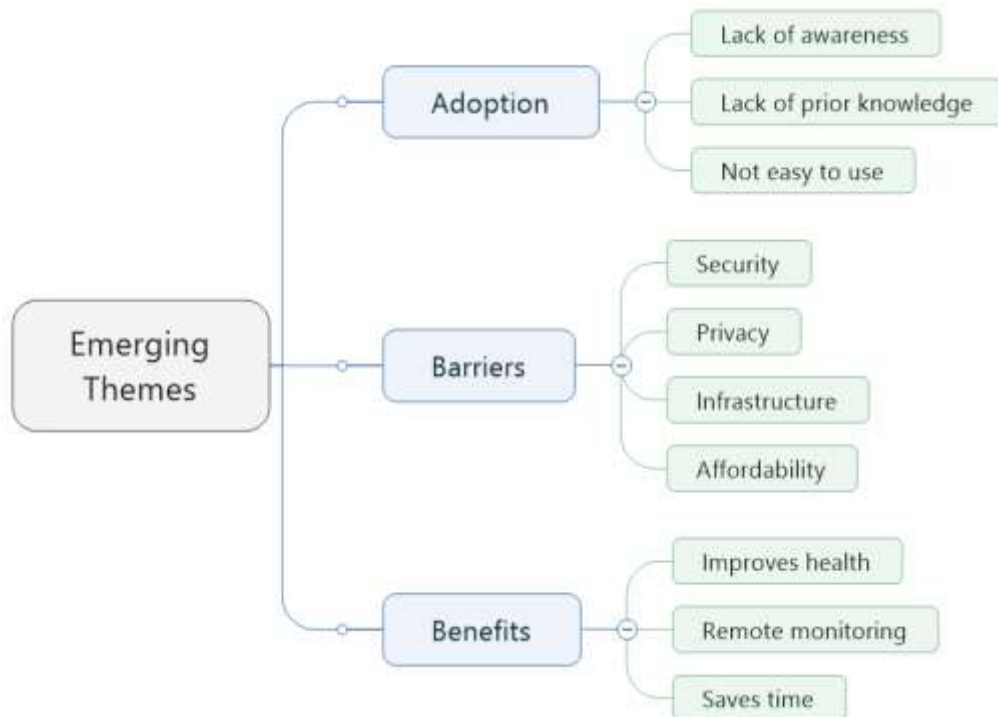
This section presents key data obtained from interviews with three respondents from the DTPS. The third engagement for collection of data was intended to be officials from ICASA. Unfortunately, ICASA rejected the request to participate without providing any reasons.

Five main themes emerged from among the many themes in the interview data:

- e-Health technologies promotion by the government,
- Benefits and barriers to the use of technologies,
- Security and privacy concerns,

- Perception of technologies,
- Affordability of technologies.

Figure 21: Emerging Themes



Source: Researcher (2019)

4.6.1 Facilitating Conditions by the Government

This section explores in greater depth the data findings from in-depth individual interviews in relation to the emerging theme: satisfaction with current health care services. The following prompt questions were posed to participants: *What interventions are required from the government to promote the adoption of e-health technologies? What are your views on the role that the government has played in addressing the adoption of e-health technologies challenges?*

Based on PM2 reaction, the issue is categorised in two folds. Firstly, the financial constraints to provide health care services to elderly persons. PM2 indicated that there is no sufficient resources in the medium term expenditure framework (MTEF) allocation from national treasury towards health care services. While the government is assisting the retirement homes where possible, the gap is invariably extensive. PM2 acknowledged that the digital divide is caused by lack of funding and sufficient

investment from the government. The government has a cap on the increase of fiscal towards health on every MTEF.

Secondly, the lack of implementation of policies, and legislation, appropriate to improve quality of life has contributed to the problems in the health sector. As such, government has a role to play to ensure the policies and regulations do support the implementation of e-health technologies.

PM2 advocate for improvement of quality of service, the quality of nurses, and the quality of nursing academy. PM2 stressed in his own view that there are policies and regulations such as e-health strategy, however the promotion of e-health technology lack implementation. Consequently, minimum achievement was realised with the implementation of e-Health strategy to drive better health care. The issue PM2 and PM2 brought forward was the implementation at the institutional level. PM2 pointed out that the success of the policy life cycle depends on the complete life cycle of the policy, from development, implementation and enforcement of regulation.

One of the respondents, PM3 emphasises that policies which are meant to facilitate adoption are available. However, they have not been implemented. One of the participants who is working closely with the Department of Health indicated that the strategy is under review. The reason provided was that it did not incorporate the latest digital transformation trends such as IoT.

So, ensuring that we have policies and also, not just policies that just sit there, but policies that are implementable and that to ensure we promote confidence in the use of these technologies.

According to a respondent, even though the World Health Organisation in 2012 encouraged developed countries and developing countries to develop e-Health strategies, the execution and implementation of the policy remain hindered.

The lack of proper feasibility studies featured as a hindrance to the proper development and implementation of strategic policies. PM2, shared her experience during the development of the e-strategy policy.

You know we did the e-strategy without doing any e-readiness? And besides, you know government and the pressure that the politicians wanted. So the

methodology that we adopted is in not the ideal one where you're saying "This is where I found them, and this is where I want to take them.

The government can intervene by implementing data pricing regulation to allow elderly persons to afford digital devices which require network connectivity. Even though, the government has recommended a, "wait and see approach" in the ICT White Paper 2017, PM3 strongly believes that intervention is immediately needed. A similar, approach that has been initiated within the South Africa Connect Policy to encourage low costs to communicate can be implemented to drive the adoption of digital transformation, as described by PM3, "I think the first thing is to get the regulations that can make these issues affordable".

The interviews and policy documents provided evidence that there is a need for a transition period to adopt the digital transformation by both health care and patients. PM2 shared her view that there is resistance to change and to the adoption of new technologies by health care practitioners. The following quotation is an illustration of the view.

Where nurses will be able to do that- because the uptake of technology in this country in the clinics is not at the level that one would like. But if maybe some assistance is available at the clinics – where a nurse is able to take this and then share with the Doctor at another level instead of patients going to the clinic.

Policy-maker responsibility is not to foster the development of e-health technologies as cited by one of the policy-makers (PM3). These phrases support the statement "government is not in the business of selling technologies, but I think government must create policy environment that is directed for people to be able to deploy the technologies".

Furthermore, PM2 indicated a need for government to subsidise the technologies for people who cannot afford them. It was clear that the government is currently subsidising certain technologies such as those used for diabetes as explained by the respondent,

Then, in other words, it means the hospital should be the one that is giving people these monitoring tools. ...But with diabetes they do, they give them-if they inject themselves- they give them those monitoring things. (PM2)

4.6.2 Affordability of e-Health Technologies

One of the respondents (PM2) indicated that it is important for the government to develop the law to regulate the IoT industry and support elderly persons. If patients could receive substantial financial support from the government to purchase sensors, the adoption of sensors can improve. PM2 provided a view on cost as follows: “So, I think the overall cost of ICT is an issue that I think government will be an interested part create standards or regulatory framework”.

The financial status of those who can afford and those who cannot determines the adoption of e-health technologies despite opportunities being there, consequently, retirement homes in urban areas are most likely to have sensors as compared to the rural retirement homes. PM3 provide a view below around digital divide:

My mother in law is staying here, and she can use a cell phone, as well as smart-phones easily. So for people like her, in affluent communities, it will be more beneficial, and the other issue is that some of these monitoring tools are already available in the market

But, when you go to disadvantaged areas where they don't have resources, uptake of this research technology is going to be very difficult, and I think that that is where the need is because you will find that most of the people in affluent communities have medical aids and all of that- and those that the burden of health it's in those disadvantaged areas.

Compared to developed countries, South Africa is still behind in terms of technology advancement and adoption, statement below explains.

What policy and regulatory are you going to put in place for you to make it affordable for everyone? I mean if you look at [the] first world countries – it's because the people there are literate- their economies are very good, so it's easy for people to adopt these things (PM3)

Lack of ICT infrastructure remains a hindrance to the adoption of e-health technologies. The statement below from the DoH strategy document states,

Although large sums of money have been used to procure health ICT and HIS in South Africa in the past, the ICT and HIS within the Health System is not meeting the requirements to support the business processes of the health system (DoH, 2011, p. 9)

PM2 also stressed the status or lack of infrastructure in public hospitals in South Africa.

That hospital doesn't have that infrastructure- then how do you make sure? Because as it is these patients go – or their entry level at the hospitals and they don't have the infrastructure? And then is it possible for government to make sure that there is infrastructure for this transition period?

So, you understand...that would take us back to the issues that we were dealing with on infrastructure...so we need to create necessary infrastructure so that those that are creative enough can...you understand.

Issues of high demand spectrum were highlighted as one of the contributors to the infrastructure deployment as indicated, “So, in terms of that, you know which are your challenges of infrastructure...your spectrum issues etcetera” PM3.

Policies such as South Africa Connect policy 2013 are crucial according to respondents to drive access to clinics.

The reason why there is broadband and South Africa Connect to make sure that at least all clinics have at least [10GB] to each clinic. That is part of the infrastructure to ensure that there is connectivity. So meaning to say that even the SA Connect project it's quite key in terms of providing connectivity? (PM1)

Policy-makers emphasised that there should be a consideration on tightening up the South African IoT standards. Other respondents from the focus group expressed a similar viewpoint, too.

Internet of things is a new technology...now the more we gather this information, the more challenges we will face...ehh, we might have to regulate...we might have to put in place standards because it's a green field and everybody is doing their own thing (PM3)

4.6.3 Limited Knowledge and Awareness of the Technology

The conversation with PM2 responsible for strategy development was interesting in the manner that prompted the issue of curriculum alignment to digital technologies being not up to the standard. PM2 stated that the health sector did not put in the effort to change the curriculum to include ICT within the health qualification. It was emphasised that health professionals leave the education system without being equipped to use the latest digital technologies.

But, I think what government tried to do like I said- we tried to put the regulations and the Act in place. But, in the health sector, what they tried to do was to work closely with the Health Professions Council to come up with regulations, and I don't know how far those regulations went

Because when you look at the curriculum for nurses and doctors, they are not talking about issues of ICT in the health sector.

The example provided as a justification was that practitioners still prefer to stick to the old-fashioned way of collecting data rather than adopting the technology as justified in the statement below.

