EXPLORING THE CHALLENGES AND IMPLICATIONS OF DESIGNING, DEVELOPING AND IMPLEMENTING ACCESSIBLE E-GOVERNMENT SERVICES

A DISSERTATION PRESENTED TO THE

DEPARTMENT OF INFORMATION SYSTEMS

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BY

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ABSTRACT

E-Government is perceived to be a vehicle for transforming how governments deliver public services and interact with each other and with their citizens as well as businesses. Governments present their services via their online websites. It is therefore paramount that e-Government services are accessible and well-designed to allow all those who use the services the ability to use them. Yet, accessibility of e-Government websites continues to remain a challenge to people with disability (PWDs) worldwide, and more so in low to middle income countries where the majority of PWDs reside. This dissertation examines the challenges e-Government designers and developers face when designing and implementing accessible e-Government services with the key purpose of understanding how these challenges affect their current practices of designing and implementing accessible e-Government services.

The study employed qualitative techniques, specifically qualitative semi-structured interviews to collect primary data from government employees working as developers, designers, business analysts, and the management team. For triangulation purposes, secondary data from South African government websites was collected to identify and understand how government is incorporating accessibility into its policies and legislatures. The data was analysed using a thematic analysis.

The findings present six challenges: legacy and bespoke systems, human and financial resources, stakeholder awareness of accessibility, monitoring of accessibility, collaboration in prioritising of accessibility and management support. All of which influence the design and implementation of accessible e-Government services. Furthermore, these findings explain how these challenges affect the current practices of designing and implementing accessible e-Government services. Identified common practices include championing accessibility, adoption of an omni channel approach as well as digital learning and awareness, development of inhouse guidelines and best practices as well as support for developing assistive technologies. The study discusses the implications of these findings for future studies.

Keywords: E-Government, accessibility, retrospective practices, tools and technology, persons with disabilities

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LIST OF COMMON ACRONYMS

AT……	Assistive Technology
ICT……	Information Communications and Technology
ID……	Inclusive Design
IS……	Information Systems
IT……	Information Technology
PWD……	Persons with disabilities
SMS……	Short Message Service
SSA……	Sub Saharan Africa
UD……	Universal design

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CHAPTER 1: INTRODUCTION

1.1 Introduction

Investment and growth within the information communication and technology (ICT) sector in South Africa is increasing (Ibrahim, Adam & Sare, 2019). ICT is being used in government, in what is termed as e-Government, which enables government to offer more efficient ways of delivering information and making services accessible to both citizens as well as to businesses, by making use of technology services such as websites, mobile applications and social media in order to reach citizens. The ability to access e-Government services 'promotes democracy through inclusive participation' and this is ultimately what e-Government is trying to achieve (Agangiba et al., 2018, p.2). Despite these benefits, e-Government has the potential to exclude persons with disability (PWDs) – these are the 15% of the world's population that live with a physical, sensory, intellectual, or mental health impairment, significant enough to affect their daily activities (Groce, 2018). These forms of disability make it difficult to participate fully in consuming e-Government services. PWDs usually receive limited support from the community, and consequently live "without equal access to health care and rehabilitation, education, and employment, and marginalised or excluded from the socioeconomic, religious, and political lives of their communities" (Groce, 2018, p724). This is concerning especially for lower to middle income countries that have higher populations of PWD's than developed economies (Flaxman et al., 2017); and have a low level of digital literacy required to navigate and use technological systems, such as e-Government systems. Adding to these challenges is the lack of clarity on the web content accessibility guidelines which fail to guide developers during implementation and the cost associated with meeting these guidelines (İşeri et al., 2017). Although several studies have documented how inaccessible online government services are to PWDs and how this alienates them from enjoying the e-Government benefits; there remains limited studies exploring how best to address the challenges PWDs face; specifically, the barriers within the context of lower to middle income countries where the majority of PWDs reside (Flaxman et al., 2017; Glyptis et al., 2020; Kariuki et al., 2019; Thinyane, 2013). Part of the problem is that there remain limited studies done in low to middle income countries on this phenomenon; and when done, these studies take accessibility into account from a web content accessibility perspective, thereby making it difficult to see the big picture. This study seeks to contribute towards addressing this challenge because "people with disabilities have routinely been overlooked by global health and international development efforts" (Groce, 2018, p.724), despite the "strong correlation between digital exclusion and social exclusion" (Othman et al., 2020, p567).

1.2 Research Problem

1.2.1 Background to the study

Many studies have focussed on the issues surrounding accessibility but there is not enough research surrounding the issues faced by designers and developers building e-Government services. Access to e-Government services remain limited for persons with disabilities (PWDs) due to several reasons including poorly designed e-Government services, lack of digital literacy, lack of awareness surrounding web content accessibility and limited access to assistive technology (Almourad et al., 2019; Almarabeh & Abu Ali, 2010; Rossvoll & Fuglerud, 2013; Harder, 2017). These studies have all highlighted e-Government accessibility from a web content accessibility perspective that assess their accessibility and usability for PWDs

(Boussarhan & Daoudi, 2014; Fuglerud & Sloan 2013; Salvio, 2020). Although these studies help practitioners identify accessibility issues in several websites, the evaluation in most cases, tend to be after the fact, with most not involving end users (PWDs) in the evaluation process. There remains limited documented literature and understanding on what challenges designers and developers face, as well as how to potentially address those challenges to arrive at an accessible e-Government solution for all. Several studies have noted the need for better understanding of these challenges and readily available resources for the implementation of an accessible e-Government system (Flaxman et al., 2017; Glyptis et al., 2020; Kariuki et al., 2019; Naidoo, 2012; Thinyane, 2013; Zhenbin et al., 2019). There thus, remains the need to examine and understand what challenges designers and developers face when developing accessible e-Government solutions.

1.2.2 Contextual background

The context for this study is South Africa. South African e-Government services are evolving and according to the United Nations e-Government survey from 2018, South Africa is currently one of only four African countries in the top 100, ranked at 78th in the world, which remains high in the global ranking together with Seychelles and Tunisia, while Mauritius has moved up to 63 as the highest ranking in Africa (UN E-government Survey, 2020). Table 1 provides insight into some of the initiatives for the e-Government roadmap and strategy for South Africa. The e-Government framework aims to ensure that all South Africans can access quality public service and government information from anywhere and at any time (RSA Government Gazette, 2017). These include the lack of strategy by key stakeholders which can guide the successful implementation (Osah & Pade-Khene, 2020); the lack of awareness of assistive technologies for accessing online websites (Kariuki et al., 2019; Agangiba et al., 2018 and Rhowder, 2018); the fact that significant investment in ICT in e-Government projects tend to be focused towards urban cities thus excluding those in rural districts (Mawela, Ochara & Twinomurinzi, 2016); the fact that “there is no dedicated budget allocation for the specific implementation of e-Government” (RSA Government Gazette, 2017, p502) and that most of these e-Government initiatives operate in isolation with no collaboration amongst various stakeholders.

Project:	Platform:
SARS e-filing sophisticated tax collection system	Web based and Mobile application
Department of Home Affairs - Smart Identification Card	Web based
Integrated National Transport Information System (NATIS): Car and License Registration (Limited to individual provinces)	Web based
Department of Health - National Health Normative Standards Framework (HNSF) for Interoperability in eHealth	Web based
SITA Government-to-Government G2G systems include Logistic Management Information System (LOGIS), National Population Register (NPR), Social Pension Fund (SOCPEN), Police Crime Administration System (CAS)	Web based
Johannesburg road agency – Find and Fix: report faulty traffic lights as well as potholes and other infrastructure issues	Mobile App

Table 1- Initiatives from South Africa e-Government (adapted from RSA Government Gazette, 2017):

1.3 Research objectives and questions

The goal of this study is to explore the challenges faced by e-Government technical experts in designing and implementing an accessible e-Government system. The objectives of the research are:

i. To identify the challenges e-Government designers and developers face when designing and implementing accessible e-Government services.
ii. To understand how these challenges affect designers and developers current practices of designing and implementing accessible e-Government services.

With these objectives in mind, this study seeks to answer the following research questions:

i. What challenges do e-Government designers and developers face when designing and implementing accessible e-Government systems?
ii. How do these challenges shape the current practices of designing and implementing accessible e-Government services?

1.4 Structure of Dissertation

This thesis is organised as follows: The current chapter, serves as an overview of the study, stating the key research goals and objectives, given the research problem. The next chapter presents related work around the e-Government and accessibility literature. The chapter provides a comprehensive analysis of the gap in literature that we seek to address. This is then followed by Chapter 3, which explains the methodological procedure the researcher followed to execute the study. Chapter 4 discusses the descriptive findings as well as the empirical findings. Chapter 5 engages with those findings, by providing a comprehensive discussion of the findings. Chapter 6 is the final concluding chapter and provides implications for practice as well as recommendations for future research as well as well as summarising the thesis.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter presents related work on key concepts on e-Government. Then, the factors influencing successful adoption of e-Government is discussed. Finally, the chapter reviews and synthesises the factors influencing the design and implementation of accessible e-Government services.

2.2 E-Government

E-Government is conceptualized as the usage of information and communication technologies (ICT) to provide services, improve efficiencies, and improve government operations (Vidmar et al., 2019; Twizeyimana & Andrersson, 2019). It can further address issues relating to access to information as well as interaction between citizens, businesses, and government (Agangiba et al. 2018; Choi & Chandler, 2020; Harder & Begnum, 2016). It is because of these benefits and others, that investment in e-Government projects across the world have increased, in order to deliver government services to citizens through the internet and web technology (Sa et al., 2016, Rana et al., 2015).

As governments embark on providing their services online (e-Government services), it is imperative that these remain accessible to all online users (Rana et al., 2015), because e-Government, although developed with good intentions, can also act as a tool of exclusion for some citizens such as PWDs, when not implemented with their needs in mind. Web content accessibility guideline (2.0) is the international guideline which provides specifications and provisions on how to ensure there is accessibility when designing and developing websites. The web content accessibility guidelines can be accessed on the official W3 website at www.w3.org which provides the standards needed to ensure accessibility. It is based on 4 principles namely: perceivable, operable, understandable and robust. Although Web Content Accessibility Guidelines (WCAG 2.0) have been proposed to ensure that online resources and services are accessible to PWDs; several researchers have noted that most websites remain inaccessible. For example, Salvio (2020) found at least 77% of the 12 e-Government websites in the Philippines were not accessible. In India, Paul and Das (2020) examined 65 Indian e-Government websites for their accessibility and usability. Their findings of these accessibility tests highlight the existence of accessibility issues and the usability tests also showed that e-Government websites give low priority to such aspects during website design and development. Similar findings are reported in Sub Saharan Africa (SSA) where Verkijika and De Wet (2017) report that most government websites in SSA still had a long way to go to become accessible based on the WCAG 2.0 standards. Specific instances are noted, like Uganda, which show that all the websites not do not satisfy the level AA accessibility guidelines (Nakatumba-Nabende et al., 2019). In Ethiopia, the current status of e-Government websites are seen to violate most of usability heuristics rules (Zeleke, 2020) and Libya's government websites had a significant number of usability problems ranging from visibility of system status, user control and freedom, and the ability to recover from errors (Karaim & Inal, 2019). According to Verkijika and De Wet (2017), factors influencing e-Government accessibility in SSA, include the Human Development Index (HDI), Corruption Perception Index (CPI), and percentage of the active population (15-64 years). They show that countries with high HDI levels and low CPI levels tend to have websites with fewer accessibility errors, while countries with high percentage of the active population have more accessibility errors. Whilst these observations pave the way in better understanding the rationale of why there remains a lack of accessible e-Government, there remains a need to understand how best to go about implementing an e-Government website that is accessible to all.

