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User-Centred Design of M-Government Services in Namibia:

Prototyping Mobile Identification

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ABSTRACT OF
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The average e-government implementation level in Africa remains low. While many African governments have created e-government strategies and informational government websites, much attention has not yet been paid to implementing socially inclusive and accessible services. Especially in Namibia, where a digital divide is prevalent and income inequality rates are high, creating equal opportunities to access government services is important in order to combat the divide. Offering services on mobile platforms, gathering an understanding of citizens' needs, and designing intuitive user interfaces have been suggested as courses of action for Namibia. It seems that Namibian e-government initiatives would benefit from user-centred design.

The aim of this thesis is to explore the opportunities of mobile platforms for delivering citizen-centric e-government services to Namibian citizens, and how a combination of design science and user-centred design might support the creation of such *m-government* services. The subject is approached through a practical design challenge: creating prototypes for two mobile services related to identification (a service for online ID applications, and for digital authentication of individuals).

According to the results, mobile platforms hold a multitude of opportunities related to making existing government services more efficient and approachable, and related to the young, urban Namibians' proficiency in mobile use and overall positive perceptions of offering identification services on mobile platforms. For rural communities, m-government services could help reduce the amount of travel related to interacting with the government, but internet coverage remains an issue. The results also indicate that using prototypes can facilitate cross-cultural co-creation of knowledge by helping to establish a mutual understanding of concepts between parties.

Keywords: digital authentication, e-government, ICT4D, ID cards, identification, m-government, Namibia, user-centred design

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Sähköisten asiointipalveluiden keskimääräinen taso Afrikassa on yhä matalalla. Vaikka valtionjohto monissa Afrikan maissa on luonut strategioita sähköisten asiointipalveluiden kehittämiseksi ja verkkosivuja tiedotusta varten, paljoakaan huomiota ei ole vielä kiinnitetty sosiaalisesti inklusiivisten ja saavutettavien palveluiden kehittämiseen. Varsinkin Namibiassa, jossa digitaalinen kuilu eri ryhmien välillä on syvä ja tuloerot suuria, on tärkeää luoda asiointipalveluiden käytölle yhtäläiset mahdollisuudet erojen pienentämiseksi. Menettelytavoiksi Namibiassa on ehdotettu palveluiden tarjoamista mobiilialustoilla, tiedonkeruuta kansalaisten tarpeista sekä käyttöliittymien suunnittelua intuitiivisiksi. Vaikuttaa siltä, että projektit voisivat hyötyä käyttäjäkeskeisestä suunnittelusta.

Tämän diplomityön tavoitteena on tutkia mobiilialustojen mahdollisuuksia kansalaiskeskeisten sähköisten asiointipalveluiden tarjoamiseksi Namibian kansalaisille, sekä tietojärjestelmätutkimuksen ja käyttäjäkeskeisen suunnittelun yhdistelmän mahdollisuuksia tukea tällaisten mobiiliasiointipalveluiden suunnittelua. Aihetta lähestytään käytännön suunnitteluhaasteen kautta: työssä kehitetään kaksi prototyyppiä henkilöllisyyteen liittyvistä palveluista (yksi sähköistä henkilökorttihakua varten, toinen sähköistä tunnistautumista varten).

Tulosten mukaan mobiilialustat tarjoavat monenlaisia mahdollisuuksia nykyisten asiointipalveluiden tehostamiseksi ja kehittämiseksi lähestyttävämmiksi. Mobiilialustojen käyttö on lupaavaa myös siinä mielessä, että nuoret, kaupungeissa asuvat namibialaiset ovat kyvykkäitä mobiilikäyttäjiä ja heidän suhtautumisensa henkilöllisyyteen liittyvien palveluiden tarjoamiseen mobiilialustoilla oli yleisesti ottaen positiivista. Maaseudulla asuvien yhteisöjen osalta mobiiliasiointipalvelut voisivat vähentää julkisten palveluiden käyttöön liittyvää matkustusta, mutta internet-yhteyden saatavuus seuduilla on yhä heikkoa. Tulokset viittaavat myös siihen, että prototyyppien käyttö voi fasilitoida kulttuurienvälistä tiedon yhteisluomista helpottamalla yhteisen konseptuaalisen ymmärryksen syntymistä eri osapuolten välille.