Basically, when it comes to data collection- on patient information- they still want to stick to the old way of doing things even though you try to provide them with technology

I think for me what government needs to do is to infuse issues of teaching and training the health professionals (PM2)

As for private institutions, it appeared not so challenging to promote the adoption; however, the public institutions that serve the majority of the population is still lagging behind explained PM2. Most importantly, the private sector has begun to drive awareness to promote health wellness. Vitality Health programmes and products offered by Discovery Health utilising some of the Apple accessories are some of the examples. Encouraging more pilot projects on e-health technologies will be beneficial to educate people as stated by the PM2 in the statement below.

If there are any pilots – because that is what we believe in seeing when we do a pilot, and it is success, and then you tell people

Maybe it is just the knowledge but defining an electronic health record and issues of what is the minimum information that has to go there has been a thorny issue for many people. I don't even know now what is it.

Furthermore, PM2 shared an experience on the HIV pilot project that was run to promote the adoption of technology that reminds patients to take pills and benefits. PM2 emphasised that there was a project where they were communicating with HIV patients and reminding them to take their medication. According to PM2, it was a

successful pilot project. PM2 states, “There is a problem with level of experience to use the technology, my mom does not even know how to use smart phone”.

4.6.4 Benefits to the Adoption of e-Health Technologies

This section relates to the research question: *To what extent are elderly persons in retirement homes adopting the use of the e-health technologies.* To assist the respondents, the following lead question was used: *What are the benefits and challenges that you would consider in adopting e-health technologies?*

To source response from policy-makers, the following open-ended research questions were used - Do you perceive the benefits of e-health technologies? What do you see as the most important benefit of adopting e-health technologies by the end users?

PM3 stressed that the use of cell phone messages sent to staff, health care practitioners, friends or family member to notify them of the incident is beneficial. Additionally, the message should be sent to the users notifying them of health condition. PM3 clarified the statement, “Now, what I mean by that: if my blood pressure is high today, I should get an SMS to say: your blood pressure...have you taken your medication today”.

Based on PM2’s responses, e-health technologies will reduce the amount daily visitors at the clinics and hospitals. This is a huge benefit to the cost of health care and administration of the health infrastructure. The statement below provides justification. “Adults in technology and they’re improving the health of their people; you will minimise patients coming to the clinic because people know how to take care of themselves before they can come to the hospitals”.

PM2 emphasised one of the benefits of the technology is that it can assist home care workers when they visit the patients. “ can use this technology for home care workers when they go out there to check these old people – like whoever is critical and all that”.

She argued that the information could be collected and shared accurately with the health practitioner in real time.

4.6.5 Limited ICT Infrastructure to Adoption of e-Health Technologies

This section investigates the barriers to the adoption of e-health technologies in South African elderly persons, and the responses are illustrated in Figure 20.

Respondents (PM3) cite 'lack of ICT infrastructure' as the most significant barriers to the adoption of e-health technologies. The following extract illustrates this viewpoint:

That hospital doesn't have that infrastructure- then how do you make sure? Because as it is these patients go – or their entry level at the hospitals and they don't have the infrastructure? And then is it possible for government to make sure that there is infrastructure for this transitional period? Then a lot depends on that.

4.6.6 Regulatory Issues as a Promoter or Inhibitor

This section analyses security, privacy and trust of e-health technologies in the adoption of e-health monitoring technology in South African elderly persons. To guide the interview process the following questions were adopted:

Do you, in general, have any concerns around privacy and use e-health technologies in your home? Do you think you could trust the implementation of e-health technologies? Do you have any concerns around security in use of e-health technologies?

4.6.6.1 Security Analysis of e-health technologies adoption

According to Cyber Security, Act implies high, “standards equal to developed countries, in building competitive human resource capacity and in competing for quality” (RSA, 2015). For example, Cyber Security (RSA, 2015, p.21) highlighted the objective as follows:

To create a secure, dependable, reliable, trustworthy cyber environment that facilitates the protection of critical information infrastructure whilst strengthening shared human values and understanding of cyber security in support of national security imperatives and the economy.

In addition to the above policy objectives, in particular, the respondents considered a process of ensuring good health for all as a good quality of health. Cyber security could be explained as:

There is a cyber-security policy framework and cyber security bill, I mean that tries to encourage or persuade people to put security measures in the way that they deal with information, but I think...I think...um, I'm thinking aloud here, but

the cyber security bill and the policy framework provides for that: cyber security infrastructure.

The lack of appropriate information systems with proper security measures poses a threat to people's confidential information. The respondent indicated a concern why people are now starting to feel threatened with digital storage space, meanwhile their confidential records were manually saved with no protection neither in clinics and hospitals.

So you understand my point to say for me at the moment, your records are not really safe manually. The next thing when I want to introduce electronics you're telling me about safety of your records.

This respondent implied that the current system poses security issues as it is manually done and different people have access to private information.

4.6.6.2 Privacy Analysis of e-health technologies adoption

This section discusses the greater depth the privacy perception of policy-makers toward adoption of e-health technologies.

Although all respondents indicated a willingness and perceived need to adopt the technology, privacy emerged as the barrier to adoption. The issue of privacy was raised the most in terms of a third party gaining access to collected data. Furthermore, the theme of privacy was the main topic of concern from the literature and policy documents. The issue of privacy pertaining to collected data being exposed and accessed by the third party appeared in all the participants' responses.

Based on the views of the respondent (PM3), current policies to protect the end-users' confidential information can be tightened to protect and ensure the end-user gives final approval to share collected data with the third party.

The fact that there are existing policies such as the POPI Act, there was a collective consensus among three respondents (PM1, PM2, PM3), from policy-maker point of view that there is no need to develop new regulations and policies to protect patient information. It is explained by the statement below that there are policies in place to protect the transmission of patient's information to a third party.

Um...I don't know; I don't think that government is not in the business of promoting technology, but I think government must create an environment that is conducive for people to be able to deploy such technologies

But I think government has already put policies and regulations – there are so many regulations that are trying to protect personal information.

The other burning issue that the respondent (PM2) raised was the implementation of the policy at the institutional level. The recipient of information was also an important factor in information transfer. Who will receive my information, could it be someone known to the patient, as such the patient would feel that his privacy is not protected. “Yes. I would want it to be only shared with my family. A person cannot keep secrets; they can even add lies to it.” (PM2)

Furthermore, policy-maker (PM1) raised a concern on the storage of big data collected from the users. Big data collected from end-users could be stored in foreign countries with different laws and regulation as compared to South Africa. This statement was supported by the respondent from policy-maker:

Yah, it is the storage mainly. Ensuring that you know people put – there should be standards for how one – for instance, I think the data authority is working on that, on the regulations on how to secure information and all of that. And also, making sure that the information resides in the country because then at least you know the legislation that will be governing and the regulations that will be governing data protection and privacy.

Most respondents did not trust the e-health technologies, but they explained that the distrust results from lack of knowledge and awareness of the systems.

And I have all the confidence because this is my doctor who's receiving my information and for sure people would be comfortable if they have a relationship with the person on the other hand. If it is a [Unclear] people would feel uncomfortable sharing their personal information.

One of the policy-makers (PM3) expressed concern about the accuracy of data harvest from the devices. The example highlighted was of a false alarm detected to conduct a specific function on a patient without validation. “But in the event of a breach or a misdiagnosis...what if this gadget of yours sends wrong signals, and then you say: Sir, you are about to die, let's go and operate.”

PM3 mentioned the urgent need to balance safety with privacy. His view is that if the two are balanced, there will be a willingness to allow a third party to access and monitor their activity “I don’t mind if others are monitoring my activity; however, there should be balance in safety with privacy”.

Storage of data and algorithm used within the device to extract and source data from users was raised as one of the concerns. This was her standpoint.

You don’t know what bugs are there in terms of the algorithms and all of that. So, you are never sure. That is why I am saying it is a mammoth task to say that people should look into it and everything that comes within the country. But, you never know you where the information ends up you know” “people are also secure from your identity theft and things like that” (PM3).

4.7 Chapter Conclusion

This chapter brought forth findings drawn from both primary and secondary sources. The collected data was presented in the form of the outcome of the interviews conducted with the focus group, individual interviews with the elderly persons from the Wisane retirement home and three officials collectively responsible for Internet strategy, implementation and usage monitoring, cyber security, and for the development, implementation and monitoring of the e-strategy.

Chapter Five: An Analysis and Discussion of Findings

5.1 Introduction

Chapter 5 provides an analysis of the research data sourced from the semi-structured interviews held with policy-makers and elderly persons. The theoretical frameworks and constructs that informed the theoretical framework and therefore the analysis are:

- Technology Acceptance Model employs constructs which determine the motivational factors influencing users to adopt and use a new technology
- Unified Theory of Acceptance and Use of Technology combines analysis of multiple theories of acceptance and use of a new technology.
- Diffusion of innovation is applied in the understanding of technological innovation.

Thematic analysis was conducted to identify themes related to the perception of e-health technologies, and factors contributing to participant perceptions to adopt e-health technologies. It is equally important to note that, since data were obtained from a small sample from one retirement home, it can be generalised for other retirement homes because the researcher, supervisor and colleagues reviewed the research questions. Secondly, a protocol was tested using pilot study, and lastly the protocol was used during the focus group and individual interview.

The chapter is structured as follows: Section 5.1 introduces the constructs and attributes that anchor the study; Section 5.2 recaps the research questions; Section 5.3 maps the literature review to contextual issues emerging from data; Sections 5.4 and 5.5 outline, describe and analyse the research questions and findings in detail; while Section 5.6 concludes the chapter.

Each section is further structured as follows: A summary of data findings is first presented, an analysis of the data is then conducted and the section concludes with analysis of related work.

5.2 Research Question

The research investigated the extent to how policies and regulations promote e-health technologies adoption.

1. How effective are policies and regulations in promoting e-health technology adoption
2. Which motivational factors will promote adoption of e-health technologies in South Africa for elderly persons in retirement homes?

Sub-question 1

How effective are South African policies and regulation to promote adoption of e-health technologies?

Sub-question 2

Which policies and regulations could encourage the adoption of e-health technologies?

Sub-question 3

What are the individual motivational factors that influence adoption e-health technologies?

5.3 Mapping Literature Review to Contextual Issues Emerging from Findings

Duanne (2011) argue that the literature review brings together the underlying concepts, which influence the understanding of the field of study. This in turn aided formulation of the themes as they emerge from collected data and provided context to the data findings.