Existing literature surrounding e-Government can be grouped into three main themes, firstly the adoption and usage of e-Government, secondly the assessment of e-Government and e-Government websites and services and lastly the impact e-Government has on countries and the implementation thereof. These are discussed in subsequent sections.

2.3 Factors influencing the successful adoption of e-Government

2.3.1 Organizational factors influencing adoption of e-Government

E-Government implementation is a complex task and requires co-ordination between the different government stakeholders when embarking on the adoption of e-Government (Hossain et al. 2011). Rowley (2011) identified several e-Government stakeholders such as citizens, e-Government project members, businesses, politicians, suppliers and partners and public administrators (employees). Government stakeholders should be seen as a group of individuals that can be affected by or affect the e-Government implementation project (Choi et al., 2016). Close co-ordination and collaboration between stakeholders is important for having a successful e-Government implementation project (Choi et al., 2016) because user's voices become incorporated and taken on board. However, Al-Rawahna et al. (2019) notes that this collaboration is very minimal during the initial design and implementation process of an e-Government project and could be the source for projects not meeting their intended goals and objectives. Gunawong and Gao (2017, p.168) sees the key challenge in e-Government system implementation as the lack of top management as focal actors to support the other actors in the network in their efforts both to play their roles properly". Harder and Begnum (2016) calls for top level management to collaborate with all stakeholders, specifically the design team and the PWD interest groups to ensure focus is on developing systems that are accessible to all users.
Several studies have also noted the need for readily available resources for the implementation of an accessible e-Government system (Flaxman et al., 2017; Glyptis et al., 2020; Kariuki et al., 2019; Naidoo, 2012; Thinyane, 2013; Zhenbin et al., 2019). Yet, many e-Government systems lack adequate resources. For example, although access to information technology experts as well as knowledge workers involved in the designing and implementation of e-Government services is important; this remains as one of the consistent organizational challenges most public institutions face (Kurt, 2018). It has also been noted by Antwerpen and Ferreira (2016) that mismanagement and inadequate financial and human resources contribute towards poor service delivery of government services. From a South African context, the national government has stated that the implementation of e-Government faces challenges due to the decentralization of e-Government funding (RSA Government gazette, 2017). Access to financial resources is seen to be limited for public actors (Wynen et al., 2014) and there is a perception that designing for accessibility is cost intensive and therefore not given a priority during design and implementation (Rossvoll & Fuglerud, 2013). The three biggest resources for e-Government services are comprised of financial resources, technological and human resources (Harder & Begnum, 2016; Zhenbin et al., 2019). From a financial resource perspective, the design for accessibility from an e-Government perspective can be constrained

due to the fact that public agents are limited in their ability to control the budget for innovation (Wynen et al., 2014).

With technological resources, e-Government initiatives rely on technological infrastructure as well as hardware, software and services (Przeybilovicz, Cunha & Meirelles, 2018). In order for e-Government and its services to develop further it is important that there is adequate infrastructure in place as without this, there are only a limited number of citizens that are able to make use thereof (Zhao, Collier & Deng, 2014). ICT is now a part of every facet of government whether directly or indirectly and to this end all employees should have a basic understanding of how to use e-Government services (McQuiston & Manoharan, 2021).

2.3.2 Environmental factors influencing adoption of e-Government

Environmental factors influencing e-Government identified in literature include socio-cultural, citizen and industry support factors. Citizen demographic factors have been noted as key in influencing e-Government adoption, for example, early adoption of technology were generally those that were young and higher income earners (McQuiston & Manoharan, 2021). Numerous studies have also shown that age, gender as well as education levels also plays a major role in technology adoption (Abu-Shanab, 2015; Komba & Ngulube, 2014; Urbina & Abe, 2017). It has also been noted that e-Government adoption is positively influenced by the levels of digital literacy (Ibrahim & Zakaria, 2016).

The lack of public and private collaboration, support and lack of clear strategy were some of the main barriers relating to implementing successful e-Government information systems (Al-Rawahna et al., 2019). Agbozo (2019) calls for e-Government authorities to create the necessary environment for the private sector to support government in achieving a formidable e-Government system. Ashaye and Irani (2019, p.253) have "recommended that public organisations would need to strategize their relationships with stakeholders in order to achieve a collective interest for successful e-Government implementation".

2.4 Factors influencing the design and implementation of accessible e-Government services

The web content accessibility guidelines (WCAG 2.1) define web accessibility to include tools as well as technology that are developed and designed so that people with disabilities can understand, interact as well as navigate and contribute with the website. WCAG 2.1 caters for all disabilities accessing the web including physical, cognitive, auditory, speech as well as neurology. Although the web accessibility guidelines are well established, studies have shown the lack of compliance to these guidelines specifically relating to e-Government websites (Boussarhan & Daoudi, 2014; Fuglerud & Sloan, 2013). Most studies surrounding e-Government have been quantitative in nature and incorporate website analysis to determine compliance for accessibility such as studies conducted by (Kamoun & Almourad, 2014; Paul & Das, 2020; Serra et al.2015; Verkijika & De Wet, 2017). To address accessibility, several techniques from literature are proposed and explained in the following subsections.

2.4.1 Universal and inclusive design

Buchdid et al. (2015) asserted that in order for ICT products to be accessible and usable to all, researchers need to identify the barriers in the design of information systems. To do so, universal design (UD) and inclusive design (ID) have been identified as potential means of addressing accessibility challenges during design. This is based on the premise that UD begins with considering all users, so as to develop products that are accessible to and usable by all people regardless of their abilities (Liu et al., 2015); and ID focuses on providing the 'full range of human diversity' and intends to provide access to as many citizens as possible (Dosis, 2014, p8). Universal Design (UD) advocates the accessibility and usability of a system for the users irrespective of their age and different abilities (Awale & Murano, 2020). Universal Design is guided by some key principles of equitability, flexibility, ease of use, access and tolerance of error. With these principles, it is envisaged that designers and developers as practitioners would be well guided in developing inclusive solutions for consumers regardless of any impairment. For example, with equitability, UD seeks to avoid disadvantaging and stigmatizing users and ensuring that one provides the same means of use, privacy, security, and safety for all users (Skuse, 2020). The design should accommodate a wide range of individual preferences and abilities; and also make it easier to understand and use. Seen in this manner, UD and ID presents an approach for exploring the barriers in the design of e-Government systems/services in the context of lower to middle income countries, with the intent of understanding how these services can be made accessible and usable to PWDs from these settings. Eikhaug et al. (2010) found that there are certain negative connotations surrounding the barriers to UD and ID, as it is perceived to be too costly, only about assistive technology and only focuses on PWD. Some organisations tend to view UD and ID as unnecessary expense and, in some cases, only justified by ethics (Halbach & Fuglerud, 2016).

Dosis (2014) calls for designers to meet two additional requirements when creating online solutions that meet the wide range of human diversity: sociability and hospitality. According to Dosis (2014) inclusive design begins when designers understand that online users are social beings who engage in social actions. As social beings, engaged in online activities, designers should develop online solutions that give users a social space of belonging, instead of a space that makes it difficult for them to participate and feel included. User experience becomes optimal when applications are designed with sociability and with people-oriented focus (Dawar et al., 2017). People-oriented focus speaks to the aspect of hospitability that requires designers to "consider what the needs and desired outcomes of the users are and mirror those in the design" (Dosis, 2014, p.19). Hospitality in this context refers to the establishment and extensions of the feelings of welcome and comfort, creating awareness and affordances for the user community (Huvila, 2009 as referenced by Dosis, 2014).

2.4.2 The demographic characteristics of the design team

Part of developing systems which have successful inclusive design (ID) requires having the ability to be sensitive to different user capabilities and needs (Lim, 2010). To reduce the exclusion nature of e-Government service, it becomes important for designers and developers to be able to understand user's limitations in interacting with technology. Olbrich et al. (2015)

pointed out that it is important to note the demographics of the design team as this may have an influence on the usability and accessibility of products and services created. A diverse group of people will generally have more members who are sensitive to at least some design accessibility issues. As stated by Olbrich et al. (2015) there is a likelihood that there will be an improvement in providing inclusivity in design if a wider array of design team members are working together. For example, it is reported that from a gender perspective, men and women assess web-based interfaces differently (Watling, 2011). Keeping gender in mind when designing a user interface is important, as the outcome of the solution may affect the user's ability in engaging on the online platform (Reinecke & Gajos, 2014). Biased design of interfaces negatively affects users of lower socio-economic backgrounds (Johnson et al., 2017). To avoid exclusion therefore, when designing for accessibility, diversity must be assumed to be the norm (Rieber & Estes, 2017) because without diversity there may be a redundancy of knowledge within the team (Mahr et al., 2014). Knowledge and information diversity amongst information systems project team members can contribute towards to the success of the project (Liang et al., 2012). Therefore, team composition is an important aspect of design when designing with accessibility in mind.

2.4.3 Design intentions and user inclusion

Design intent "is the reflection of the design idea in designers' brain – it is the reflection of product function in design process, and designers can express design intent by expressing target function" (Wang et al., 2016, p.1758). It is important that design intentions of the team are communicated throughout the team to ensure a shared vision. Without this shared vision, there could be a "fragmented understanding of the different elements of the design requirements and how they are connected", across the design team (Laursen & Mriller, 2016, p.3). To have a shared understanding across the team, designers should incorporate the user's themselves – making them part of the design and development team through a development process such as user-centred design (Almaliki et al., 2015). In this manner users can suggest as well as test any enhancements made to the system. Another method of including users is adopting the design thinking framework which through its six phases, of understanding, empathizing, defining, ideating, prototyping, and testing, the focus is on the needs of the user and that the solution being designed constantly takes the perspective of the user into account (Carrel et al., 2018).

2.4.4 Practitioners' reflective practices

Scholars such as Samuels (2018) have indicated the need for practitioners to be reflective of their work for them to be aware of their potential biases and inequitable practices. Highlighted benefits of reflection include "better education, improved design processes, and increased self-knowledge" (Baumer et al., 2014, p.99). These benefits of reflective practices are significant when designing for inclusion lest practitioners adopt certain values and norms unconsciously that could lead to PWD barriers (Stumpf et al., 2020). Thus, simply following universal design principles is inadequate without reflective practices. Yet, most scholars agree that reflection is a challenge because reflective practices are usually seen as "uncomfortable… as it may reveal characteristics" practitioners do not want to see (Samuels, 2018, p.26). Further, there have been few studies exploring what reflection should be about in systems design; and this has created

some sense of vagueness to what reflection involves (Baumer et al., 2014). To ensure the focus remains on inclusive design, practitioners need to establish a working definition of reflection in the context of systems design, development, and testing; and most importantly, actively involve PWDs participants in the entire process of design, development and testing to evaluate barriers.