Asiasanat:	henkilökortit, henkilöllisyys, ICT4D, käyttäjäkeskeinen suunnittelu, mobiiliasiointipalvelut, Namibia, sähköinen tunnistautuminen, sähköiset asiointipalvelut
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Joanna Mehtälä

Abbreviations and Acronyms

AfriCHI	African Conference for Human Computer Interaction
DS	Design Science
DSRM	Design Science Research Methodology
EGDI	E-Government Development Index
eID	Electronic Identification
HCI	Human Capital Index
HDI	Human Development Index
ICT	Information and Communication Technology
ICT4D	Information and Communication Technology for Development
ID4D	Identification for Development, a World Bank initiative
IT	Information Technology
MHAI	Ministry of Home Affairs and Immigration (of Namibia)
NUST	Namibia University of Science and Technology
OSI	Online Service Index
TII	Telecommunications Infrastructure Index
UCD	User-Centred Design
UI	User Interface
UN	United Nations
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization

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Chapter 1

Introduction

Delivering government information and services online is a practice known as *e-government*, which is common in advanced economies around the world. E-government replaces traditional rigid government functions with flexible service delivery that allows citizens to interact with the government at any moment they choose (West 2004). In low and middle income countries, however, e-government implementation levels remain low. The African continent has the overall lowest E-Government Development Index (EGDI) in the world, with an average score of 0.342 out of 1, while the world average stands at 0.55 (UNDESA 2018). E-government development in Africa is hindered by gaps in infrastructure, expensive broadband access, a lack of ICT skills, and low adoption rates of created services (Lallmahomed et al. 2017, UNDESA 2018). Still, e-government holds promise for the continent; while many Sub-Saharan African countries are suffering from hierarchical, manual, inefficient, and opaque governance (Ngulube 2007, Schuppan 2009), e-government is expected to increase transparency, responsiveness, and efficiency, and allow for citizen empowerment through the direct availability of information and other resources (Bwalya 2009).

Namibia belongs to the middle EGDI group with the majority (63%) of African countries (UNDESA 2018). Namibia's challenges related to e-government are mainly due to limited service implementation, low usability and accessibility where services exist, low awareness and perceived value of the services, and gaps in infrastructure (Amukugo and Peters 2016, Fröhlich and Peters 2017). A digital divide exists among the people: about half of the overall population and 28.7% of the rural population have access to electricity, and only 31% of the population reported to using the internet in 2016 (UNDP 2018*a*, World Bank 2019). The mobile subscription rate is high, however: in 2016, there were 107.3 mobile subscriptions per 100 people (UNDP 2018*a*).

To design and implement inclusive, citizen-centric e-government services in Namibia, several factors need to be taken into account. Offering services on mobile platforms, developing an understanding of citizens' information needs and underlying attitudes towards using technology, and designing intuitive and usable interfaces for the services have been suggested as courses of action (Fröhlich and Peters 2017, 2018). These goals seem attainable through the practice of *user-centred* (or *human-centred*) *design*—an approach to ICT systems design where users are incorporated into the design process in order to produce solutions that meet users' requirements and are suitable for their contexts (Finnish Standards Association SFS 2010). User-centred design has been applied to cases of software design in low and middle income countries before, and several researchers have found user-centred design activities to be useful in uncovering cultural and context-specific issues affecting the use of ICT (e.g. Ramachandran et al. 2007, Stanley et al. 2015, Jones et al. 2017). Applying user-centred design to the domain of e-government in African countries remains, however, a little studied topic.

This thesis aims to provide more insight into the opportunities of building citizen-centric e-government in Namibia using mobile devices as platforms, and to how such *m-government* services could be designed in a user-centred manner. The subject is approached through a practical design challenge: designing prototypes for two m-government services, one related to applying for an ID card online, the other to digital authentication of individuals. The method used is a combination of user-centred design and *design science*. Design science is a research approach where knowledge of a problem, its context, and its solution is accumulated in the design and application of an artifact (Hevner et al. 2004). This approach was chosen based on e.g. the findings of Ramachandran et al. (2007), who recommend the interactive use of a technology artifact for finding out about technology baselines, market expectations, and cultural background information while working with communities in developing contexts. Here, design science is applied to the design of the two prototypes, and to generating knowledge about the problem of how to design citizen-centric m-government services in Namibia. However, since design science is traditionally an engineer-centric approach, user-centred design activities were combined to it in order to shift the focus to the users. The development of this combined approach can be seen as one the scientific contributions of this thesis in addition to the knowledge created about the problem domain.