Various research studies relating to e-health technologies adoption have examined motivational factors, which is summarised in Table 7 maps the results of the analyses of the adoption of e-health technologies with respect to the theoretical framework constructs and emerging concepts and in relation to the literature review.

- Perceived ease of use: elderly persons are not certain about ease of use of e-health technologies.
- Perceived usefulness: Useful for health care.
- e-Health technologies security and privacy: Lack of data security and privacy.
- Facilitating condition: Affordability of the e-health technologies, existing e-Health strategy lack proper framework to drive technology adoption, strategy

policy to promote digital transformation do exist, ICT Infrastructure expansion constraint in rural settings.

- Knowledge of the technology: Lack of awareness of the technologies, introduction of digital skills in health curriculum.

Table 7: A summary of findings in relation to Literature Review

Constructs	Emergent Constructs	Ehrenhard, et al. 2014	Wildenbos et al (2018)	Amsing (2015)	Chen & Chan (2011)	Yusif et al, (2016)	Jacobson et al.(2016),	Chung et al. (2016)	Demiris (2008)	Balta-Ozkan et al , (2014)	Malwade et al (2014)	Lee et al. (2014)	Kim et al. (2010)	Caron et al. (2016)
Perception of technology	Close to none existence of ease of use of e-health technologies							X						
Perceived useful	Useful for health care	X	X		X	X								
Security and privacy concern	Lack of data security and privacy				X		X	X	X	X	X	X		
Facilitating conditions	Affordability of the e-health technologies	X			X					X	X			
	Existing e-Health strategy lack proper framework to drive technology adoption										X			
	e-strategy policy to promote digital transformation do exist													X
	ICT Infrastructure expansion constraint in rural areas	X			X									
Knowledge of e-health technologies	Lack of awareness of e-health technologies												X	
	Introduction of digital skills in health curriculum												X	

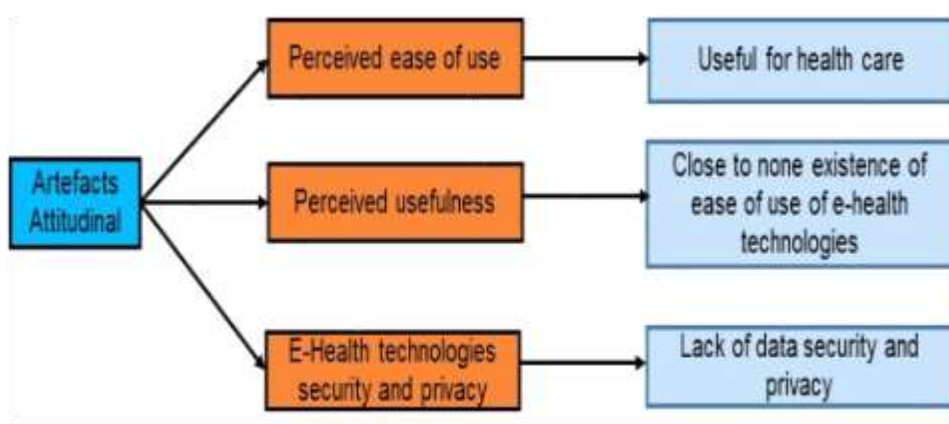
Source: Researcher (2019)

5.4 A Qualitative Analysis of Impact of Attitudinal Artefacts

This section presents analysis of data collected from three officials of the national Department of Telecommunication and Postal Services, and from single focus groups from the Wisane Retirement Home in Hammanskraal. The three officials are collectively responsible for internet strategy, implementation and usage monitoring, cyber security, and for the development, implementation and monitoring of the e-strategy.

Three theoretical constructs are employed to determine the attitude towards the adoption of e-health technologies, namely perceived ease of use (Davis, 1985 and perceived usefulness (Davis, 1985) as reflected in Figure 22. Two additional constructs - security and privacy emerged from the data collected. As Davis (1985), explained, the potential user attitude to adopt a technology is mainly influenced by whether they will use it or not. Figure 22 illustrated the relationship between the constructs and emerging themes.

Figure 22: Moderating relationship between attitudinal factors



Source: Researcher (2019)

5.4.1 Ease of Use of e-Health Technologies

In his study, Davis (1985) maintains the definition of perceived ease of use as “perception an individual have on how easy or effortless using a particular product or system would be”. According to Davis (1985), behaviour of users to adopt the technology is predicted by how they perceive technology to be easy to use. From the research findings, it emerged that the adoption of technology by elderly persons is influenced by the perceived ease of use of the technology. According to data collected,

the adoption of e-health technologies in rural elderly persons is close to non-existence. The data shows that 1 out of 16 (less than 10%) respondents from the focus groups had experience of or used e-health technologies. In particular, the data indicates that 16 of the respondents perceive learning the technology to be difficult. The research further shows that 16 of the respondents feel that technology is not clear and they will not understand it, meanwhile, after explaining the benefits of the technology 13 out of 16 respondents perceive the technology to offer ease of monitoring. Their motivation appeared to be driven by past experience in using technology, how it met their needs and productivity. In general, participants had mixed reactions about the adoption of e-health technologies.

The data suggested that age, literacy and lack of e-skills are precisely the deciding factors that determine the perceived ease of use of e-health technologies. This study on adoption of e-health technologies by South African elderly persons has presented evidence that elderly persons in rural areas are not 'tech-savvy'.

Kim et al. (2010) recognise awareness of ICT skills development and digital literacy as one of the key components that facilitated broadband demand in Korea. In an extensive examination of the contribution of the culture of acceptance of home monitoring technologies by Korean and Korean American elderly persons Chung et al. (2016) contend that elderly persons in Korea are accepting the use of health monitoring technologies. The authors claim that in Korea the level of technology acceptance is high because of the background of users being more tech-savvy and digitally skilled. e-health technologies hold the promise of an improved quality of life for elderly persons (ITU & CISCO, 2016; Brown, 2012). However, transforming the perceived benefits into action in developing countries is far from being realised and this was affirmed in the review of adoption of e-health application literature studies (ITU and CISCO, 2016). This is supported by this study, which has proven that respondents did not understand the benefits of e-health technologies and there are barriers to adoption in South Africa. According to Chung et al (2015), adoption is the initial step to the use of new technology with the latter stages expanding to large-scale diffusion of a new technology.

5.4.2 Perceived Useful for Health Care

Diffusion of Innovation Framework argues that not all users adopt a new technology at the same time (Rogers, 1983, p267-299). According to the author, the process of innovation adoption rate is made up of four different categories, innovators, early adopters, early majority, late majority and laggards. The last category constitutes 15% of the users who adopt the technology late. Rural areas adopters seemed to fall at the end of the bell curve (around 15% of the late adopters); this could also be due to factors that include infrastructure readiness.

From the collected data, it emerged that 6 out of 16 respondents believed e-health technologies would provide peace of mind and most importantly, it can be useful for health care. Respondents could not make a clear distinction of the different healthy monitoring technologies before the examples were presented. Upon presentation of examples of e-health technologies the elderly persons were confident that the technology is useful. Based on the positive responses all 16 respondents, the technology would improve their quality of life. It further emerged that 6 out of 16 respondents indicated that if the technology is presented with a value proposition to improve their quality of life, they will be interested.

The results above from data collected is consistent with Chung et al. (2015) who argue that perceived usefulness is a core determinant to influence adoption of monitoring technologies.

All participants from policy maker raised issues, which include low level of satisfaction with primary health care service in general.

According to statistics, the ratio of nurses to patient is 1 to 20 (Van Rensburg, 2014). The issue can be ascribed mainly by staff shortage and disparities of human capital in the public health sector (Van Rensburg, 2014). Based on resource allocation, shortage and disparities are often evident in rural areas due to unequal resource allocation between rural and urban health facilities (Van Rensburg, 2014)

The monitoring and preventative capabilities of e-health technologies can have an impact on elderly persons significantly (Czaja, 2016).

Furthermore, according to Dubravack and Ratti (2015), paramedics while transporting the patient could conduct pre-testing, data collection and transmission and the doctor

could access the information timeously and provide a quick and comprehensive diagnosis for the patient.

mHealth initiatives related to immunization are being pilot tested too. In Mexico a pilot which include using mHealth for mobile collection of immunisation data and sending reminders via SMS to citizens (Ronveaux, O., Arrieta, F., Curto, S., Laurani, H., & Danovaro-Holliday, M.C. (2009). Wildenbos, Peute and Jaspers (2018) has identified four barriers influencing use of mHealth in elderly persons: “cognition, motivation, physical ability and perception”. The physical inability and age could results in data errors in data collection.

Furthermore, Demiris (2004) re-affirmed in his study, that users found the technology to be cost- and time-efficient. The time taken to visit a practitioner was compared to telecare service. Telecare service was more time-efficient. Reeder, Chung, Le, Thompson & Demiris (2014), indicate that e-health technologies enable family and friends to monitor their loved ones remotely, therefore in the long term, it could boost the quality of health of elderly persons. ITU and CISCO (2016) affirm that e-health technologies will also enable practitioners and nurses to remotely monitor patients, and react in real time. This research findings, suggest that the technology could be applied as a proactive solution for prevention and early detection of potential health issues.

5.4.3 Lack of Data Security and Privacy

The vulnerability of cyber systems remains a concern by both the government and private sector (RSA, 2015). Data security, protection and privacy are highly classified as barriers to the adoption of e-health technologies in literature (Cisco, 2015; Chung et al. 2016). The White Paper GSR (2017) suggests, some of the negative effects of digitisation are linked to how secure is the digital space.

5.4.3.1 Existing policy provision for management of security

In the context of this study security is defined as a means of privacy. One of the findings was the online security of the Internet. The majority (100%) of the respondents were not comfortable with adopting the technology because of security concerns. There were concerns raised during in-depth interviews directly related to the algorithms biases running inside the sensors and the data storage. There is a risk

particular related to regulating the use of big data in health sector. This is due to possible threats to misuse of users' personal data in the cloud environment and data stored in other countries. For example, PM1 argue that foreign companies are responsible for manufacturing sensors without defined standards and data is stored in servers outside South Africa. Another respondent (PM2) highlighted that currently files are manually locked in file cabinet with neither protection nor security in clinics and hospitals, in contrast users feel insecure with the introduction of digital storage or space, meanwhile, the current filing system is not cyber resilient, and secure. This respondent implied that the current system poses security issues as it is manually done and different have access to private information.