2.4.5 Use of assistive technologies

Assistive technologies such as screen readers that read web pages aloud for the visually impaired, screen magnifiers for people with low vision, and selection switches for people who cannot use a keyboard or mouse (Moreno et al., 2018), should be accessible to PWD as a support mechanism when performing tasks. The challenge as Agangiba et al. (2018) points out, is the cost associated with acquiring assistive technologies. Most PWDs in developing countries see the cost to be high and this hinders them in making use of online services (Rohwerder, 2018). Based on literature the assistive technologies as a component in aiding e-Government accessibility can be divided into three dimensions, namely cost, usage and availability. The usage of smart phones and tablets requires that there is greater support for assistive technology on the smart phone platform with apps being able to support screen reading as well as screen magnification or voice recording; however smart phone devices with this technology are also associated with a higher cost (Pal et al., 2017). This is further compounded with the fact that PWDs may require third party assistance when navigating and using technological systems; such as e-Government systems and in some cases, use these assistive technologies (Almarabeh & Abu Ali, 2010) that tend to be developed not within the context of lower to middle income country users. A study conducted by the WHO shows that the assistive technology industry is still very much specialized and currently mainly catering to the needs of high-income environments (WHO, 2018). Governments in developing countries only provides for 38% of assistive technologies as opposed to in high income countries where government is involved in providing for 80% of assistive technologies (Rohwerder, 2018). For there to be both affordable as well as accessible assistive technologies for citizens there is a need for government commitment in providing financing as well as have procurement measures in place (WHO, 2018). Along with affordability there are several researchers who have raised the lack of awareness of the different types of assistive technologies available and the benefits thereof as a barrier to accessibility (Dollie et al., 2017; Agangiba et al., 2016; Borg & Östergren, 2015; Oliveira et al., 2017; Rohwerder, 2018, Visagie et al., 2017). Whilst some e-Government websites might integrate assistive technologies during design, the challenge remains, that most websites are not adapted to or compatible with the assistive technologies used by PWDs (Boussarhan & Daoudi, 2014). To combat this challenge, periodic expert and end user testing is recommended to allow for assessment for compatibility with a wide range of assistive technologies and verify programming flaws in the interface that can cause confusion to assistive technology users. Another aspect surrounding accessibility was a lack of training and intervention from government surrounding the usage of e-Government systems and the associated assistive technologies, for those who can access them (Agangiba et al., 2018).

2.4.6 Evaluation of the accessibility and usability of website

Although usability as well as accessibility are both considered to be a quality assurance measure in information systems development, there remains a lack of proposals which focus on identifying way to improve usability as well as accessibility, as this may lead to reduced errors, and implementation time (Quintal & Macías, 2018). Literature surrounding website usability and accessibility focuses mainly on accessibility automated tools, web content accessibility law and guidelines and periodically monitoring sites for accessibility. The accessibility maturity model (AMM) used as a guide for planning and assessing for accessibility remains as an online tool and does not have the sufficient methods and techniques in place to execute an assessment that relates to both usability and accessibility (Lacerda & von Wangenheim, 2018; Quintal & Macías, 2018). Other tools and resources available for ensuring accessibility include the developed web content accessibility guidelines (WCAG). However, several studies have noted that these guidelines lack clarity, and they only accommodate for the remediation of around thirty-five to fifty percent of PWD accessibility issues (Power et al., 2012; Romen & Svanæs, 2011). Focusing purely on the WCAG 2.0 compliance guidelines can cause developed solutions that are not holistically accessible and may lead to missed opportunities to include certain PWD (Fuglerud & Sloan, 2013). To address this missed opportunity, one solution is to have periodic monitoring of e-Government websites for accessibility.

2.8 Summary

This study seeks to identify the challenges e-Government designers and developers face when designing and implementing accessible e-Government services; and how these challenges affect their current practices of designing and implementing accessible e-Government services. This chapter firstly presented related work on e-Government and accessibility to provide background information on the phenomenon in section 2.1. Then, factors that influence the successful adoption of e-Government are presented in section 2.2. These are important because these factors can also influence the successful adoption of e-Government services by PWDs.

This study focuses on the designers and developers. Specifically, challenges they experience when designing and implementing e-Government services that are accessible. Related work on this led to Table 2 – the presentation of factors influencing the design and implementation of accessible e-Government services which is discussed in section 2.3. These key concepts would be instrumental in guiding the next phase of the study

Universal and inclusive design	Awale & Murano, 2020; Dosis, 2014; Eikhaug et al., 2010; Skuse, 2020;
Demographic characteristics of the design team	Johnson et al., 2017; Olbrich et al., 2015; Rieber & Estes, 2017; Watling, 2011
Design intentions and user inclusion	Almaliki et al., 2015; Carrel et al, 2018; Laursen & Mriller, 2016;
Practitioners' reflective practices	Baumer et al., 2014; Samuels, 2018; Stumpf et al., 2020;
Use of assistive technologies	Boussarhan & Daoudi, 2014; Borg & Östergren, 2015; Pal et al., 2017; Rohwerder, 2018; Visagie et al., 2017
Evaluation of the accessibility and usability of website	Lacerda & von Wangenheim, 2018; Quintal & Macías, 2018;

Table 2: Factors influencing the design and implementation of accessible e-Government services

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter lays out the research methods and techniques employed during the study. This chapter is structured as follows: To begin, there is a discussion of the research philosophies that have been used. The research methodology is next described, which comprises the research strategy, the research purpose, the research approach, population and sampling, research instrument, and data collection. Thereafter, there is a discussion of the data analysis methodologies. The ethics and confidentiality issues are then discussed and how these were addressed. Lastly, a chapter summary is presented.

3.2 Research philosophy

All research is founded on some underlying philosophical beliefs about what constitutes valid research and which research methods are appropriate for creating new knowledge. The presented philosophical stance for this study is interpretivism. An interpretative stance considers human insights and interaction to describe the phenomenon. The research is guided by the researcher's perspectives about the world and how it should be studied (Denzin & Lincoln, 2005). Interpretivism allows the researcher to be a social actor in appreciating the differences among people (Saunders et al., 2012) as well as allowing for new observations to be considered (Pozzebon, 2004). Interpretivism as a philosophical stance will be used to understand the experiences of all actors involved during the design of an accessible e-Government system. The researcher recognises that the knowledge of designing accessible services sits with the e-Government actors who would provide a contextual understanding of the phenomenon (Saunders, Lewis & Thornhill, 2009).

3.3 Research Method

The research method can be seen as a method of investigation that progresses from the assumption to the research design to the data collection (Myers, 2019) and in information systems there are three methods, namely: qualitative, quantitative, and mixed methods (Creswell & Garrett, 2008). Qualitative methods focus on understanding how others conceptualize, construct as well as understand events. There is focus on the context, on observation and words in data collecting (Cibangu, 2013). Quantitative methods are seen to be good for deductive reasoning since they rely heavily on statistical or experimental methods to test theories and hypotheses (Bhattacherjee, 2012). Mixed methods comprise of both qualitative and quantitative methods within the same study. This study uses qualitative research methods to understand the context as well as behaviour surrounding the designing of accessible e-Government information systems. The qualitative research methodology will aim to identify how developers and designers conceptualise accessibility of e-government services through their assumptions, values, perceptions and beliefs (Neuman, 2014).

Most studies surrounding e-Government have been quantitative in nature which incorporate website analysis to determine compliance for accessibility such as studies conducted by

(Kamoun & Almourad, 2014; Paul & Das, 2020; Serra et al., 2015; Verkijika & De Wet, 2017). This study is explanatory in nature and adopted qualitative semi-structured interviews as the research strategy to detail how the researcher in this study explored the phenomenon and connect the research questions to the methods of data collection. This strategy allows for the participants to give context to their experiences in order understand exactly what factors are hindering the implementation of accessible solutions. The semi-structured interviews are appropriate as they allow for open ended and probing question to get the subjective response from the respondent as well as capture rich organisational behaviour (Newcomer et al., 2015).

3.4 Data collection

3.4.1 Population and Sampling

Data was collected from two data sources: primary data sources and secondary data source. The target population from which the primary data source was collected was government employees that were part of projects and in departments which focussed on e-Government services. This includes government employees and contractors in e-Government teams comprising of developers, designers, business analysts, project managers and management. The sample frame comprised of stakeholders who are actively involved in the design and development of e-Government projects. The sample size of this study was 12 participants. Target participants include designers, developers and project team members who are specifically focusing on e-Government projects. Purposive sampling method was employed because it empowers the researcher utilise their judgment to choose participants that will best answer their research question(s) and to meet their research goals (Clarke & Braun, 2013). The source population for the secondary data was the South African government websites to get documents specifically relating to e-Government. The secondary documents include policy's, frameworks, and ICT plans to identify and understand how government is incorporating accessibility into its e-Government services. This included documents such as the South African National e-Government Strategy as well as provincial and departmental e-Government policies.

3.4.2 Data collection and development of the research instrument

Prior to data collection, ethics clearance from the University of Cape Town ethics committee in the Faculty of Commerce was sought. This was an important step as ethical considerations are important specifically in qualitative studies which involves collecting data from human subjects (Eysenbach & Till, 2011). Each organisation and participant were sent a letter requesting their participation prior to the study (Appendix A). Participants were also notified that their participation is completely voluntary and may remove themselves from the study at any point in time. All participants' names as well as any other identifiers were anonymised to ensued confidentiality. Confidentiality and upholding UCT's ethics were one of the highest priorities throughout the collection and analysing of data. Once ethics requirements were met, data collection commenced. Primary data was collected using semi-structed interviews the interviews were developed from prior literature and informed by the emergent themes presented in Table 3. The interview instrument was categorised into the six sections. The first section, section A sought to identify the stakeholders involved and how they collaborate during the design and implementation of e-Government systems. Section B discussed the team demographics to understand the diversity amongst the e-Government agents and more specifically the design and implementation team. Section C sought to understand the design

intention of the team and the stakeholders at large. The purpose was to understand the importance placed on the intention to design with inclusivity in mind as well as discover what is the shared vision when building and designing an e-Government system. Section D garnered information surrounding universal design principles and section E aimed at identifying what assistive technology solutions were in place or considered during the design and implementation process. Finally, section F sought to understand how e-Government systems are evaluated for their usability and accessibility purposes.

Data collection commenced by contacting and communicating with government departments that were embarking on or in the process of implementing e-Government services. Government departments that had already implemented e-Government services were also contacted. Management consent from these entities was sought before commencing data collecting from the targeted participants. After approval from management, participants from these government entities were contacted requesting them to participate in the study. Each respondent was given a letter for consent to participate in this study. After consent was given, interviews were scheduled. These interviews took place using Microsoft Teams as due to social distancing, taking COVID-19 into consideration, face-to-face communication was not possible. All interviews were recorded and stored electronically as well as the researcher taking notes throughout the interview process. The data collected was stored via audio recordings and this was then transcribed into text format. The recorded sessions as well as audio recordings were stored on the UCT Microsoft OneDrive in order to keep the recordings secure. Thereafter the data was uploaded to NVivo for analysis.
Secondary data was gathered via a desktop search specifically on South African e-Government websites both provincially and nationally. The secondary data documents found were also uploaded to NVivo for analysis.

3.5 Data analysis

Data was collected from 12 participants. For qualitative studies there are guidelines regarding how many interviews are needed to ensure that there is data quality. Cresswell (2009) has a broad recommendation of 5 to 25 interviews whereas Bavik (2016) recommends that 18 interviews are needed to reach data saturation. Guest, Bunce and Johnson (2006) found that of the 60 participants interviewed they had reached data saturation with 12 interviews. This study interviewed 12 participants and data saturation was reached at 11 interviews. It has been noted by Sebele-Mpofu (2020) that the emphasis should not be on how many participants were interviewed but rather how they are relevant to the study and whether they possess competencies and knowledge which is beneficial to the study.

Once all interviews were recorded, the initial stage of analysis commenced. A mobile application called *Write4Me* was used to dictate the audio repeated from each interview and transcribed into text. Then, each transcript was repeatedly read to ensure that the researcher not only relived the interview experience and added more contextual data to the transcription if needed to, but also ensured that the transcription was indeed accurate and representative of the

actual interview. Once each transcript was assessed, the transcript was uploaded to NVivo for analysis. Across the data set, initial codes seen in Figure 1, were identified in each transcript – these were interesting facts about the data set which related to the research questions, phenomenon or concepts identified in Table 2. Then, codes that spoke to or appear to discuss the same aspect were grouped or aggregated together to form five themes shown in Table 3. The secondary data was analysed in the same manner as the primary data of the semi-structured interviews. The data analysed from the policies found online became the basis for the discussion surrounding e-Government policy.