In the next two chapters, related work about e-government in Africa and Namibia and about user-centred design in developing contexts is studied in order to gain a better understanding of the topics. This understanding is then used to formulate the exact research questions, which are presented in

Chapter 4 along with the context of the design challenge. In Chapter 5, the combination of the design science and user-centred design approaches is presented and its application to this study is detailed phase by phase. The results of the study are presented in Chapter 6. Finally, the results are discussed in Chapter 7 along with implications for further research and the limitations of the study. The conclusions are drawn in Chapter 8.

Chapter 2

E-Government in Africa and Namibia

Electronic government, or *e-government*, is commonly known as "the delivery of government information and services online through the Internet or other digital means" (West 2004, p. 16). The term was first coined by the former U.S. Vice President Al Gore in his 1993 publication where he envisioned innovations such as smart benefits cards with chips that could render government functions and services fairer, more efficient, more secure, and more responsive. Today, 25 years later, the ideas he once wrote down on paper are a reality in many countries; applying for, say, personal identification documents and social benefits over the internet is already a given for millions of people around the world.

While traditional government functions have been seen as hierarchical and rigid, e-government allows citizens and businesses to access information online and interact with the government at any hour that suits them (West 2004). *E-governance* is a term related to the use of e-government for good governance; UNESCO define it as "the public sector's use of information and communication technologies with the aim of improving information and service delivery, encouraging citizen participation in the decision-making process and making government more accountable, transparent and effective" (as cited in Furuholt and Saebø, 2018, p. 3). However, in many low and middle income countries, e-governance is not yet the norm and public e-services are not offered to citizens.

2.1 The State of E-Government in Africa

According to UNDESA (2018), the African continent has the overall lowest E-Government Development Index (EGDI) score in the world. The EGDI is based on three indices: the Telecommunications Infrastructure Index (TII), the Human Capital Index (HCI), and the Online Service Index (OSI). The EGDI measures the "readiness and capacity of national institutions to use ICTs to deliver public services" (UNDESA 2018, p. xx). Countries are divided into four categories according to their EGDI score: very high (0.75 to 1.00), high (0.5 to 0.75), middle (0.25 to 0.5), and low (below 0.25). Africa's overall score is listed as 0.342, while the world average is at 0.55.

Fourteen African countries (26%) belong to the low EGDI group. The only other region with countries belonging to the low EGDI group is Asia, where the group makes up 4% of the region. Low EGDI countries tend to belong to the least developed and lowest-income countries in the world, where wide gaps in infrastructure, expensive broadband access and a lack of ICT skills hinder the progress of e-government and other technological advancement. Despite the rapid spread of mobile broadband access in Africa during the past years, the overall level of mobile broadband subscription is only 27.84% in the region, and its price takes up an average of 13.49% of a person's income. This is extremely high compared to 0.63% in Europe, where 80.46% of people have mobile broadband access. Only 22% of Africans were estimated to use the internet in 2017, which is less than in any other region. (UNDESA 2018)

Most African countries (63%) belong to the middle EGDI group. Namibia, the focus country of this study, represents this majority with an EGDI of 0.4514. Six African countries (11%) make the high EGDI group. These countries are Mauritius, South Africa, Tunisia, Seychelles, Ghana, and Morocco, whose scores range from 0.5214 to 0.6678. No African country belongs to the very high EGDI group. Despite the overall low score of the continent, Africa saw the widest improvement in e-government from 2016 to 2018 with thirteen countries moving up from the low group to the middle group. The overall rise in Africa's EGDI was the third highest in the world, mostly due to the increase in availability of online services. (UNDESA 2018)

Literature on e-government progress in Africa describes similar phenomena. Ngulube (2007) states that governments in Sub-Saharan African countries still function in hierarchical, manual, paper-based manners, and lack transparency and accountability; Schuppan (2009) notes that public administration in Sub-Saharan Africa is inefficient, has limited capabilites, and is handled by poorly-trained personnel. Bwalya (2009) states, however, that

many African countries have come up with strategic plans for the implementation of e-government, and that African governments generally accept the possibility of positive impact stemming from e-government: increasing transparency, responsiveness, and efficiency, and empowering citizens through the more direct availability of information and other resources.