Respondents during the in-depth interviews contend that there should be a consideration protecting users against potential cyber-attacks and cyber breach. The respondent indicated that there are legislations that can be implemented to reduce the level of risk. Institutions are encouraged to continue to test their systems vulnerability of cyberspace, prevention of cyber threats and attacks and the ability to recover swiftly from any attack (RSA, 2015). PM1 emphasises that progress is made to secure user data, she mentioned that authorities are working on regulations to secure users' information. The extract from the interview with policy-maker demonstrates "data authority is working on that, on the regulations on how to secure information". According to the timelines for data security regulations, South Africa is behind in imposing data security regulations because the target date has passed. The findings from individual and focus group interview confirmed that more understanding of the privacy risks and opportunities.

Another study, conducted by ITU and CISCO (2015), also offers evidence in support of lack of standards on Internet of Things (IoT) technology. He further concludes, that there are research efforts needed to identify standards for IoT.

At a national level, policy such as national cyber security policy framework for South Africa (NCPF) is intended to ensure a streamlined, strategic security involvement and safety in the cyber security environment. Furthermore the policy is classified as a governance to put a balance between privacy and national security. The Cyber Security, highlighted the objective as follows "to create a secure, dependable, reliable, trustworthy cyber environment that facilitates the protection of critical information

infrastructure whilst strengthening shared human values and understanding of cyber security in support of national security imperatives and the economy” (RSA, 2015, p. 21).s The policy further provides cyber programme to reach out to the civil society and promote the implementation of different strategies towards cyber-attacks. According to Cyber Security Bill, security is defined as

The collection of tools, policies, security concepts, security safeguards, guidelines, risk management approaches, actions, training, best practices, assurance and technologies that can be used to protect the cyber environment, organisation and user assets.

The policy further advocates that “cyber security awareness initiative should have a plan, clearly defined goals and objectives, expected results, delivery methods, risks, and methods to evaluation the initiative” (RSA, 2015).

The Council for Scientific Industrial Research (CSIR) and University of Venda have collaborated to raise cyber security awareness in local rural communities in the South African Limpopo province, Vhembe district to prevent users from becoming victims of cyber-attacks. Recently the department of communication held various local community awareness sessions on cyber security. South African Banking Risk Information Centre (SABRIC) is an awareness initiative consisting of a team of specialists who provide support to the public to reduce bank related crime through effective partnership between the public and private sector (SABRIC, 2011).

In the USA, the cyber security team suggested that any national cyber security policy should encompass the following criteria. Firstly, a governance framework, which incorporates structures for policy development and coordination of operational activities, related to the cyber mission. Secondly, a solid architecture, which deals with strategic planning for the optimal system and security characteristics, evaluates performance and related costs. Thirdly, methods to addresses elements of law, regulation, and international treaties and undertakings, as well as consensus-based measures. Lastly, capacity building – includes human resource, capital resource to enable the citizens to be capable cyber competent (RSA, 2015).

The influence of state security policy has not been effective as compared to other European countries, because cyber security bill of 2015 has not been implemented to

date. The bill comprises of the regulation that governs the sharing of information between sectors ('inner-inter sector'), cooperation principles over the critical infrastructure and regulation to hold top management of operators of sensors accountable to provide infrastructure which is free of vulnerabilities to cyber-attacks are stipulated in cybercrime and cyber security bill (RSA, 2015).

The study data analysis of factors affecting adoption of e-health technologies, offered evidence of omitted constructs that did not form part of the Technology Acceptance Model. The research evidence suggest that the TAM model should be applied on e-health technology acceptance research. These factors would have to be incorporated in the model. Chung et al. (2016) also observed that it is possible that TAM may not be successful, if applied in its current format to health researches because, it has not been successfully implemented in testing technology acceptance for health. In the work conducted in Sweden by Jacobson et al. (2016), it emerged that security risk is considered high as one of the inhibitors to adoption. An overarching security feature strategy was recommended as part of the design. Bodeau, Boyle, Fabius-Greene, and Graubart (2010) developed a cyber-prep which is a conceptual framework which defined five levels of organisation. The framework outlines the levels in terms of preparedness as follows:

...the organisation's perspective on, and/or assumptions about, the threat it faces; strategy for addressing the threat, including which adversary tactics, techniques, and procedures it addresses, and approach to cyber security governance.

According the data collected, e-health technologies has a regulatory implication such as data security, protection and privacy and adequate security and privacy strategies are critical for management of end user information and collected data (RSA, 2015).

5.4.3.2 Existing policy provision for management of user data privacy

In the context of this document, privacy is defined as the confidentiality level classified for user data and who has the right to access the data. The data analysis confirmed that data protection and privacy was reported as a concern to adopt technology, by the majority (100%) of respondents. All respondents from the focus group indicated they do not feel safe with their private life. The findings of online privacy concerns are

of importance as they represent how vulnerable users are in the online space when using e-health technologies. The data provided conclusive insights that users do not feel that their data will be private.

In 2013, a comprehensive legislative framework to deal with consumer data privacy was enacted in South Africa. The Protection of Personal Information (POPI) act policy objective is to protect individual personal private information from been shared with or provide access to third party without the user consent (The Presidency, 2013). The policy furthermore provides a legal framework through which personal information processed both locally or across the borders should be safeguarded and protected. The policy furthermore, provides principles on measures to be implemented to manage personal information and guidelines on development of privacy policy. In essence, the Act promotes security and privacy to personal information, certainly, the current policy is still applicable and enforced. A study by Caron, Bosua, Maynard and Ahmad (2016), investigated the extent to which the Australian Privacy Principles (APP) protect the individuals. It emerged that the APP does not appropriately protect individual's gathered data.

In Europe, the European Union (EU) has the general data protection regulation ACT (The European Parliament and the Council of the European Union, 2016) which deals with data protection and privacy. The act was adopted in November 2016 by the European Union and it come into force in May 2018 which replaced the data protection directive. The Act furthermore provides an additional framework which introduces strict consent to personal data collection such as the right to deletion of personal data, and the right to object or disagree to sharing of data. The government has further introduced fines for failure to comply on the organisation if they do not put measures and controls in place to safeguard collected data (The European Parliament and the Council of the European Union, 2016).

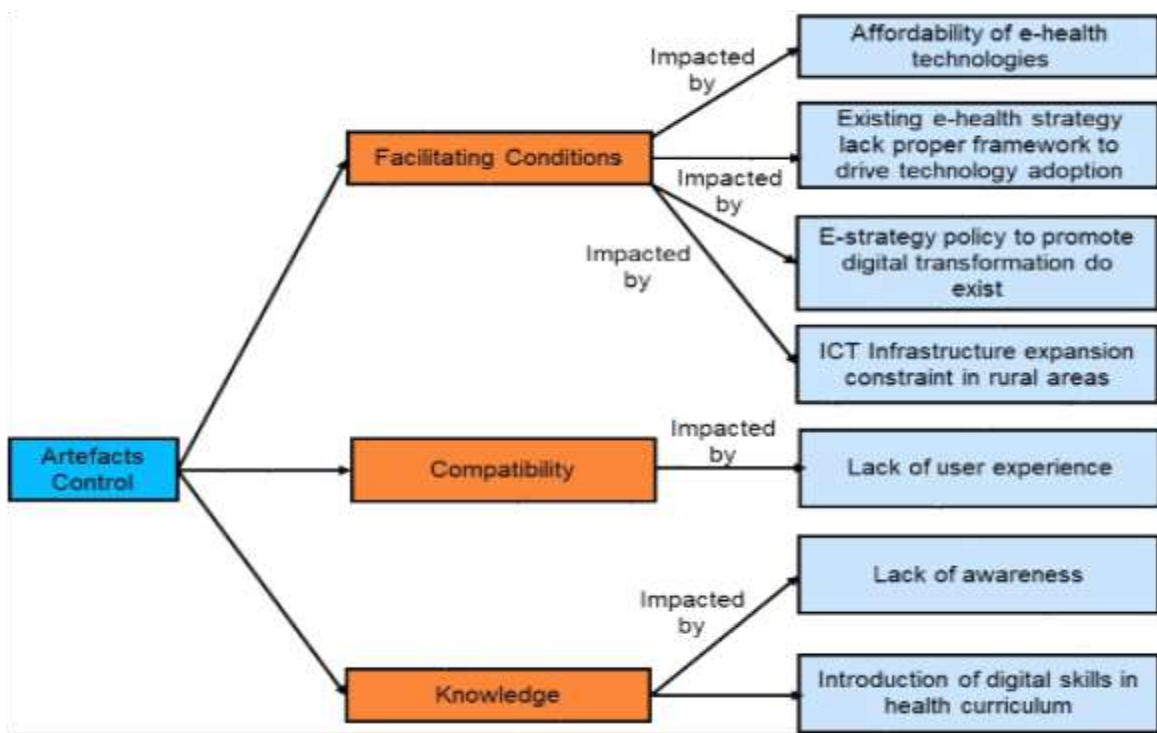
Chung et al. (2016) also observed that it is possible that TAM may not be successful, if applied in its current format, to health researches because, it has not been successfully implemented in testing technology acceptance for health. Amsing et al. (2014), identified four constructs which has a relation to privacy concern which are not part of TAM model. Amsing et al. (2014) argue that even though e-health technologies

promises benefits, the adoption rate is low in elderly persons homes because of privacy concerns.

5.5 A Qualitative Analysis of the Influence of Control Artefacts

In this section, three theoretical constructs are of interest to determine the attitude towards the adoption of e-health technologies as depicted in Figure 23. Firstly, facilitating conditions, adopted from Venkatesh et al. (2003), which explains the resource required to support diffusion of new technology. Secondly, compatibility adopted from Rogers (1983), which indicate the level of skills of an individual user to use the technology. Lastly, Knowledge or experience adopted from Venkatesh et al. (2003).

Figure 23: Moderating relationship between control factors



Source: Researcher (2019)

5.5.1 Facilitating Conditions

Facilitating conditions in the context of this study refers to contributing factor towards adoption of e-health technologies, which could hinder adoption of e-health technologies. This includes external factors such as affordability and infrastructure readiness to support and facilitate the adoption of the technology.