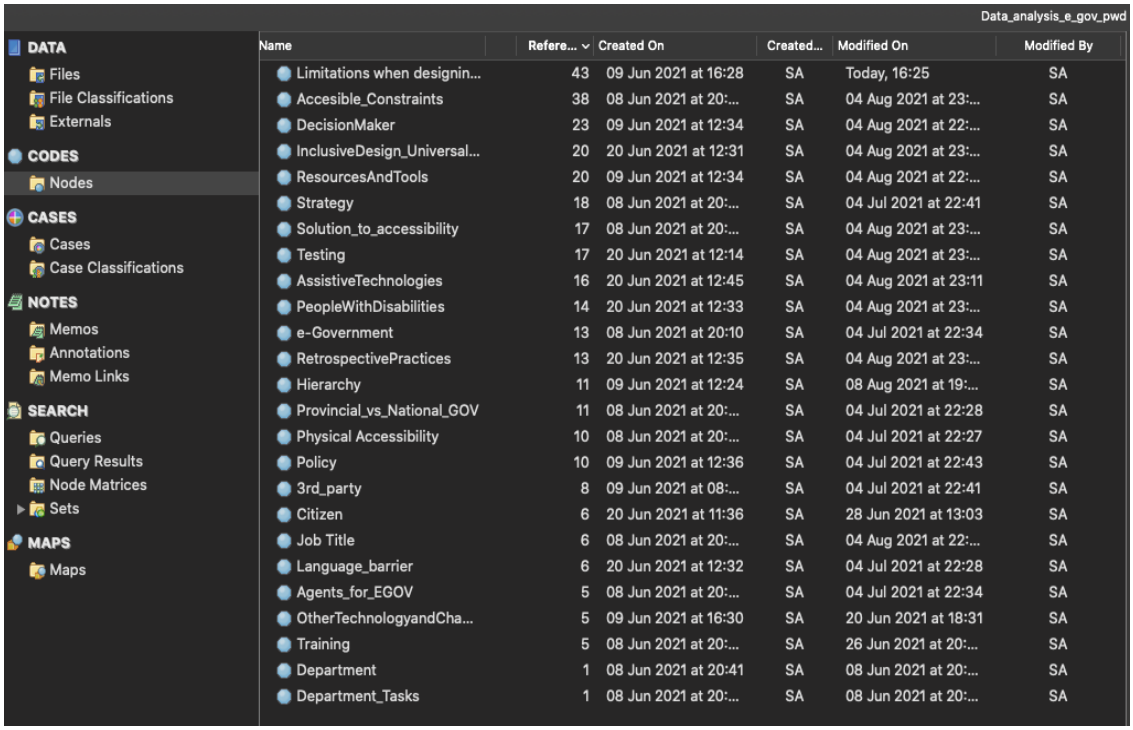

Figure 1: Data analysis example of codes derived using Nvivo

	Sub theme	Data extract example:
Constraints when designing and developing accessible e-Government services	Legacy and bespoke systems	*"We can't always manipulate the technology to suit our intended user requirements and needs"* (Participant J)
	Lack of IT expertise	"*I have learnt that here in my department it's a skill issue It's not like people are not interested they just don't know how - it's a skill issue*" (Participant B)
	Lack of financial resources	"*We currently understaffed at the moment …. affects not only accessibility but our ability to implement a host of other things"* (Participant I)
	Lack of accessibility awareness	*"We don't really check to see how accessible our solutions are to be honest"* (Participant H)
	Understanding the complexities of implementing the digital strategy	*"Nothing has come of it, once these strategies come about and get implemented, we need to work together not only top-level management"* (Participant C)
Current practices in developing and designing accessible e-Government systems	Design and implement minimal accessible standards	"*From a content perspective, when we produce video, we make sure that we have text provided or hard of hearing which is things we consider beforehand"* (Participant C)
	Adoption of an omnichannel approach	*"We looked at design thinking, user-centered design, universal design, inclusive design. The omni channel was set as an approach and is what we trying to do"* (Participant A)
	Champion accessibility needs at decision making bodies	"I*t's the tender brief that needs to outline that the website should cater for accessibility specifically"* (Participant H)
	Reflection of current practices	"L*ack of foresight and awareness is probably the biggest issue as it's just not a consideration*" (Participant E)
	Testing	"W*e will need to get somebody on board to help with testing accessibility"* (Participant C).
E-government stakeholder dynamics	E-Government decision makers	*"Budget is motivated by a decision so if there is a motivation or priority from the top then it will be budgeted for"* (Participant B)
	Third parties	*"At the end of the day government people in general buy whatever you sell them so it's only now when we say but guys let's sit down and look at our requirements.."* (Participant B)
	Citizens	*"...If you don't understand the citizens and their needs you can deliver all the best program in the world but if you don't meet their needs it's going to be pointless.."* (Participant A)
	Local, provincial and national government	*"We get very little if any directives from national government to put focus on ensuring accessibility when building services"* (Participant J)

E-Government for persons with disabilities and impairments dynamics	Citizens with disabilities	*"We can't disagree that people with disabilities are being deprived of our products and services as government"* (Participant C)
	Language barrier	*"At the end of the day government people in general buy whatever you sell them so it's only now when we say but guys let's sit down and look at our requirements.."* (Participant B)
Technology	Citizens with disabilities	*"We can't disagree that people with disabilities are being deprived of our products and services as government"* (Participant C)
	Language barrier	*"At the end of the day government people in general buy whatever you sell them so it's only now when we say but guys let's sit down and look at our requirements.."* (Participant B)
Policy and Strategy (Secondary Data)	**Government Policy/Strategic Document**	**Data extract example**
	Electronic Communications and Transactions Act, 2002 (Act No.25 of 2002)	The national e-Strategy for South Africa is to *'promote universal access to electronic communications and transactions'.*
	Republic of South Africa (2017, April) National e-Government Strategy and Roadmap, Government Gazette	*"The mandate of the Minister of Public Service and Administration therefore empowers the DPSA to provide direction on e-Government for the public service."*
	Gauteng Department of e-Government Revised Strategic Plan 2020-2025	*"an inclusive economy depends on the accessibility, connectivity and interaction made possible by infrastructure investments that are strategic, including the rollout of Broadband and the development of e-Services".*
	Department of Communications ICT Policy Review e-Services	*"Government Information Technology Officers Council (GITO Council, which consists of national and provincial IT officers, is responsible for consolidating and coordinating IT initiatives in government, including e-Government, to facilitate service delivery".*

Table 3: Emergent themes from qualitative interviews and secondary data

CHAPTER 4 RESEARCH FINDINGS

4.1Introduction

This chapter presents the results and findings of this qualitative study. It will discuss the data collection as well as the themes identified from semi-structured interviews and policies available online, relating to e-Government accessibility for persons with disabilities and lastly a summary of the chapter.

4.2Descriptive findings

Primary data was collected from 12 participants who worked for various government departments on e-Government projects across South Africa in local, provincial and national government. Of the 12 participants, 4 were female and 8 were male – see Table 4 for ease of reference. Most of the participants were actively involved in the design and development of e-Government services in South Africa with only Respondent C and G playing a more senior role in decision making. Four of the 12 participants worked for third party companies contracted to government to build e-Government solutions. Of the participants interviewed 11 of the 12 participants came from an ICT background and only one being a content creator. Only 2 participants had previously worked with someone with a disability. The participants spanned across 3 provinces of South Africa, namely Western Cape, Gauteng and Limpopo.

Interviewee	Role	Government level	Department	Gender
Participant A	Team Lead: UX design	Western Cape: Local government	e-Government for citizens	Male
Participant B	Business Analyst	Limpopo: Provincial government	ICT	Female
Participant C	ICT Lead	Western Cape: Local government	e-Government for citizens	Male
Participant D	Content Creator			Male
Participant E	Developer	Gauteng: National government	3rd Party: Dept of Tourism	Male
Participant F	Designer	Gauteng: Provincial government	3rd Party projects	Female
Participant G	Architect	Western Cape: Provincial government	ICT	Male
Participant H	Designer		3rd Party projects	Female
Participant I	Developer		Dept of Health	Male
Participant J	Business Analyst	Western Cape: Local government	Knowledge Management	Male
Participant K	Department Head	Western Cape: Local government	e-Services platform	Female
Participant L	Business Analyst			Male

Table 4: Participant' demographics

4.3 Empirical findings

4.3.1 Challenges affecting e-Government designers and developers when building accessible e-Government services

a) Legacy and bespoke systems

A consistent perception amongst participants was the view that legacy systems made it difficult to work around and produce solutions that are accessible and meet all user needs. Legacy systems were not developed with accessibility in mind, and this complicates the design and implementation for later systems. Respondent A explains that "these *legacy systems we use are not that customizable like we would want to and this makes the process of designing and implementing for accessibility a challenge*". Respondent A went on further noting that *"we have bespoke systems… we know realistically it will take a long time to change and somethings we cannot do"*. There was a concern that practitioners were constrained by the legacy systems in their practices and felt frustrated by the fact that "*we can't always manipulate the technology to suit our intended user requirements and needs"* (Respondent J). In many of the interviews, participants working in e-Government teams discussed the current IT infrastructure from a legacy perspective as an obstacle to becoming more accessible. From this observation, it is evident that legacy and bespoke systems negatively influence the design and implementation of future accessible software solutions.

b) Lack of IT expertise and understaffed department

The findings showed that there was a lack of IT personnel, specifically those who have the background in the development of accessible solutions. Respondent A lamented how understaffed they were and how they had to find ways to distribute the workload among employees who did not hold that expertise of executing the task. According to him, a team of 8 experts or more would have made it easier to provide the intended solution but currently "*we must find different ways to approach the problem… it's a mixture between leveraging internal teams".* Respondent I mentioned: "*we currently understaffed at the moment, when we started with our projects, we had multiple developers however now we are under resourced and this affects not only accessibility but our ability to implement a host of other things".* According to Respondent B, the lack of IT experts was problematic in the development of accessible solutions. He voiced out that the issue is not that employees were not interested in providing accessible solutions, but rather they did not have the required expertise: "*I have learnt that here in my department it's a skill issue It's not like people are not interested they just don't know how to do it*". Respondent B further elaborates:

> *"Every time you speak to someone and ask them if they cater for people with disabilities, they will tell you yes we cater for them we bought them this expensive hardware it's a Braille reader it's R160,000 they have those, but they cannot use it we don't have expertise to integrate it to the website and make it work the way it supposed to work so"*

Despite providing technological resources for implementing accessible solutions such as assistive technology, it was evident that employees lacked the necessary skills to use them and that there is a need to "*up skill the team and myself"* (Respondent E) so as to provide accessible systems. The implication therefor is that departments that are understaffed and lacked technical

expertise on how to design and implement with accessibility in mind, negatively influence the design and implementation of accessible software solutions.

c) Lack of adequate financial resources and project time constraints

A factor raised by all participants was the issue surrounding resourcing, budgets and time constraints. As Respondent C mentions *"we're severely strained from a budget point. We are motivating for funding and we will need to adjust that funding to incorporate a disability component and we will need to get somebody on board to help with testing accessibility".* In many instances the amount of resources available were just not adequate to be able to do support and maintenance, new projects, as well as cater for accessibility and this is further reinforced by Respondent J *"We have lost team members and not re-hired and the amount of work hasn't decreased, accessibility is difficult to incorporate at this point".*