Despite these existing strategic plans and policies, Mutula (2008) found that most government websites in Sub-Saharan Africa were under-developed (perhaps excluding South Africa, Mauritius and Seychelles), and Maumbe et al. (2008) found that existing services had little interactivity. Some advanced implementations do exist, though. Mutula (2008) describes the Mauritius government web portal as one that allows citizens to submit and track online applications in a "one-stop-shop" manner (p. 242), and the more recent 2014 United Nations E-Government Survey reports that Mauritius offers over a hundred e-services to its citizens along with a platform for e-participation, including discussion forums and blogging opportunities (UNDESA 2014). Schuppan (2009) describes three successful e-government projects from Tanzania, Kenya and Ghana: in Tanzania, a tax management system has been put in place; in Kenya, citizens can report incidents of corruption online; and in Ghana, almost all affairs related to the import and export of goods at ports and airports can be handled electronically.

The challenges related to the successful implementation and uptake of e-government in Africa identified by researchers are plentiful. Emphasis has traditionally been put on issues such as the lack of infrastructure and infostructure, as well as the lack of ICT literacy (see e.g. Ngulube 2007 and Mutula 2008). While these are important issues for the success of e-government, Lallmahomed et al. (2017) state, however, that sociological issues impacting the adoption of e-government services have been neglected by governments. These issues are related to both the qualities of the services themselves, and to the way they are perceived by citizens. The services need to be designed to fit local contexts; Maumbe et al. (2008) argue that e-government models taken from developed countries do not necessarily fulfil the needs of Africans, and that social and cultural factors need to be taken into account. Shalini (2009) studied the e-readiness of Mauritians, and found that even though Mauritius offers its citizens a wide range of e-services, their usage rates were low. This was due to the services being offered only in English (not the Mauritians' native Creole), limited interactivity and opportunities for e-participation, low awareness of services, mistrust towards the services, and resistance to change (Shalini 2009). Lallmahomed et al. (2017) found similar issues, and add that the perceived difficulty of using e-government services may also affect their lack of adoption in Mauritius.

These results point to a need for a comprehensive approach when design-

ing and developing e-government in African countries. Ochara (2011) further points out that even though e-government is offered as a panacea to problems related to governance in Africa, it can drive social exclusion if the rural and the poor are excluded from access. Thus, providing all citizens with equal opportunities to access both technology and services is important.

Ghana, which has recently moved up to the high EGDI group, is a good example of comprehensive investments made into ICT. The country is currently making advancements in the form of the e-Ghana and e-Transform projects, and putting effort into providing connectivity for people living in rural areas: solar-powered base stations providing wi-fi hotspots are being installed around the country, allowing locals to access the internet and various e-services (UNDESA 2018). Lavery et al. (2018) also suggest using solar power for providing rural communities with community networks. Community networks are also described by Saldana et al. (2017), who give a classification of Alternate Networks aiming to provide internet access for all—they describe community networks as self-managed networks "built and organized in a non-centralized and open manner" (p. 190). Further, Rey-Moreno et al. (2014) state that local ownership of such community networks improves their sustainability, because externally-initiated projects often create dependencies.

Another approach for improving the accessibility of e-government services in African countries is offering them also on mobile platforms. Munyoka and Manzira (2014) state that *m-government* is an extension of e-government, and that it allows reaching the vast majority of society who either cannot or prefer not to access e-government services on platforms other than mobile ones. They state, however, that issues such as trust, security, privacy, and legal matters will hinder the adoption of m-government services in Sub-Saharan Africa. Henceforth, the terms e-government and m-government will be used to convey similar meaning as in Munyoka and Manzira (2014): e-government will be used as an umbrella term for all government services offered online either on desktop or mobile format, and m-government will be used to describe e-government services offered solely on mobile platforms.