The following sections analyse the facilitating condition to support the adoption of technologies with respect the emerging concepts and theoretical constructs: national e-strategy policy to promote digital transformation do exist, existing National e-health strategy lack proper framework to drive technology adoption, ICT Infrastructure expansion constraint in rural areas and affordability of the technologies by elderly persons.

5.5.1.1 National e-strategy policy to promote digital transformation do exist

The interviews suggested that electronic transformation (e-transformation) in government departments are still lagging behind. The results shows that there is national electronic strategy (e-strategy) to promote digital transformation and address

e-skills gap. One of the most salient achievements in the development of digital transformation is the development and publication national e-strategy adopted by the South African Parliament in 2017. The national e-strategy was developed with the objective to expedite the adoption and use of ICT applications, encourage provisioning of strategic secured ICT infrastructure and government databases. The benefits of e-government were emphasised by most of respondents from the policy-maker. A review of the SWOT (strength, weaknesses, opportunities and threats) analysis is provided:

- Strength: South Africa has a detailed e-strategy to address e-skills (DTPS, 2017). According to e-strategy, very clear analysis of the implications of the strategy in South African context was taken. The strategy is concrete however it is still early to indicate whether it would be successful.
- Weaknesses: The roadmap on how both private public partnership will address lack of digital skills is not clear. PM2 stressed that there are policies and regulations, however the promotion of e-health technology lack implementation frameworks. Consequently, minimum achievement was realised with the implementation of e-Health strategy to drive better health care, even though there was an approved e-health national strategy. Policy implementation lacks proper policy life cycle evaluation to complete life cycle of the policy, from development, implementation and enforcement of regulation. This is substantiated by the fact that e-strategy is currently under review without results of the successful of the first policy.
- Opportunities: e-strategy is developed with the objective to expedite the adoption and use of ICT applications, encourage provisioning of strategic secured ICT infrastructure and government databases (DTPS, 2017).
- Threats: If the policy is not expedited, the digital divide will continue and South Africa will not realise the benefits of fourth industrial revolution.

Furthermore, the policy argues that the slow uptake of e-government is associated with low IT literacy skills. Proposed solution by the strategy encourages development of e-skills to upskill government officials inclusive of officials from health sector. On the one hand, the rapid adoption of e-government strategy could be viewed as an acceleration strategy for digital transformation. Despite these advances, the country's digital transformation in the health system is also confronted with high demands to

digitise the health sector and adopt the latest digital technologies both in the private and public sector (DoH, 2012).

5.5.1.2 Existing National e-Health strategy lack proper framework to drive technology adoption

Based on the analysed documents, it emerged that there is a national e-Health strategy, however not all elements of the strategy were successfully implemented since publication in 2012. The e-Health Strategy South Africa 2012-2017 highlights the need to implement a national health insurance (NHI) nationwide to encourage long and healthy lives for all South Africans. Furthermore, the purpose of National Health Insurance,

... is to improve access to quality health services through the development and implementation of policies to achieve universal health coverage, health financing reform, integrated health systems planning, monitoring and evaluation, and research (DoH,2012).

While significant progress has been made in the legal framework to implement e-health technologies, the gap still exist. The data also suggest there may be a lack of coherence between adoption of e-health technologies and the adaptation of the legal framework (health strategy) within which technology must be function as argued by PM2. In addition, the department of health website confirmed that the strategy is under review. The reason provided was that it did not incorporate latest digital transformation trends such as IoT. A respondents advocated that to ensure that there are policies and also, not just policies that just sit there, but policies that are implementable and promote confidence in the use of these technologies”.

In 2012, World Health Organisation pronounced a global policy framework, which more generally calls for development of a national e-Health strategy, within which in its broader parameters all member states were encouraged to develop e-Health strategies. In the South African, particularly in the context of health reforms, the Department of Health (DHE) developed an e-Health strategy as a response and support of the strategic objectives of WHO. The e-Health strategy that includes how to improve access to and quality of health services using ICT was developed in collaboration with private sector and key stakeholders. e-Health strategy define e-

health technologies as “an application of information and communications technologies (ICTs) to health (DoH, 2012). The strategic objectives emphasises the importance of adopting e-health technologies within the health sector to improve quality of life, promote digital skills, health care effectiveness and potential measures to strengthen healthcare (DoH, 2012). Furthermore, the strategic document put forth the collaboration and integration e-health initiatives by both private and public sector in South Africa. A review of the SWOT (strength, weaknesses, opportunities and threats) analysis is provided:

- Strength: there is an existing e-Health strategy on how the health sector will leverage on electronic applications.
- Weaknesses: the current e-Health strategy does not address the issues of fourth industrial revolution and how the country will address the digital skills South Africa has a detailed to address e-skills. The question is whether the initial expectations of the policy of were met. These expectations include ICTs for health which is regarded as appropriate to promote equitable, affordable, and universal access. Appropriate legal frameworks were developed to encourage private and public sector partnership to embrace e-Health strategy implementation, however the framework was lacked support from both parties. According to some interviews taken to policymakers in the DTPS, the transition to adopt the e-strategy will be a journey that everyone has to embrace. In terms of issues of health care affordability, initiatives such as national health insurance (NHI) were proposed to address issues of health care cost. However, it appeared that there was no clear analysis of the implication of the model in South African context.
- Opportunities: e-Health strategy is developed with the objective to expedite the adoption and use of ICT applications, encourage provisioning of strategic secured ICT infrastructure and government databases.
- Threats: the digital divide will continue and South Africa will not realise the benefits of fourth industrial revolution if the policy is not expedited.

On the one hand, the findings showed that the e-Health strategy was not successfully implemented and it is currently under review. However, according to the responses from DTPS the establishment of the health council will assist in resolution. What is

more disturbing is that the unsuccessful implementation of the strategy has led to the South African health system not meeting the patients' needs and continued poor quality of health. The mission and goals of e-Health strategy played a minor role in the influence to adopt e-health technologies at state health institutions, while in the case of private health, efforts to adopt the goals and objectives of e-health have been encouraged.

This is also confirmed by Martin (2018) that South Africa was ranked number 121 out of 139 countries in terms of health and education systems.

As these statistics show, there has been a slight increase from 0.6 to 2.3 points in health systems compared to 2017. This data supported the participants' responses about the e-health adoption and status of health and it indicates that the policies lack influence on the health industry.

Furthermore, Katuu (2016) contends that despite the efforts put into developing and publishing the strategy, there is a perception that the implementation failed in the South African health sector.

South Africa has various lessons to learn from other countries such as Germany and Australia on health policy implementation to execute the e-Health strategy objectives. The German public sector is serving 90% of the population under the statutory national healthcare insurance according to Van Rensburg (2014). The National Health Act, as well as the e-Health Strategy South Africa 2012-2017 have put extensive emphasis on leveraging technology to address the issue of poor health care service delivery within the country's health sector. While the use of e-health technologies may enhance the service efficiency and effectiveness of health care service, there are human resource and capital resource aspects that should be in place to address the challenges within the health sector.

5.5.1.3 ICT Infrastructure expansion constraint in rural areas

A respondent from the policy-maker responded that organisations would require building robust data capturing systems, governance process and adequate ICT infrastructure to interface with the retirement home infrastructure. Single focus group data shows that 13 out of 16 respondents (80%) pointed out that the lack of infrastructure in rural health institutions as a concern. According to the Martin's (2018)

report, out of 139 economies surveyed, South Africa was ranked of 44 in terms of ICT infrastructure.

According to broadband policy 2012, South Africa has relatively underdeveloped digital infrastructure in rural areas. Network operators devoted extensive attention to rollout network in urban areas neglecting the infrastructure rollout in rural areas (Ministry of Communications, 2013). As such, with the current infrastructure it is not feasible to realise the benefits of e-health technologies. ICT infrastructure contemporary challenges are discussed, inter alia the infrastructure position of South Africa.

Lack of ICT infrastructure remains a major hindrance to the adoption of e-health technologies. The statement below from the DHE strategy document suggests,

Although large sums of money have been used to procure health ICT and HIS in South Africa in the past, the ICT and HIS within the Health System is not meeting the requirements to support the business processes of the health system (DoH, 2012).

The South Africa Connect policy aspiration is to transform South Africa into a knowledge-based economy through implementation and expansion of robust, reliable and affordable broadband network delivering a minimum of 10 Mbps to households, government and businesses by 2030 (Ministry of Communications, 2013). Most significantly, the policy is determined to achieve 100% 1Gbps connectivity to all government health facilities by 2030. Government through Broadband Infraco (BBI) has implemented 13300km of fibre with plans to extend it to achieve a target of 15000 by 2018/19 (BBI). The policy also cites transformation of South Africa citizens to a “literate and skilled society that can effectively access services and content, including public information and public services” (Ministry of Communications, 2013). To ensure all citizens can afford broadband services, the government is calling for introduction of wholesale open access regime to drive down broadband services cost. Furthermore, the policy claimed that the regime would reduce the powers of the dominant operators who controls the market (Ministry of Communications, 2013).

Furthermore, National Development Plan 2030 (NDP) calls for collaboration and co-ordination by both the private and public sector to deploy a “universal ICT

infrastructure that is accessible, cost effective and meets the demands of the population and business” (NDP, 2012).

In efforts to increase broadband connectivity, ICASA reported a capital and operational investment increase of 69% in telecommunications infrastructure within a 12 month period ending September 2017 (ICASA, 2018). The investment was part of the digital inclusion drive, network maintenance and expansion. Investment into fixed line-telephone services increased by 11%, fixed (wired)-broadband services, which includes fibre increased by 61%, mobile communication services increased by 41%.

President J.Z. Zuma in his state of the nation address announced the government’s decision to award Telkom as the “lead agency” to roll out broadband to South Africa’s rural areas. However, the decision was not successfully implemented because the decision was in contradiction to Section 51 (1) (a) (iii) of the PFMA, the Preferential Procurement Policy Framework Act 5 of 2000 (PPPFA) and the Provisions of the PPPFA Regulations. The rule states that

...an accounting authority for a public entity must ensure that public entity has and maintains an appropriate procurement and provisioning system which is fair, equitable, transparent, competitive and cost effective (National Treasury, 2000).

ITU and CISCO (2016), in particular, have argued that more recently studies have become more interested in research of the understanding of the impellers of adoption of e-health technologies. ICT Infrastructure was ranked the highest as an impediment to adoption of e-health technologies.