With COVID-19 and budget cuts in place in local and municipal governments, various interviewees had mentioned a reduction in staff. One team had begun an e-Government project pre-COVID-19 with 8 developers in the team and now they are down to just 3 developers, *"austerity hit us hard. Our budget has been cut in the UX team and our development team is down to 2 resources which is a massive drop"* (Respondent A). The implication therefor is that the introduction of austerity measures which affected both financial and human resources, negatively influences the design and implementation of accessible software solutions, as priority is directed to other functions perceived to be significant to the project.

d) Lack of accessibility awareness and focus

Several participants noted that when e-Government projects begin or requirements are being drawn up accessibility is not prioritised as Respondent C explains:

> *"at the back of our mind we are always concerned about the disabled but we are so bogged down with trying to get something out to the citizen that it's so far back at the mind is that we don't put the effort that we need to do you know make that voice louder for accessibility it kind of is there is but it's an afterthought not really planned for that"*

Interestingly, it was found that accessibility from an e-Government perspective was two-fold. It related to the physical access on being able to get online in terms of internet connectivity and access to a computer as Respondent B mentions: *"it's a totally different structure when you talk e-government inclusion it's not only on persons with disabilities but an individual's ability to access a computer and the internet to use our systems and services".*

Many have cited the fact that those who do not have internet access or access to computers or smart phones need to travel kilometres in order to reach a government facility which provides them with these services, as Respondent A mentions *"people always think oh we need to get a service online but realistically if people don't have access to the internet, and maybe don't have free Internet, it doesn't make sense".* Most participants seem to think that the government is far more concerned with catering for physical accessibility as opposed to building accessible e-Government services and Respondent D points out that providing accessible e-Government websites are their responsibility: *"I think that's kind of a two-part problem one there is the actual physical equipment that the user needs to have and then also in terms of the accessibility of the website that is on us"*. Thus, governments understanding of accessibility and the lack of

awareness of accessibility from stakeholders negatively influences the design and implementation of accessible software solutions

e) Minimal accessibility monitoring of systems

Due to the lack of minimal awareness and prioritisation of accessibility amongst various stakeholders, most participants noted the minimal and in some cases lack of monitoring of systems for accessibility. According to Respondent H *"we don't really check to see how accessible our solutions are to be honest"*. In agreement, Respondent C adds that *"we should be developing systems or outsourcing systems that talk to persons with disabilities, but in reality, this is difficult to put into action".*

It was found that during the COVID-19 vaccination drive campaign, the South African government initially rolled out the COVID-19 vaccination registration to be an online registration process. However, it was soon found out that there were a number of people over the ages of 60 who did not have access to the internet. Respondent A further mentioned *"numbers were still low as this required smartphone technology which at times we take for granted. Only once registration was made available via SMS as well did government see increase in COVID-19 vaccinations particularly in the over 60's category as they were the first age group opened for the rollout"*. The implications therefore are that the minimal or lack of ongoing accessibility checks performed by e-Government stakeholders, specifically the design and implementation team as well as PWD, perpetuates the design and implementation of inaccessible software solutions.

f) Government structures operate in silo

A compelling finding raised by most participants is the complexities which encompass carrying out the digital strategy of governments, be it local, provincial or national. Contextually in South Africa the provincial governments form part of the national government, however as Respondent C mentions, *"For the last many years I can only remember a few times we've met with national but just for meetings nothing has come of it, once these strategies come about and get implemented, we need to work together not only top-level management".* Findings show that local, provincial and national government are not aligned in their vision or how to realise that vision. As Respondent A explains that *"We rely quite heavily on the national level strategies and so forth but again every province has their own kind of that, and each focuses on what they perceive as important"*. There is currently a national e-Government strategy which has been gazetted, however participants interviewed in both local and provincial e-Government have mentioned that they have their own strategy's which they align to. Mandates regarding e-Government are driven from a national point of view, however the design and development of e-Government solutions specifically catering for persons with disabilities in terms of accessibility and inclusivity are not apparent at national level as respondent J explains: *"We get very little if any directives from national government to put focus on ensuring accessibility when building services".* In terms of ICT planning there is no directive which informs the various local, provincial and national e-Government departments as to what should be prioritised, instead they are left to follow the mandate provided by the CIO or director of the department as pointed out by Respondent I *"One of our aims is to integrate on a technical*

level on an ICT level with national and local because we provincial so that the citizen doesn't need to care whether it's local national or provincial everything must be seamless and that needs collaboration and there isn't currently".

Secondary data analysis on the policies mirrors the findings. Few policies and frameworks touched specifically on e-Government accessibility and many referenced the Electronic Communications and Transactions Act, 2002 (Act No.25 of 2002) which states that the national e-Strategy for South Africa is to *promote universal access to electronic communications and transactions*. Respondent C noted that most policies and strategy are not timely and "*this needs to change, when policies were written it's kind of written in that time and sometimes it doesn't look at what's okay now given the digital changes*". The national development plan for 2030 aims to ensure that all citizens have access to ICT resources regardless of disability.

g) Lack of top government management support in implementing the digital strategy to support the implementation of accessible solutions

There appears to be a lack of cohesion in terms of both informing government entities of the strategy being implemented by national government as well as the execution thereof. As Respondent A pointed out the fact that the existing strategies "*do not consider the needs of citizens up front… so even before we get to the solution there needs to be considerations of all citizen on how best to incorporate concerns of various citizen especially the vulnerable".* According to Respondent A, the key challenge is that "*services are created for the top of the triangle - all the middle-class the elite with minimal considerations of the vulnerable. There needs to be a shift from the strategy point of view and mind shift - don't think of a service only for the middle class"*. This was agreed upon by Respondent I that *"we need to understand the citizens needs and take that into account when trying to strategize on how to develop for accessibility and this requires greater collaboration between us, the vulnerable, government stakeholders and mandates by the premier of the provinces as well as national government*". This need for collaboration includes according to Respondent A "*getting citizens in every step and a focus on accessibility issues. There is a lot of talk about inclusive design, participatory design HCI digital inequality but just getting people more involved and doing it is always the problem".* A recurrent theme amongst the participants was the e-Government strategy on issues of inclusion and accessibility *"needs to be a top-down push" (*Respondent A). Whilst top management executives such as those in the *"department of the premier, are aware of the importance of accessibility"* (Respondent D), the challenge was in the lack of priority in implementation and support. Two factors were noted that showed the lack of management support for accessibility. Firstly, respondent B stated profoundly that *"budget is motivated by a decision so if there is a motivation or priority from the top then it will be budgeted for".* Secondly, was government's lack of focus on accessibility when conducting business with their stakeholders, specifically during the tender process. Most participants indicated that when government goes out for tender to allow for external parties to design and build e-Government solutions, there is no requirements or specifications in the tender brief that include accessibility or specifically ensuring that solutions are catered to ensure persons with disabilities are also able to make use of it. As respondent H points out: *"it's the tender brief that needs to outline that the website should cater for accessibility specifically, however I have never seen this requirement specifically stated in my experience".* Third party vendors who have been

outsourced to design and develop e-Government solutions such as Respondent E mentions:

> *"It's a bit of both we as a company should bring it[accessibility] up and suggest to government; but with government there's other mandates they prioritise and so they have specific things in place that they want done. It is best if government mandate will set it in motion rather than us recommending it as a third-party.".*

Third party vendors tend not to focus on citizen's needs but focus on the government who is their customer. According to respondent B, the challenge is that the government at times "*buys whatever you sell them without assessing what the needs are or whether we have the resources and capability to deliver"*. To avoid this dilemma, Respondent C mentioned the need for top management "*to be more involved* by *making them partake in the design, implementation and testing process, to see what we are talking about".* In this manner, top management would see the "*considerations they need to do to address all citizen's needs because they would see during the initial requirements stage, why the actual data collected must be used to inform their decisions. We must do this because there's always a gap when it comes to understanding the citizens if you don't understand the citizens and their needs you can deliver all the best program in the world but if you don't meet their needs it's going to be pointless"* (Respondent A). The implications therefore are that the lack of top government management support and digital strategy for accessibility perpetuates the design and implementation of inaccessible software solutions; and that third party involvement in the design and implementation of accessible software should be mandated by the digital strategy that seeks to fulfil the needs of all citizens .

4.3.2 Current practices in developing and designing accessible e-Government systems.

a) Accessible content that can be understood

All participants described how important it was to design and implement systems that can easily be understood by all users in South Africa. According to Respondent A, whilst issues of accessibility are given importance, there is also a need to focus on the education level of users and ensure that literacy and accessibility are integrated into the system because "*when it comes to English some users do not understand so we consider grade 7 English as we are convinced, they can all understand at that level*". This debate also brought the challenge of providing the same content and ensuring that it can be accessed in all South African languages whilst meeting PWDs needs. Respondent C explains that: "*From a content perspective, when we produce video, we make sure that we have text provided in other south African language. We also consider, how easy it is to find the content"*. Respondent D comments that: "*We tackle the most viewed pages first, it is the demand, for that we need to ensure that one it's credible until it's up-to-date so that the accessibility on those is given preference or priority and then move down to the pages with less traffic*". From these findings we note that current practices of e-Government design and development team considers the provision of accessible content, the digital literacy and systems that support multilingualism.

b) *Adoption of an omnichannel approach*

Several participants identified the use of an omnichannel approach for ensuring that government can reach citizens by providing information and services through various platforms such as their e-Government websites, WhatsApp and social media, and creating less reliance on traditional brick and mortar offices. Respondent A explains the role of an omnichannel in their team:

> *"we looked at design thinking, user-centred design, universal design, inclusive design. The omni channel was set as an approach and is what we trying to do. For example, the vaccines - they pushed an online registration. So, we have provided an SMS or WhatsApp number for engagement with citizens because majority of the people in the rural areas don't have access to e-services".*

There has been a big drive towards reaching citizens via WhatsApp chat bots as well. According to respondent A, chatbots are being used when citizens may not have access to laptops and PC's but have access to smartphones with data and leveraging on WhatsApp messaging platform is something government is doing. The biggest use for WhatsApp chatbots currently within e-Government solutions are for COVID-19 vaccine registration.