5.5.1.4 Affordability of the technologies by elderly persons

In the case of this study, affordability is defined as the price tag an individual user is willing to pay for a technology or service. According to data collected as presented in Figure 20, 13 out of 16 respondents (80%) indicated that the cost of the technology is a barrier to adoption, the imminent issue in respect of financial challenges was due to government grant being their only source of income. Meanwhile retirement homes in urban areas are introducing sensors which monitors if an elderly persons person has fallen as one of the security mechanisms to provide security to residents and to

address the specific needs of elderly persons (Ehrenhard et al, 2014). Affordability is also one of the determiners to install the sensors.

Although the changes and adoption of e-health technologies was commonly evident in both the public and private health institutions, it was strongest in the case of private health institutions (Van Rensburg, 2014). According to Van Rensburg (2014), there is a broader health gap between those who can afford and who cannot. The difference between the public and private health institutions was mainly due to the level of affordability and literacy. This may be an indication that low-income earners did not find value in spending on e-health technologies, but rather to depend on the public health care service. This observation can be regarded as a major policy and pricing consideration by both policy-makers and services providers.

Ehrenhard et al. (2014), argues that smart home technology for aging in the Netherlands was mainly a target for the affluent market and the level of adoption was adequate. The author indicates that the majority of the users in the affluent market are literate, they have experience and they can afford the technology.

Affordability (cost to purchase technology) was ignored on the TAM model, and literature review has established that cost play a significant role in adoption of a new technology. Similarly, Chen and Chan (2011), agree with the findings that cost is a critical determinant to adopt a technology. The author further contends that most researches omitted the cost of technology as a determiner to adopt and accept a technology.

The participants emphasise that it is necessary for government to introduce a subsidy and policy to support elderly persons, especially those who cannot afford to acquire e-health technologies. The research is of the opinion that if government could intervene and provide a subsidy, there will ultimately be willingness to adopt and use the technologies. The research outcome are consistent with the literature review findings of other authors as reflected in comparison to Table 7.

In the study by Chung et al, (2016), the participants emphasised the role that the market and the government's policy would play in expanding the accessibility and affordability of this technology.

5.5.2 Knowledge and Experience of the e-Health Technologies

A critical area of investigation is the understanding of the experience and knowledge available to use the technology. The following sections analyse the knowledge and lack of experience to support the adoption of technologies with respect the emerging concepts and theoretical constructs: lack of awareness and user experience of e-health technologies and limited emphasis on digital skills.

5.5.2.1 Lack of awareness and user experience of e-health technologies

From the collected data presented in Chapter 4, elderly persons 13 out of 16 respondents (80%) indicated lack of awareness of the benefits of technology. Sensors collecting health information of patients were relatively unknown, this was evident as represented by 3 out of 16 (80%) respondents indicating little knowledge of them or not been aware of any adopters of the technology.

Elderly persons from the Wisane retirement home had limited exposure to information regarding benefits of e-health technologies. What emerged from the study is the knowledge gap and experience as a barrier to adoption of technology by elderly persons. The study confirmed that, elderly persons in Hammanskraal do appreciate the benefits of e-health technologies. The research highlights the lack of awareness of benefits arising from use of technology in rural areas as a reason for low perceived usefulness and adoption.

What is also evident is, data shows that level of education or technology experience is the determiner to adopt. PM2 states, "There is a problem with level of experience to use the technology, my mom does not even know how to use smart phone." Balta-Ozkan et al. (2013), argue that "lack of knowledge and experience of the technology, contributes to fewer users perceiving e-health technologies as useful".

5.5.2.2 Limited emphasis on digital skills

Introduction of digital skills aimed at overcoming nursing technology skills limitation are among the barriers to adoption as emphasised by policy-makers. Respondents during in-depth interview emphasised that during development of e-government strategy, one of the barriers identified was the shortcomings of the nursing syllabus, which does not include the latest technology developments and technology skill shortage.

Respondents equally proposed that South African health institutions should review its curriculum to include the latest technologies such as e-health technologies, because the current syllabus does not include e-health technologies as part of the syllabus. There was an impression that the DoH did not do enough to enforce the adoption of the technologies, but instead took an intuitive approach. As PM2 describes, the nursing syllabus should follow the latest development on technology and there was no consistency in organising nursing academic in line with the WHO (2005).

Martin (2018), indicates that South Africa is ranked 65 against 139 peer countries in ICT Infrastructure readiness. The confirmations shows that South Africa is not ready for emerging digital economy and information society.

The need to develop e-skills is recognised in national policies such as National Development Plan (2012), National e-Skills (2012), National Integrated ICT Policy White Paper and South Africa Connect Policy. According to ICT Policy White Paper, the government will develop basic skills requirements of all citizens, provide training and support at public institutions to enable everyone to participate in the digital society.

Nemisa is state owned entity responsible for development of e-skills capacity in South Africa and deliver on its mandate to transform the nation to become digitally inclusive. The role is to create guidelines, initiatives and public and private partnership to expand on e-skills. Digital technology is becoming more critical and essential in people's daily life. As such developing e-skills is as critical as building the ICT infrastructure so that users would effectively leverage on the benefits of the infrastructure.

Indeed, without a health professional equipped with the right e-skills and utilization of ICT systems that improves their work the potential benefits of e-health will remain unrealised. Training in e-Skill training, and the provision of government-supported health internet labs that offer information in South Africa all official languages is crucial to realise the potential of ICT to help improve the health knowledge and adoption behaviour of all citizens. Rasmussen, Belisario, Wark, Molina, Loong & Cotic (2014) argue that access to basic infrastructure remain a major impediment to the implementation and adoption of technology-enhancement in developing countries. The author further affirm that mainly in rural areas with poor internet access and high data cost health education syllabus can be provided via offline eLearning ("portable storage devices") (Rasmussen et al, 2014).

De Veer et al. (2015) states that people with low level of digital skill were less motivated to adopt the technology, meanwhile those with high level of exposure to using Internet were positive to adopt and use technology. For instance, the study referencing Wade, Cartwright & Shaw (2012) argues that if an opportunity is given to people to use the technology, the level of intention of adopt will increase, those that who are slowly introduced to the technology would later adapt the use of the technology.

In this study, the research has reaffirmed that with efforts put on e-skills and support provided to learn the technology, the rigid fear of using technology could be removed, and level of adoption could change respectively.

5.6 Was the Objective of the Study Met?

In this research the researcher acknowledge that the findings and research took a different direction. The research design initially intended to investigate: motivational factors towards adoption of e-health technologies. The view the researcher had was that the elderly persons have adopted the use of digital technologies. However, during the in-depth interview it emerged that the elderly persons from retirement home have not adopted the technology and they were not aware of the existence of the technology. Secondly, the interview protocol was changed to accommodate elderly persons who were not in a position to express themselves. To address the flaws the research concluded that the research focused on whether the elderly persons would adopt the technology, and what they perceive as benefit and barriers to adopt the technology.

5.7 Chapter Conclusion

The objective of the analysis was to investigate and understand effective has policies and regulations contributed to influence the perception and motivational factors to adopt e-health technologies by elderly persons in retirement homes. As with the majority of respondents, the respondents from Wisane Retirement Home were extremely critical of the cost of the technologies. There is a significant need to promote the health technologies in rural areas. It has also been revealed that despite the elderly persons depending on grants to fund their medical requirements there is an interest to adopt e-health technologies. All respondents were of the opinion that the technology will improve their quality of life and data extracted from the sensors will be beneficial.

It was evident that a majority of the respondents were not satisfied with the current health care service and would opt for alternative solution. It was also noticeable that the DoH and DTPS have gone through different strategic phases to promote awareness of the technologies.

The research draws attention to the use of UTAUT constructs to guide questions and sub-questions development. The results were consistence with the literature review that confirmed adoption of e-health technologies by elderly persons in rural areas to be low. The reasons found range from affordability, poor ICT infrastructure, digital skill limitation, privacy concerns and fear of security. On the other hand, other researchers have found that the adoption rate depends on social economics, due to the income factor. On the other hand, DoH (2012) and WHO (2005) indicate that the benefit of e-health technologies to be more on enhancing people's quality of life.

Embracing e-health technologies promises a considerably high pervasive impact on elderly persons through the improvement of quality of life based on researchers such as ITU and CISCO (2016), and Brown (2012). However, transforming the perceived benefits into action in developing countries is far from being realised and this was affirmed in the review of adoption of e-health application literature studies. This is further maintained by the research findings, which have proven that respondents did not understand the benefits of e-health technologies and there are barriers to adoption in South Africa. Chung et al. (2015) believes that adoption is the initial step to the use of new technology and in a later stage it exacerbates to diffusion of new technology.

This chapter has discussed what the results from in-depth interviews with policy-makers and focus group from retirement homes mean in relation to the theoretical frame of knowledge.

Chapter Six: Conclusion on e-Health Technologies Adoption

6.1 Introduction

This chapter outlines a detailed reflection of the journey of the research and the evaluation of its outcome. Furthermore, the chapter concludes the research report to and research objectives are discussed, it assesses the strength of the research, original contribution to the body of knowledge, and reflects on limitations of the study. Opportunities for further research are suggested. Chapter one introduced the study and comprehensively described the approach to the research. Chapter two presented the literature review, which presented the underlying concepts of the research including the perceived ease of use, perceived ease of usefulness, intention to adopt. It also introduced the historical context of the industrial revolution from the first industrial revolution to the fourth industrial revolution. The research methodology applied for the study was outlined in chapter three following suggestions from Bryman (2012) where data collection protocols were deliberated on. Data collection protocols and the process flow of primary data collection is explained. How effectively has policies and regulations contributed to influence the perception and motivational factors to adopt e-health technologies by elderly persons in retirement homes? This question was supported by sub-questions whose answers have since been incorporated in Chapters 4 and 5. In this chapter, the researcher responds to the above question guided by the analysis of the research findings, makes specific recommendations, and reflects on theory to inform future research.

6.2 Research Objective Re-cap

The study intended to investigate the effectiveness of policies and regulations and motivational factors to adopt e-health technologies by elderly persons in retirement homes.

This study is based on qualitative data gathered from single focused group with elderly persons adults from the Wisane retirement home and three individual in-depth interviews with policy-makers. The approach offered the researcher an opportunity to respond to the research questions, attain the broader data perspective, and also an extensive understanding of the motivational factors.