In some cases, smartphones are not affordable and then USSD and SMS technology is the best option to reach the citizen, and this negates creating accessible solutions. Government has also provided contact centers and access facilities in place for citizens to make use of computers and internet facilities. A pipedream mentioned by Respondent C was that *"one of our aims is to integrate on a technical level on an ICT level with national and local because we provincial so that the citizen doesn't need to care whether it's local national or provincial everything must be seamless and that needs collaboration and there isn't currently".* The adoption of omnichannel as an approach to deliver e-Government services is an avenue for addressing inclusion and aspects of accessibility.

c) *Champion accessibility needs at decision making bodies.*

Whilst the need to adhere to accessibility needs for all was vocalised by all participants, there was a consistent perception that the lack of a champion for accessibility rights and needs at decision making committee made it difficult to design and implement solutions that are accessible. Respondent B narrates her experience:

> *"At the provincial planning monitoring and evaluation system is the right time to bring in issues of accessibility – and these should be vocalised. Otherwise, once a decision has been made to acquire a solution without bringing the issue of persons with disabilities as a requirement in this phase, accessibility issues are not brought in at any other time.*
>
> *We are now busy with an e-signature project, and they've bought a solution and when I asked about its accessibility for people with disabilities, they said it was a new thing and there was no accessibility checks. Now we will have to go back to the developer and see if it can be incorporated it was never a high-priority or a requirement upfront with the e-signature solution".*

Respondent H has also noted that government needs to ensure that accessibility is catered for in requirements upfront and this requires that those drawing up the tender briefs are specifically catering for accessibility, "*it's the tender brief that needs to outline that the website should cater for accessibility specifically, however I have never seen this requirement specifically stated in my experience".* Most participants perceived management to be interested in fulfilling compliance requirements in their organisation, but they lack the will to do so as Respondent E stated: *"we know about disabilities concerns and tools to allow a person with a disability to use the website. I guess we just not prioritising involving this from the start because there is no one driving the issues".* These findings illustrate the need for a project champion who advocates for designing and implementing accessible solutions during the *planning, monitoring, and evaluation of e-government systems.*

d) Encourage multiple language use

Language barrier was identified as a key challenge to address. South Africa comprises of 11 official languages, but it appears that all participants interviewed have advised that when e-Government solutions are built, the dominant language used is English. According to respondent A, in addition to English, each province tries to provide an additional language that is spoken in that Province or by most community members. For example, in the Western Cape Province, "*we focus on the three: English Afrikaans and Xhosa content. We used to provide content in all three languages but it's too expensive to maintain and update content in three languages given the human and financial constraints"* (Respondent A). What was opined by the participants was that language can further hinder accessibility issues for PWDs who do not understand the language. Respondent D stated: *"we try to make the content as accessible as possible in the way that it is written even across language barriers. If English is not your first language it is written in such a way that it can be easily interpreted".* The findings show that using a language that most community members do not associate with to communicate and deliver e-Government services, further compounds accessibility challenges for PWDs.

e) Development of Inhouse User Experience (UX) checklist

Findings identified that the lack of expertise in designing and implementing for accessibility is influenced by the lack of guidelines on how to do it. As such, some had developed in-house UX checklists – to be used as a guideline when building e-Government websites and includes ensuring that alternative text is used when doing header and body tags as well as ensuring that the tagging and labelling of buttons are correct to allow screen readers to function correctly. Respondent A has also mentioned ensuring that the correct cascading style sheets (CSS) templates are used when building HTML websites including as making use of bootstrap.
The challenge noted by several participants and more vocalised by respondent C was that the checklist is a work in progress and requires resources, mainly (i) expert knowledge, and experience to develop the checklist; (ii) stakeholders such as PWDs to test the checklist, and (iii) financial resources to not only upskill the team to acquire the necessary expertise, but also to carry out the tasks in developing and testing the checklist (respondent B, E).

f) Use of limited assistive technology

This study has found that all participants interviewed are fully aware of assistive technologies and how it may be beneficial in using e-Government services. However currently the recurrent assistive technology in use is a built-in screen reader and an eye tracker on provincial government websites. Both of these assistive technology tools only talks to the visual impairment disability. In addition, there is lack of integration for citizens using their own third-party applications to integrate into existing e-Government websites or mobile applications (Respondent B). According to Respondent A, part of the reason why screen readers are not widely used and catered for by e-Government design and development teams is due to the fact that "*people use their own screen readers the biggest flaw with a lot of these visually impaired software it's crazy expensive one other software was R20,000 for a license you could get some free ones but there are limitations to it".* Apart from cost, there was minimal intention to focus on assistive technology incorporation into the systems design and implementation process (Respondent B and J), *"but rather do the basic like the screen reader kind of text – to be honest it has not been our priority"* (Respondent E).

g) Reflection on current practices

The findings show that very few participants had specific reflective practices in place to allow them to review implemented solutions and decide how to better them. For some, reflective practices were afforded to large projects as Respondent F explains that "*we normally do with bigger projects we have a review afterwards with feedback of what to improve so that could be where takes place but it's usually not something that is done immediately but it is definitely something that could be afterwards".* Respondent I also agreed saying "*we have lessons learnt in terms on how to better execute as we move from project to project but whether we are actually using the lessons learnt to implement accessibility the answer is no".*

It was noted that often the improvements and enhancements are something they would like to look at and it gets added to the backlog however with the current resource constrains accessibility never gets given any priority to be implemented. Currently there are no monitoring and measuring of accessibility in place in any of the e-Government solutions from those that were interviewed. It has been mentioned for example by Respondent E that the "*lack of foresight and awareness is probably the biggest issue".* Respondent F also noted the lack of reflective practices on issues of accessibility because:

> *"Often accessibility is sort of a last thought as a designer you always have to remind people and companies about people with disabilities and they say you know it's a small percentage of people with disabilities and it's not worth spending money on that area so I try my best as the UX designer to push it and to cover the basic things like alt tags and describe images and even it's a video have a title description do you know from coding point of you".*

It is also noted that third party vendors designing and developing e-Government service did not consider reflective practices as significant because of "*current constraints - we have a backlog we must clear. A very long backlog and the biggest challenge is we must look at*

maintenance for security that takes priority. The fixes and reflection on issues for accessibility get lower down priority – you see in reality we not going to get more money out of that" (Respondent A). Thus the current lack of reflective practices on accessibility continues to negatively influence the design and implementation of inaccessible software solutions.

h) Testing

The testing of e-Government services has shown to have multiple challenges. Firstly, it requires the team to have capacity to conduct the testing. participants reported that the lack of employees who possessed the skill set to conduct testing for PWD influenced how the team delivered inaccessible systems for PWDs. Further, financial resources to identify, convince and transport PWDs to the testing site was noted as a challenge. According to Respondent A, "*government regulations, bureaucracy make it difficult to find participants to test our systems and to even provide transportation means or incentives for them….and so most do not come"*

Respondent C also reported how the delivery of accessible systems is dependent on both financial and human resources. According to them, *"we severely strained and so we are motivating for funding, and we will need to adjust that funding to incorporate a disability component and we will need to get somebody on board to help with testing accessibility".*

The use of an agency that advocates for and houses in some cases, PWDs was also identified as a potential solution for assisting in testing. According to respondent C, the agency can provide access to a list of PWDs who have several disability types, of which they are able to invite into the testing center via the agency. This pool of testers was perceived as a means to successfully address some of the system accessibility challenges as respondent E explains: *"who better to find a bug with regards to accessibility, other than by having someone with a disability to assist us for testing".* Respondent F confirms that the testing process usually involves internal testing of the system functionality and usual bugs. The challenge she highlights is that "*the testers aren't necessarily people with disabilities but clients who in all cases, from my experience, are able bodied"*.

From these observations, it is evident that the inclusion of PWDs in the implementation of accessible systems is dependent on both financial and human resources; and that the use of agencies that advocate for PWDs concern can improve accessible systems design and implementation.

CHAPTER 5 DISCUSSION

5.1 Introduction

This study was driven by two key research objectives: to identify challenges e-Government designers and developers face when designing and implementing accessible e-Government systems; and how these challenges shape how they perceive the design and implementation process. This chapter discusses the results and findings of this qualitative study. It will discuss the challenges identified that e-Government designers and developers face when designing and implementing e-Government systems. As well as discuss how these challenges shape the design and implementation process of accessible e-Government and lastly a summary of the chapter.

5.2 Discussion of the challenges e-Government designers and developers face when designing and implementing accessible e-Government systems

The findings identified seven challenges. The first was on legacy system. Legacy systems are an important asset of organisations as they contain longitudinal business logics and data that support critical functions (Bakar et al., 2019). Yet, these systems pose significant challenges to the organisation such as technical difficulties and unnecessary expenses in maintaining the systems (Bakar et al., 2019). The findings in this study show that legacy and bespoke systems were not developed with accessibility in mind, and this complicates the design and implementation for future systems. Mergel (2016) contends that for organisations to continue providing quality services in line with the global changes, legacy systems need to be refreshed through modernisation. In addition to modernisation, systems should also address accessibility concerns that are key to having systems that are inclusive for all. The findings in this study demonstrate that legacy and bespoke systems negatively influence the design and implementation of future accessible software solutions. The study therefore posits that legacy and bespoke systems influences the design and implementation of future accessible software solutions (*Proposition 1*).

A reported consistent challenge to the design and implementation of accessible e-Government systems was the lack of information technology expertise in government, and the limited number of available staff to perform ongoing duties. Prior studies have also highlighted that availability of expertise and trained personnel in e-Government who can provide solutions that are accessible by all groups remains a concern (Falco & Kleinhans 2018,4). When staff who have the expertise are available, they become overwhelmed with additional work due to being understaffed, and in so doing, overlook issues of accessibility. The implication therefor is that government departments that are understaffed and lack technical expertise on how to design and implement with accessibility in mind, negatively influence the design and implementation of accessible software solutions. Further, it has been persistently reported in the empirical findings that the constraints surrounding budget when developing e-Government solutions puts a strain on the ability to implement accessibility. E-government readiness requires that there is availability of human resources as well as the availability of budget (Joshi & Islam, 2018). The study therefore posits that the limited number of and in most cases lack of human resources

with expertise, as well as the inadequacy of financial resources influences the design and implementation of accessible software solutions (*Proposition 2*).

The findings have revealed that there is a lack of awareness and understanding by stakeholders as to what accessibility entails for e-Government. It has been noted that when government stakeholders discuss accessibility, stakeholders use physical accessibility and web accessibility interchangeably. Prior studies have shown that stakeholders need to be made more aware of digital accessibility in order to assist the adoption and implementation of accessibility (Velleman et al., 2017). The findings have additionally shown that accessibility is not being taken into account when project requirements are being gathered at the project initiation phase. This consequently makes catering for accessibility an afterthought. The study therefor posits that the lack of digital awareness of accessibility and inclusion or lack thereof in drawing up project requirements that aim to target accessibility, influences the design and implementation of accessible software solutions (*Proposition 3*).

Most participants noted the minimal and in some cases lack of monitoring of systems for accessibility. Monitoring or checking for web accessibility is essential to measure for compliance as well as explain reasons for non-compliance (Campoverde-Molina et al, 2021). Whilst the participants did not provide any rationale as to why they do not check their developed systems for accessibility, Larson (2019) notes that one of the reasons is that designers and developers are aware that no one will be reviewing their website to ensure compliance with a set of standards. There is also minimal engagement with PWDs to check whether systems are compliant with accessibility standards. Domínguez Vila et al. (2018, p.2895) advocates for designers and developers to comply with mandatory benchmark standards and have external agencies audit website designs. The authors also encourage designers and developers to rely on their pre-existent experiences to develop more dynamic knowledge. The study therefor posits that accessibility monitoring by technical experts, project owners who seeks to ensure the project complies with the set standards, as well as the PWDs proponents such as PWD interest groups and PWDs themselves influences the design and implementation of accessible software solutions (*Proposition 4*).

A significant finding from this study has shown that there is a lack of cohesion and collaboration between local, provincial and national government when it comes to carrying out digital strategies surrounding e-Government. There are very little to no directives given from national government to drive how e-Government solutions need to be designed and developed to cater for accessibility. In addition, most participants have noted that there are no mandates to prioritise accessibility. The implications thereof are that municipalities, provinces and national government design and build e-Government solutions as they see fit and operate in silos which leads to a disjoined user experience as well as obstructing equal access for all from the perspective of the citizen. The findings in this study extend those of Hussey et al. (2017) which indicates that government departments and efforts working in silos has proven to be a political barrier for the implementation of the United Nations (UN) Convention on the Rights of Persons with Disabilities. For accessible and inclusive delivery of services to be actionable, policy makers should rather see assistive technology as cutting across all sectors and ages, and policy initiatives recognize and reflect this, rather than seeking to silo it (MacLachlan et al., 2018). The study therefor posits that collaboration in prioritising and standardising of accessibility at a local, provincial and national level, encourages the dismantling of silo

mentality in government which consequently then favourably influences the design and implementation of accessible software solutions (*Proposition 5*).

The final challenge identified from the findings relates to the lack of management support in implementing the digital strategy to facilitate implementing accessible solutions. A recurrent finding during this study was that there needs to be a push from the top down to drive the implementation of accessibility within e-Government. Although management are aware of accessibility there was a lack of support and advocacy for its implementation. Gunawong & Gao (2017, p.168) sees "the lack of top management to support other actors in the network in their efforts both to play their roles properly" as the main barrier to accessibility. Harder & Begnum (2016) calls for top level management to collaborate with all stakeholders, specifically the design team and the PWD interest groups to ensure focus is on developing systems that are accessible to all users. The implications therefore are that the lack of top government management support and digital strategy for accessibility perpetuates the design and implementation of inaccessible software solutions; and that third party involvement in the design and implementation of accessible software should be mandated by the digital strategy that seeks to fulfil the needs of all citizens (*Proposition 6*).

5.3 Discussion on how the challenges shape the design and implementation process of accessible e-Government systems

The challenges identified in the prior section have notably shaped the current practices of designers and developers, specifically on how they perceive accessibility. Firstly, all participants acknowledged the need for accessibility to be prioritised in their practice. They however are constrained by the lack of ownership and championing for accessibility when designing and implementing e-Government solutions. Brosens (2017) found that issues of accessibility and user experience are not being incorporated into South African enterprises' information systems development methodologies (ISDMs) because the quality of software solutions as perceived by its users is not typically a measure of success for the project. To address some of these challenges, some designers and developers have resorted to independently acting as the champion for accessibility and have noted that without management interest and support, their role as championship weakened with time, as this was constrained by time and financial constraint. These findings extend those of Shetty (2020,16) who calls for 'a greater need for more accessibility champions who aim at developing access for all, while ensuring that everyone works towards providing a positive and inclusive customer experience which promotes equality and diversity'. These champions should strive to employ 'the best practices, so organisations can follow them and work towards providing inclusive and accessible environments to all people' (Shetty, 2020, p.16). Thus, the presence of accessibility champions who strive to employ 'the best practices, so organisations can follow them and work towards providing inclusive and accessible environments to all people' (Shetty, 2020, p.16), influences the design and implementation of accessible software solutions (*Proposition 7*).

Secondly, the awareness that accessibility was paramount was exhibited in their ongoing practices by providing content that was literary accessible for all, given the literacy rate of the demographic; by incorporating multi-language approach to cater for the various languages in the country; and adopting an omni channel approach that allows the provision of information

and services to citizens via channels such as WhatsApp, social media and SMS services other than e-Government websites. This omni channel approach provides an additional outlet for government to reach those in rural areas who do not have access to laptops and PC's but have access to smartphones with data and leveraging on these omnichannel platforms is something government making use of. The ability to incorporate accessibility on these platforms can be seen as a strategy for addressing the challenge of legacy and bespoke systems which are seen as an obstacle to accessibility.

The findings of Merritt & Zhao (2020, p.15) support the omni channel approach where they report that PWDs found shopping online as a preferred choice than instore buying due to 'avoiding inconveniences, having a hassle-free shopping experience and having a diverse range of products to shop from and even having more usability and access for those with disabilities. The findings in our study further extends those of Dennis et al. (2016, p.1061) that indicate that socially excluded people spend more time shopping by all three channels, with PWDs using the cell phone and significantly ameliorates the negative effects of social exclusion on happiness and wellbeing for PWDs consumers. By incorporating the various languages in their public service delivery platforms, designers and developers seek to address the concern raised by Tönsing et al (2019, p.1) that in the South African context, 'participants generally are not able to express themselves in all the languages they understood and were regularly exposed to; and thus, more appropriate systems and interventions as well as literacy learning opportunities need to be developed and provided'. These findings and discussion thereof, imply that the use of omni-channels, availability of appropriate systems and interventions that allowed PWDs to engage in the language they are most comfortable with, as well as literacy learning opportunities, influences the design and implementation of accessible software solutions (*Proposition 8*).

Thirdly, designers and developers were cognisant of the fact that there remains a challenge in the number of available accessibility experts who can design and develop accessible solutions but also engage with bespoke and legacy systems in government. In addressing this challenge, some of the participants implemented inhouse UX checklist as a guideline when building e-Government websites. Although the UX checklist is a step in the right direction it still requires resources, expert knowledge surrounding accessibility as well as involving all stakeholders which is something that will need to be given priority. Similar UX guidelines have been proposed in literature and have reported similar constraints. For example, Billestrup et al's findings (2015, p.1) show that their material and guidelines for increasing user experience are a step forward but were too general and failed to ensure a reasonable level of usability and user experience. Issues of accessibility user experience, usability and accessibility are persistent issues that remain a great barrier to even the websites of governmental institutions with the highest level of competitiveness (Acosta-Vargas et al., 2017). Coupled with these challenges, in this study we note evidence of minimal awareness of assistive technologies that can be used to compliment and address issues of accessibility, as well as the provision of resources by government towards this end. In practice, designers and developers used built-in screen reader and an eye tracker as the only afforded assistive technologies provided. Although this aids citizens who are visually impaired there is still the lack of inclusivity in catering for those with hearing impairments, cognitive impairments as well as physical impairments such as citizens

with mobility constraints who are unable to use a mouse or keyboard. Over and above this it has been pointed out that citizens who have their own forms of assistive tools and applications, there are no provisions by government to allow for seamless integration between third party tools and applications. This lack of awareness and access to technology is in part, according to MacLachlan et al. (2018) due to the fact that:

> "assistive technology provision in many countries, particularly low- and middle-income countries, has traditionally been conducted through small-scale local providers, manufacturing products of varying degrees of quality at a limited price range…and that an effective way to scale these production and provision enterprises to the required level is needed to close the gap between available and required assistive technology".

Thus, more efforts are needed to sensitise and bring awareness of assistive technologies to all stakeholders as well as the production and provision of quality assistive technologies at a more affordable price. These findings and discussion thereof imply that inhouse development of UX checklists as guidelines, coupled with access to affordable quality assistive technologies influences the design and implementation of accessible software solutions. However, the development of guidelines and availability of affordable quality assistive technologies need to be complimented with both financial resources, expert knowledge surrounding accessibility as well as involving all stakeholders for quality monitoring and evaluation purposes (*Proposition 9*).

Finally, the challenges outlined left minimal room for designers and developers to reflect on their work practices. Currently, lessons learnt are being noted but not something which is actioned to improve accessibility. The improvements and enhancements are noted and added to a backlog, but this rarely gets given any priority due to resource and time constraints as well as the lack of priority given to including accessibility in requirements for e-Government solutions. Whilst the principles of universal and inclusive design are there to guide designers and developers in their reflective practice (Mcguire et al., 2006), very few were able to engage in the practice. Pineda et al. (2022) propose the use of virtual focus group discussions as a means of facilitating reflective practices where key stakeholders such as PWDs interest groups and champions, engage with designers and developers to improve their practice. Thus, when designers and developers are given sufficient resources (such as time, accessibility champion, access to expert knowledge and are not understaffed) to reflect on their practice, this can favourably influence the design and implementation of accessible software solutions (*Proposition 10*).

In summary, this study has presented the challenges of how designers and developers implement accessible e-government services or the lack thereof; and how their practices are shaped by their contextual challenges. Based on the propositions presented in the discussion, an empirical framework is proposed in Figure 2 documenting how designers and developers perceive the achievement of accessible e-Government services. They perceive six organisational challenges influencing the design and implementation of accessible e-Government service. To produce an accessible e-Government service, they present four recommendations, referred in the framework as supporting structures, to mitigate some of the challenges they experience.

The highlighted propositions are as follows:

Proposition 1	Legacy and bespoke systems influence the design and implementation of future accessible software solutions
Proposition 2	The limited number of and in most cases lack of human resources with expertise, as well as the inadequacy of financial resources influences the design and implementation of accessible software solutions
Proposition 3	The lack of digital awareness of accessibility and inclusion or lack thereof in drawing up project requirements that aim to target accessibility, influences the design and implementation of accessible software solutions
Proposition 4	Accessibility monitoring by technical experts, project owners who seeks to ensure the project complies with the set standards, as well as the PWDs proponents such as PWD interest groups and PWDs themselves influences the design and implementation of accessible software solutions
Proposition 5	Collaboration in prioritising and standardising of accessibility at a local, provincial and national level, encourages the dismantling of silo mentality in government which consequently then favourably influences the design and implementation of accessible software solutions
Proposition 6	The lack of top government management support and digital strategy for accessibility perpetuates the design and implementation of inaccessible software solutions; and that third party involvement in the design and implementation of accessible software should be mandated by the digital strategy that seeks to fulfil the needs of all citizens
Proposition 7	The presence of accessibility champions who strive to employ 'the best practices, so organisations can follow them and work towards providing inclusive and accessible environments to all people' (Shetty, 2020, p.16), influences the design and implementation of accessible software solutions
Proposition 8	These findings and discussion thereof, imply that the use of omni-channels, availability of appropriate systems and interventions that allowed PWDs to engage in the language they are most comfortable with, as well as literacy learning opportunities, influences the design and implementation of accessible software solutions
Proposition 9	The development of guidelines and availability of affordable quality assistive technologies need to be complimented with both financial resources, expert knowledge surrounding accessibility as well as involving all stakeholders for quality monitoring and evaluation purposes
Proposition 10	When designers and developers are given sufficient resources (such as time, accessibility champion, access to expert knowledge and are not understaffed) to reflect on their practice, this can favourably influence the design and implementation of accessible software solutions

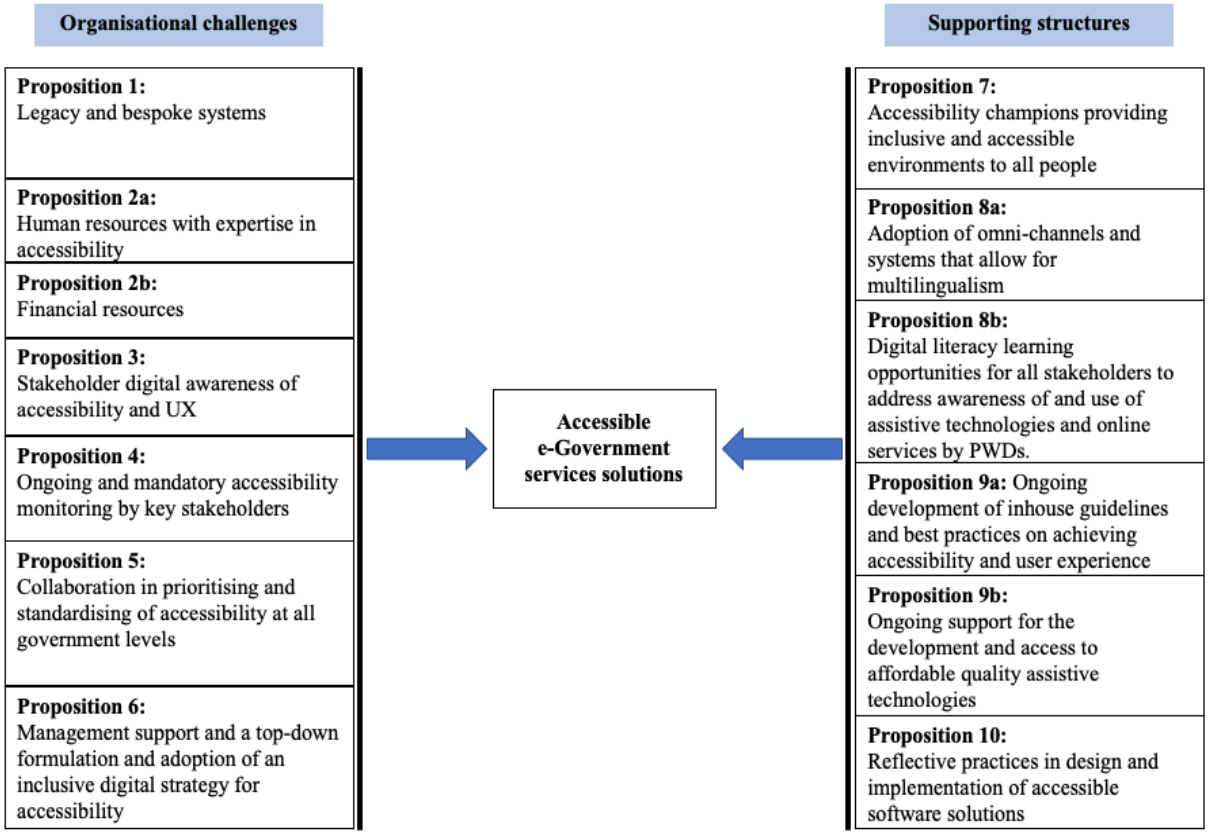

Figure 2: Factors influencing how designers and developers perceive the design and development of accessible e-Government services

CHAPTER 6 CONCLUSION

As Governments embark on providing their services online (e-Government services), it is imperative for them to ensure that these remain accessible to all online users. Prior studies have demonstrated that providing accessible online services, remains a challenge for most governments and more so for developing countries. The aim of this study was twofold: firstly, to identify the challenges facing e-Government designers and developers when building accessible e-Government services; and secondly, to understand how these challenges affect designers and developers' current practices of designing and implementing accessible e-Government services.