The first objective of the study, the investigation of the extent of e-health adoption technologies in rural areas of South Africa was met through the analysis of interview data collected from South African elderly persons in retirement homes and policy-makers. The study provided deep insight into the extent to which the elderly persons in rural areas are adopting e-health technologies. The theoretical frameworks that supported this analysis are the technology adaption model (Davis, 1985) that focused on the adoption of health technologies, unified theory of acceptance and use of technology (Venkatesh et al 2003) and diffusion of innovations framework as proposed by Rogers (1983).

Conducting the interviews with elderly persons adults appeared to be challenging due to issues of literacy, lower ability to focus over an extended period, the limitation as a result of poor hearing and speaking. During the interview process, methodology and procedure development, the protocol design for interviewing elderly persons should include consideration all these factors.

In terms of responding to the research question posed, what is the extent and the implications of e-health technologies adoption in elderly persons living in a retirement home in South Africa? Firstly, the research found that adoption and use of e-health technologies in elderly persons in rural areas are close to non-existent. The evidence from the findings confirmed that the majority of respondents did not know about the technology. Secondly, based on their opinion, the technology is not cost effective; there is a lack of sufficient infrastructure readiness, and it will invade their privacy and security. Lastly, the evidence confirmed that the respondents were positive towards adopting technology, which was perceived to be beneficial for health care.

In the South African context what emerged was that elderly persons from rural communities have a low level of knowledge of the technologies, there is low to non-existence of adoption. Furthermore, the data collected indicated that there are low levels of affordability, which could be partly explained by the historical and economic impact. More in-depth analysis revealed that the relationship between literacy, experience and technology adoption are linked and there is still a need for the government to understand the motivational factors to develop policies to bridge the gap.

6.3 Recommendations

With proper awareness and policy intervention by government and business, there could be a better understanding of the benefits, and a willingness to adopt, which would ultimately lead to a better quality of life. It is essential to expedite the communication efforts to promote and make users aware of the societal benefits of e-health technologies. On the other hand, research evidence demonstrates how vital it is to focus on people with low level of education, limited digital experience, and no exposure to Internet inclusive of in health sector can change the perception to adopt and use the technology. Furthermore, the findings in this report show that with an increased level of awareness educating users on the benefits of e-health technologies there is an opportunity to increase the level of intention to adopt the technology.

A useful method in training interventions would be to design a strong e-health technologies adoption awareness framework aimed at increasing positive attitudes towards the use of the technology in elderly persons. To address the main identified barriers to e-skills. The findings recommends a paradigm shift in how health curriculum is delivered, perceived, implemented and evaluated. Finally, the introduction of digital skills in health institutions could assist in expediting the adoption of e-health technologies. This will result in efficiencies in the sector. This increase in efficiency will reduce long queues and improved quality of offered service. Training and continuing professional development of students and health professionals is essential to promote e-health technologies and improve high quality of life. E-skill training and the provision of government supported health facilities that offer internet access in South Africa in all official languages is crucial to realise the potential of ICT to help improve the health knowledge and adoption behaviour of all citizens. WHO offers free online and offline education material and courses; however, the courses should align to local health care, culture dynamics, customs, and customized in various local languages. The necessary transformation of the health care structures holds potential for digital acceleration and universal access to effective plans to promote healthy older care.

The study findings can assist with development of strategy framework into the development of e-health standards and pricing guidelines for the rural market. Lack of security and privacy may partly be addressed through public engagement and a form of awareness to POPI act and cyber security bills available to protect the public.

Meanwhile South Africa has e-Health strategy, POPI Act and Cyber-security, there is a need to develop confined in level of legislation to drive the adoption of e-health solutions into day-to-day health care. Additionally, to overcome privacy risk national policy such as POPI ACT and e-Government strategy was developed. The results show that government has a huge role to influence the privacy by regulating the industry.

6.3.1 What the Study Adds to the Body of Knowledge

- Infrastructure readiness in rural areas is low
- Health care service and funding per capita remain a challenge in rural areas
- Technology affordability in rural areas is a significant barrier to adoption of technology
- Development and implementation of information infrastructure are critical to support the technology at health institutions to promote the adoption of digital transformation.

6.4 Where the Study can be Applied?

The study findings did add to the body of knowledge, and it can be applied to any field of study relating to technology acceptance.

- Policy development
- Professionals in the field of study

6.5 Future Study

- This study suggests additional scope to build upon the current study in the future.
- The study utilised only qualitative methodology principles there is an opportunity for future study utilising quantitative methodology.
- Furthermore, data was collected from a small sample focused in a rural geographic area, an additional collection of data for elderly persons living in a developed geographic area with a different economic background and exposure to a different level of education because other authors' findings indicated evident positive attitude to the adoption of e-health in developed countries.

- To evaluate the extent to which POPI act protects individual users' private data collected through the technologies.
- Digital development in health technologies are crucial to improve health service in rural areas; researchers are encouraged to explore and investigate motivational factors towards adopting the technology by elderly persons in rural areas.
- Insights from the policy-makers suggest there are gaps in the current policy implementation to address the digital skills and effective adoption of the technologies. Further research could be conducted to understand the extent of the gap.

6.6 Limitations of the Study

Similarly, to other models, the TAM model as a developed model, which has been consistent, implemented in technology acceptance studies has limitations. Chung et al. (2016) in his study, point out that TAM has a limitation when applied in research in smart home technology acceptance because the framework is not extensively applied in technologies in the health environment. Equally so, what emerged from this study is that there is agreement with other related studies that constructs such as security and privacy contribute to factors affecting technology acceptance.

6.7 Chapter Conclusion

The learnings from this study can form key input in understanding how health institutions, policy-makers, and the ICT industry can promote, develop, manage and introduce e-health technologies in developing countries amongst the elderly community. Furthermore, it can be used as an analysis in ensuring that the technologies are relevant and adopted.

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Annexure A



THE PARTICIPANT INFORMATION SHEET MASTERS RESEARCH

RESEARCH TOPIC: INVESTIGATING MOTIVATIONAL FACTORS, POLICIES AND REGULATORY ISSUES INFLUENCING DIFFUSION OF E-HEALTH TECHNOLOGIES

My name is Evah Mthimunye, I'm currently studying for the Master of Arts in the field of ICT Policy and Regulation (MA-ICT-PR) with the University of the Witwatersrand (Wits). In order to successfully complete the degree, I am required to conduct focus group with relevant residences in the retirement home in South Africa to understand the impact of emerging regulatory issues in the adoption of e-Health technologies.

Before deciding whether or not to take part, it is essential for you to know why this research is being conducted and what it will include.

Purpose of Research

The purpose of the study is to investigate motivational factors, policy and regulatory issues influencing diffusion of e-Health technologies for older people in South African rural settings.

The research is conducted in my personal capacity for academic purpose only. The focus group should take less than an hour to complete and it will be conducted in English. Focus group is a method of data collection from small group of people with similar experience and attributes and the researcher leads the group.

With your permission, the interview will be audio recorded and I will also take notes. The recording will accurately record the information you provide, and will be used for transcription purposes only. Neither your name nor any other identifying information will be associated with the audio recording or the transcript. The response will be linked to a fictitious code number or a pseudonym. If you choose not to be audio recorded, I will take notes instead. If you agree to be audio recorded but feel uncomfortable at any time during the interview, the recorder will be turned off at your request. If you agree to be audio recorded, you will be given the consent form for audio recording to sign.

Any personal information collected about you will be kept strictly confidential, any identifiers that can compromise your identity will be removed from the data and will also not be included in any subsequent publications.

There are no risks that are anticipated with your participation. There are no immediate benefits to the participant in the study. Issues to be discussed will cover what is already in the public domain in the form of policies, regulation and strategies for e-Health technologies.

The data generated in the course of the research will be stored electronically in a secure environment and used for research or academic purposes now or later date in a manner that will not compromise your identity. All future

use of the stored data will be subject to further research Ethics Committee evaluation and approval. This report can also be given to you upon request.

Research Ethics

If you have concerns about the research, its risks and benefits or about your rights as a research participant in this study, you may contact my supervisor Dr. Kiru Pillay, see contact details below.

Contact for Further Information

Program Director:
Lucienne Abrahams
luciennesa@gmail.com
+27 (0) 825697675

Supervisor:
Kiru Pillay
kiru2010@gmail.com
+27 (0) 826027261

Researcher:
Evah Mthimunya
mthimue@gmail.com
+27 (0) 81 435 4199

Annexure B



Faculty of Humanities University of the Witwatersrand, Johannesburg

P O Box 601, Wits, 2050

INFORMED CONSENT FORM

TITLE OF STUDY: MOTIVATIONAL FACTORS, POLICY AND REGULATION WITH RESPECT TO
ADOPTION OF e-HEALTH TECHNOLOGIES ON OLDER PEOPLE

I hereby agree to participate in research on investigate motivational factors, policy and regulatory issues influencing diffusion of e-Health technologies for older people in South African rural settings. I understand that I am participating freely and without being forced in any way to do so. I also understand that I can stop participating at any point should I not want to continue and that this decision will not in any way affect me negatively. I understand that this is a research project whose purpose is not necessarily to benefit me personally in the immediate or short term. I understand that my participation will remain confidential.

Please initial box

1. I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions.
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving a reason.
3. I understand that the researcher will not identify me by name in any reports using information obtained from this interview and that the views I express will remain confidential; **OR**
4. I agree to my institution name being listed as a participant in this study in the annexure to the report, as well as in the main body of the report.
5. I agree to the interview being audio recorded.
6. I agree to the use of anonymised quotes in the dissertation.

7. I agree that data gathered from me in this study may be stored
(after it has been anonymised) and may be used for future research.

☐

Name of Research Participant

Date:

Signature:

Ms. EVAH MTHIMUNYE

Name of Researcher:

Date:

Signature:

Annexure C



RESEARCH INTERVIEW GUIDE WITH POLICY-MAKER

1. What are your views on the role that the government has played in addressing the adoption e-Health technologies adoption challenges? How can the government address these challenges? Please elaborate
2. Which laws or regulations are available in South Africa to promote or inhibit the adoption of the e-Health technologies?
3. What interventions are required from the government to promote the adoption of e-Health technologies?
4. To what extent does the existing policy protect the e-Health technologies user? Please elaborate
5. Do you perceive the benefits of e-Health technologies? What do you see as the most important benefit of adopting the e-Health technologies by the end users?
6. Do you see any security risk in using the technology? How is the policy protecting the consumers?
7. Do you perceive any privacy risk in using the technology by the end users?
8. Do you foresee any privacy concerns in using the technology by the end user?
9. How effective is the policy in promoting the adoption of e-Health technologies?

Annexure D



RESEARCH INTERVIEW GUIDE WITH OLDER PEOPLE

RESEARCH INTERVIEW GUIDE OLDER PEOPLE:

1. Are you aware of the e-Health technologies for health? Cues: monitor activity, vital signs, fitness etc. What do you think about the e-Health technologies?
O a tseba na ke technology e-Health [yes/no]
2. If the e-Health technologies were installed in your home, do you think this technology would improve the way you carry out your daily activities? Why?
A na wa dumela gore fa go ka tsentswa e-Health technologies mo ntlong ya gago.
O nagana gore bophelo bo ka kaona fala. [yes/no]
3. What would influence your decision to adopt e-Health technologies (e-health application) and why?
Ke eng se se kago tshutsomeletsang ho sebedisa kapa ho amohela technology e?
lebaka la hao e kaba lefeng? [yes/no]
4. If you had an opportunity to live in a home with e-Health technologies installed, would you be comfortable to live in such an environment? Why?

E kaba hao o ne o ena le monyetla wa ho dula ka hara ntlo e sebedisang technology eo, e ekaba o ne o tla iketla nna? [yes/no]
5. What are the benefits and challenges that you would consider about adopting e-Health technologies?

Mathata le menyetla eo o kae nahanang mabapi le tsebediso ya technology e kea feng? [yes/no]
6. How easy it is for you to learn how to operate e-Health technologies? How easy do you find the use of e-Health technologies in your daily life? Please elaborate

Ho bonolo ha kang kang ho sebedisa technology e lapeng? O bona hole bonolo ha kae ho sebedisa rechnology e letsatsi ka letsatsi bophelong ba gao? Ka kopo hlalosa ka hofetelela. [yes/no]

7. What are the most important perceived risks about using e-Health technologies (e-health application)? Can you describe these risks and explain why they are so important?

Ke eng se o se naganang hore e kaba kotsi ka technology ena. O ka hlalosa mathata ao, le ho rehlaloesetsa bohlokwa ba ona? [yes/no]

8. Would data resulting from the installed technology that show how active you are be of benefit to you and your health practitioner?

A na di kgathiso tse di tswang go technology di ka go sebeletsa le doctor ya gago [yes/no]

9. Do you in general have any concerns around security and use of e-Health technologies (e-health application) in your home?

E kaba o nale matshwenyeho a polokego mabapile go sebedisa technology mo gae? [yes/no]

10. Do you in general have any concerns around privacy and use of e-Health technologies in your home?

E kaba o nale matshwenyeho a hlokofoetso mabapile go sebedisa technology [yes/no]

Annexure E



Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)

R14/49 Mthimunya

CLEARANCE CERTIFICATE

PROTOCOL NUMBER: H17/04/21

PROJECT TITLE

Investigating the impact of emerging regulatory issues, benefits and challenges in adoption of smart home monitoring technology in South Africa

INVESTIGATOR(S)

Mrs E Mthimunya

SCHOOL/DEPARTMENT

Literature, Language and Media Studies/

DATE CONSIDERED

21 April 2017

DECISION OF THE COMMITTEE

Approved
Permission letters are required before data collection can commence

EXPIRY DATE

10 July 2020

DATE

11 July 2017

CHAIRPERSON


(Professor J Knight)

cc: Supervisor : Dr K Pillay

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University. Unreported changes to the application may invalidate the clearance given by the HREC (Non-Medical)

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to completion of a yearly progress report.**

Signature _____

Date _____

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

Annexure F



OFFICE OF THE DIRECTOR GENERAL

Private Bag 70860, PRETORIA, 0001 – IPerlot Office Park, 399 Jan Shaba Street, Hatfield, PRETORIA
Tel: +27 12 427 8000- Fax +27 12 427 8016 –email: director-general@dtps.gov.za. www.dtps.gov.za

Ms Evah Mthimunya
Director: Broadband Modelling and Data Analysis

Dear Ms Mthimunya

REQUEST FOR APPROVAL TO CONDUCT RESEARCH INTERVIEWS IN THE DEPARTMENT FOR YOUR MASTER OF ARTS IN THE FIELD OF ICT POLICY AND REGULATION

Your request regarding the above dated 24 October 2017 has reference.

Approval has been granted for you to conduct research interviews in the Department for your Master of Arts in the field of ICT Policy and Regulation, however, this is subject to the signing of the attached confidentiality agreement by yourself and any employees who participate in the research.

The completed and signed agreement should be returned for the attention of Ms Cynthia Maponya, Director: Human Resource Development. Once it has been signed on behalf of the Department, a copy will be forwarded to you.

Yours sincerely

MR ROBERT NKUNA
DIRECTOR-GENERAL
2017-11- 10



Annexure G

RE: Request for participation and Individual  Inbox x

CEO (ICASA) <ceo@icasa.org.za>

to Tsatsi,, CEO, me ▾

Good Afternoon,

We refer to your request.

Our CEO has not approved this request.

We wish you all the best in your studies.

Kind regards,

Shameetha Maharaj

Executive Personal Assistant to CEO

Tel: 011 5663085

Cell: 0829799900

Email: smaharaj@icasa.org.za



Annexure H

Investigating motivational factors, policy and regulatory issues influencing diffusion of e-Health technologies for older people in South African rural settings.

Advert to Recruit Focus Group Participants



This will be a 1 hour discussion. This is an opportunity to ensure that technology develops

NOVEMBER 2017, 23TH /24TH/25TH AT 4:00-5:00 PM

Invitation to be a participant on a focus group

My name is Evah, a student at the **University of the Witwatersrand**, conducting research on benefits and impact of emerging regulatory issues **on adoption of assistive digital technologies** in elderly persons.

Due to your firsthand experience use of some of the health monitoring technologies, you are invited to be part of this study as a participant in a focus group discussion. Hearing your **experience, perceptions, privacy and security concerns of data collected**, will help the technology developers to incorporate your concerns during technology development, and regulators, or policy-makers **to develop policies and regulations** that protect elderly persons against emerging technologies.

If you are available on any of the dates above and willing to take part in this discussion, kindly contact **The Office for further information on logistics.**

Snacks and light refreshment will be provided.

Annexure I

Ms. Evah Mthimunye

Masters Student at WITS University

Dear Ms Mthimunye

REQUEST FOR APPROVAL TO CONDUCT RESEARCH INTERVIEWS IN THE
RETIREMENT HOME FOR YOUR MASTERS OF ARTS IN THE FIELD OF ICT
POLICY AND REGULATION

Your request regarding the above dated 24 November 217 has reference.

Approval has been granted for you to conduct research interviews in the retirement for
your Masters of Arts in the field of ICT Policy and Regulation. Confidentially, should
be adhered to of the member of the participants from the retirement.

We wish you all the best with your studies.

Yours Sincerely

Annexure J

Heart tracking device

Health sensor wearable



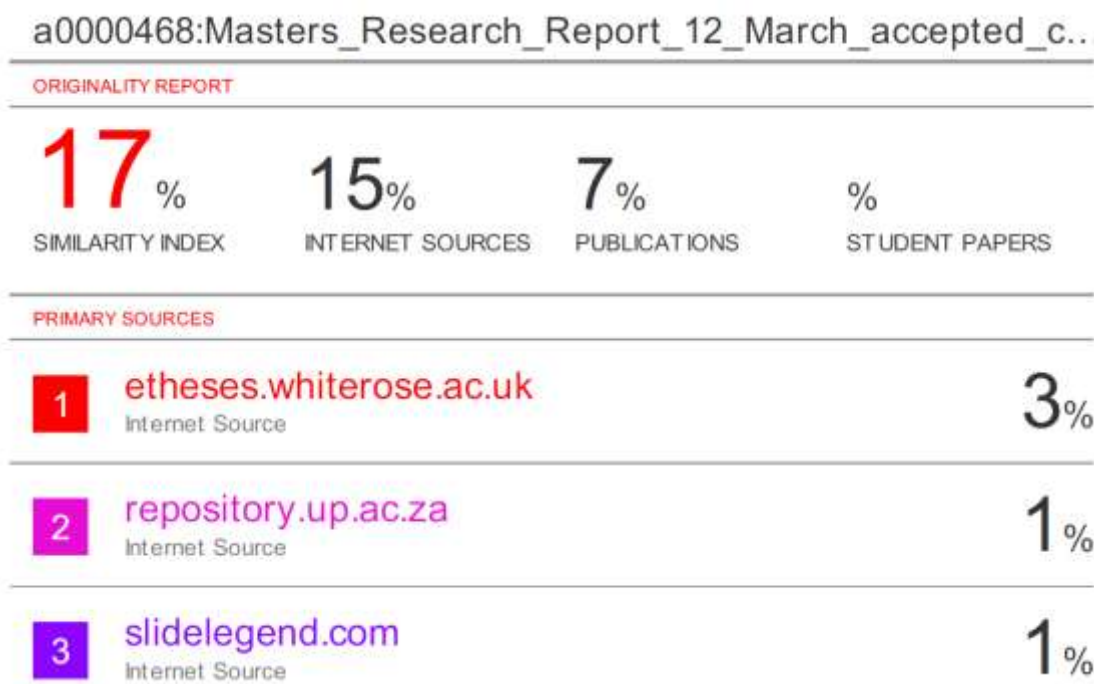
Annexure K

TurnIt In results and Fix:

When I initially submitted the Masters report for Turnitin to check plagiarism, the results come back with 17% similarities index with the following breakdown: 15% internet source, 7% publications and 0% students papers.

How did I resolve the issue?

- Firstly I focused on issues highlighted red with more than 3% rating.
- The review included quotes that were referenced – all direct quotes that were correctly references were not amended
- Quotes without proper referencing were fixed
- Sentences which were highlighted as issue were paraphrasing



Annexure L

Thank you to the examiners for the essential comments. I have taken the comments with a positive spirit and ensured that I correct each comment as requested.

The title was amended as per proposal: Motivation factors, policy and regulation with respect to adoption of e-health technologies for elderly persons.

Grammar, spelling, punctuation, paragraph logical flow of ideas, paragraphs and sections were corrected and verified by editor. Theoretical framework and constructed were corrected. Research question and sub- question were amended as per recommendations.

Abstract section was corrected.