The literature review provided key concepts that were instrumental in shaping the study; and as such the study was deductive in nature. The key concepts were focused on the factors influencing the design and implementation of accessible e-Government services. These concepts guided the data collection process. The methods employed for the study are outlined in chapter 3. The study followed an interpretive philosophy with the purpose of providing an explanatory contribution towards the research questions posed.

Following a qualitative enquiry approach, and semi structured interviews as the main data collection technique, and secondary data as a means of support towards the primary data collection techniques used; this study identifies six challenges which influence the design and implementation of accessible e-Government services. These are: (i) legacy and bespoke systems were not designed with accessibility in mind and complicates the design and implementation for future systems; (ii) there is a limited number and in some cases lack of human resources with expertise and inadequate financial resources to implement accessibility; (iii) there is a lack of digital awareness of accessibility and lack of inclusion thereof when drawing up project requirements that aim to target accessibility; (iv) a lack of ongoing accessibility monitoring by key stakeholders and little to no engagement with PWDs interest groups; (v) accessibility is not being prioritised and standardised at a national level and there is a lack of collaboration and cohesion at local, provincial and national government; (vi) little to no support from top government management in driving the digital strategy for accessibility. These findings address the first research question.

Further findings explain how these challenges affect designers and developers' current practices of designing and implementing accessible e-Government services. Four practices were recognised to be in use and instrumental in the design and implementation of accessible e-Government services: (i) a recognition for the need of accessibility champions providing inclusive and accessible environments to all people in the organisation; (ii) providing omni-channels and systems support that allow for multilingualism ; as well as digital literacy learning opportunities for all stakeholders to address awareness of and use of assistive technologies and online services by PWDs; (iii) there was the need for ongoing development of inhouse guidelines and best practices on achieving accessibility and user experience, as well as ongoing support for the development and access to affordable quality assistive technologies; and (iv) a

conducive environment that allows for reflective practices in the design and implementation of accessible software solutions. These findings address the second research objective.

These findings have implications for future studies – specifically on how to ensure collaboration amongst government internal stakeholders (to avoid silo mentality), as well as external stakeholders holds to support the achievement of accessible e-Government solutions. Such a framework should consider the need for stakeholders to be made aware and sensitised to issues of accessibility. A collaboration framework towards this agenda would serve designers and developers well when seeking to expand their demographic profile and include pertinent voices in the design and development process, as well as in the ongoing monitoring, evaluation, and testing of the services. But it is interesting to note that the empirical findings did not report on the role of demographic characteristics of the design team, making it difficult to reduce the exclusion nature of e-Government service. To ensure that accessible e-Government solutions are made possible, designers and developers need to understand user's limitations in interacting with technology as well as other facets of demography such as gender. This finding has implications for practice as well. Practitioners should carefully reflect on their demographic profile when designing and developing accessible e-Government solutions.
Other findings not reported in the empirical results was the lack of design intentions made for accessible e-Government solutions. Findings show that practitioners are constrained by other structural issues of finance, time, human resource capacity, expert knowledge and competing tasks in creating design intentions for accessibility. These findings call on government to prioritise and become the champion for accessibility and in so doing, provide structural mechanism to allow for the support of accessibility design intentions which would then be inscribed in the design and development process for accessible e-Government solutions.

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APPENDIX A: Interview introduction Letter

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https://www.commerce.uct.ac.za/InformationSystems/

Re: Interview Introduction Letter

Dear Sir/Madam,

My name is Saleem Abdurahman, a student enrolled for the Master of Commerce in Information Systems at the University of Cape Town. As part of the requirements of the course program, I am required to submit a Research Report. The focus of the report is on the accessibility of e-Government systems/services. ICT is now being used in government, in what is termed as e-Government, as a catalyst in enabling government to offer more efficient ways of delivering information and making services accessible to both citizens as well as to businesses, and the process transparent. The ability to access e-Government services 'promotes democracy through inclusive participation' and this is ultimately what e-Government is trying to achieve. However, e-Government has the potential to exclude persons with disability (PWDs) due to their inaccessibility. Several studies have documented how inaccessible online government services are to PWDs and how this alienates them from enjoying e-Government benefits of better access to a vast amount of information, saving time, simplified services, and increased transparency. The objective of this study is therefore to *explore the challenges faced by e-Government designers and developers with regards to the designing of e-Government systems and how best they can address these challenges*.

I have been given ethical clearance to collect data by the University of Cape Town, Commerce Faculty. During this research, no information that can identify you or your business will be collected in the questionnaire. Your participation is entirely voluntary, and you will be free to withdraw at any point should you not feel comfortable participating in the study. All the data collected will only be used for academic purposes and findings will be presented to the University of Cape Town as part of the completed dissertation.

The interview requires approximately thirty (30) minutes. Thank you for your time.

Sincerely,

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APPENDIX B: Semi-structured interview guide

Introductory section:

#	**Question**
1	Who are some of the key decision makers with regards to e-Government systems scope and requirements?
2	What resources and tools are currently available to ensure accessibility is ensured for people with disabilities (PWD)?

Section 1– E-Government Agents and Resources

#	**Question**
1	Who are some of the key decision makers with regards to e-Government systems scope and requirements?
2	What resources and tools are currently available to ensure accessibility is ensured for people with disabilities (PWD)?
3	What additional resources do you feel will better assist you and your team in designing and developing accessible e-Government systems?
4	Is there a need for top level management to be more aware of inclusivity and accessibility when designing e-Government solutions?

Section 2– Universal and inclusive design

#	**Question**
1	Are the user's perspective considered from the beginning of the design and development process and carried throughout the lifecycle until the product or service reaches the end user?
2	Are you familiar with the Web Content Accessibility Guidelines standards (WCAG 2.0) ?
3	Do you feel that more needs to be done to be inclusive to the widest range of citizens being able to access e-Government systems? And what more do you feel can be done to be inclusive?
4	Do you feel that the e-Government solutions currently designed and develop caters for multiple preferences as well as a wide range of physical, learning and mental abilities?

Section 1– E-Government Agents and Resources

#	**Question**	**Reference**
1	Who are some of the key decision makers with regards to e-Government systems scope and requirements?	(Choi et al., 2016; Hossain et al.,2011; Rowley,2011)
2	What resources and tools are currently available to ensure accessibility is ensured for people with disabilities (PWD)?	(Harder and Begnum, 2016;

		Wynen et al., 2014; Zhenbin et al., 2019)
3	What additional resources do you feel will better assist you and your team in designing and developing accessible e-Government systems?	(Harder and Begnum, 2016; Wynen et al., 2014; Zhenbin et al., 2019)
4	Is there a need for top level management to be more aware of inclusivity and accessibility when designing e-Government solutions?	(Ashaye and Irani 2019;Gunawong and Gao, 2017)

Section 2– Universal and inclusive design

#	**Question**	**References**
1	Are the user's perspective considered from the beginning of the design and development process and carried throughout the lifecycle until the product or service reaches the end user?	(Awale & Murano, 2020; Buchdid et al.,2015)
2	Are you familiar with the Web Content Accessibility Guidelines standards (WCAG 2.0) ?	(Fuglerud & Sloan 2013; Power et al,. 2012; Romen & Svanæs, 2011)
3	Do you feel that more needs to be done to be inclusive to the widest range of citizens being able to access e-Government systems? And what more do you feel can be done to be inclusive?	(Dosis, 2014, Halbach & Fuglerud, 2016; Liu et al., 2015)
4	Do you feel that the e-Government solutions currently designed and develop caters for multiple preferences as well as a wide range of physical, learning and mental abilities?	(Dosis, 2014; Tomberg et al., 2015)

Section 3– Design team demographics

#	**Question**	**References**
1	Do you or anyone in your family have any disabilities that may hinder their access to e-Government services?	(Rieber & Estes, 2017)
2	Do you feel that the current team you're in is diverse in knowledge, culture and values?	(Mahr et al., 2014; Olbrich et al., 2015; Rieber & Estes, 2017)

Section 4– Design intention

#	**Question**	**References**
1	Have any of the projects you've worked on catered for people with disabilities up front when drawing up requirements?	(Harder & Begnum,2016; Otey et al.,2018; Laursen and Mriller, 2016)
2	Are PWD consulted when drawing up requirement for any e-Government project?	(Harder & Begnum,2016; Lee & Wong, 2017)

3	How is the testing of e-Government solutions done, does it involve UX testing and do PWD get included when testing a solution?	(Almaliki et al., 2015; Carrel et al, 2018)
4	At which stages are PWD being catered for and are they are included up front in the design and development of e-Government solutions?	(Carrel et al., 2018; Lee & Wong, 2017)

Section 5– Assistive technologies

#	**Question**	**References**
1	Are you aware of any assistive technology tools and applications that can be used for accessing online platforms? And if so which ones	(Moreno et al., 2018; Östergren 2015; Rohwerder,2018)
2	In your experience have any of the projects you've worked on aimed at integrating or using an assistive technology to facilitate ease of use for PWD?	(Boussarhan and Daoudi 2014; Bhomick and Hazarkia, 2017; Rohwerder, 2018)
3	In your current environment do you think that there may be any use cases where assistive technologies can be implemented?	(Almarabeh and Abu Ali, 2010; Boussarhan and Daoudi, 2014)

Section 6 – Evaluation of accessibility and usability of website

#	**Question**	**References**
1	Is the usage of the e-Government system easy and does not need to overly consider the level of skill, knowledge or experience of the citizen accessing it?	(Fuglerud & Sloan 2013; Lacerda & von Wangenheim, 2018; Power et al, 2012; Romen & Svanæs, 2011)
2	Are there any current measures in place to monitor and measure e-Government systems to check web content accessibility compliance?	(Power et al, 2012; Quintal & Macías, 2018; Romen & Svanæs, 2011)
3	Do you feel PWD are disadvantaged in their access to e-Government services that cannot be substituted by the private sector?	(Fuglerud & Sloan 2013; Kamoun & Almourad, 2014)
4	Are you aware of the South African national e-Government strategy?	(RSA Government gazette, 2017)