2.2 The State of E-Government in Namibia

Namibia is a country in southwestern Africa with a landmass of about 823,860 km^2 and a population of about 2.5 million, with about half of the population living in urban settings and the other half spread relatively sparsely in different parts of the country (Mendelsohn et al. 2002, UNDP 2018*a*). The biggest language groups in the 2011 census were Oshiwambo (spoken by 49%

of households), Nama/Damara (11%), Afrikaans (10%), Kavango (9%), and Otjiherero (9%). English is the official language, and is used as the primary language in education from the secondary level onwards. Two indigenous nomadic groups exist in Namibia: the San and the Ovahimba. (Government of Namibia 2019) Namibia gained independence from South Africa in 1990 and is a parliamentary democracy.

According to UNDP (2018*a*), Namibia has a medium human development rate with a Human Development Index (HDI) of 0.647 and a life expectancy of 64.9 years. The UNDP currently considers Namibia a developing region, but it is also categorised as an upper middle income country (UNDP 2018*a*, UNDESA 2018). This contradiction may be related to the fact that Namibia's income inequality rate is 53.6%, which is significantly higher than the Sub-Saharan African average of 27.7% (UNDP 2018*b*). This points to a large gap between the rural and urban, and the educated and less educated populations.

Technology-wise Namibia is experiencing the same mobile boom as many of its African neighbours: in 2016, there were 107.3 mobile cellular subscriptions and 64.98 mobile broadband subscriptions per 100 people (UNDESA 2018). Internet usage was less common: 31% of the population reported to using the internet in 2016 (UNDP 2018*a*). Namibia's EGDI, according to UNDESA (2018), is 0.4514, which means it is a middle EGDI country along with the majority of African countries. While Namibia's score is mediocre on a global scale, its EGDI rank is still the 10th highest in Africa. When looking at the three indices forming the EGDI, it seems that Namibia has a relatively high HCI (Human Capital Index) of 0.5850, but its low TII (Telecommunications Infrastructure Index) of 0.3299 pulls the overall score downwards. Rural electrification is still progressing slowly, and only 28.7% of the rural population have access to electricity (UNDP 2018*a*). Namibia's OSI (Online Service Index) of 0.4514 is quite low compared to the other countries in the African top 10, who have an overall average OSI of 0.6542. In fact, Namibia's OSI is closer to the African average of 0.363. (UNDESA 2018)

Namibia's relatively low OSI score is reflected in findings of the e-government service level of the country's Ministry of Home Affairs and Immigration (MHAI) by Amukugo and Peters (2016). The authors found that it was possible to access information and download application forms online at the Ministry website, but it was not possible to fill in the forms online and it was required that they be submitted physically at government offices. An SMS service for tracking the progress of applications was in place for ID and passport applications, but not for other applications.

Amukugo and Peters (2016) interviewed citizens seeking services at an MHAI office, and found that despite there being interest among Namibian

citizens towards using e-government services, the current initiatives had not proven very successful. This was mainly due to issues related to usability, accessibility, and perceived value. There was a lack of awareness about the benefits of the services, and some citizens did not know how to use them. Many expressed concerns related to the security of the services. Most citizens only had access to the internet through basic mobile feature phones, which meant that when accessing government sites, they would have to navigate the websites on small screens. The cost of internet access was also regarded as a hindrance to using the services. The information offered on the websites was not always consistent, and caused confusion.

Fröhlich and Peters (2017) back up these findings; they found that only 24% of randomly selected 44 citizens waiting in line at a government ministry were aware of available e-government services, and only half of those few had used the services. The authors' findings indicate that factors such as poor service design, high costs of internet access, lack of awareness, lack of compatibility between the e-government services and citizens' devices, lack of ICT skills or poor usability of the services, and weak ICT infrastructure affect the low adoption rates of Namibia's e-government services. This is in line with the aforementioned findings of e-government service adoption in other African countries.

2.3 Implementing E-Government in Namibia

It has been suggested that for African e-government projects to be successful, it is not enough to merely transfer models from the West to African countries; needs of specific user groups and cultural factors need to be taken into consideration (Maumbe et al. 2008, Schuppan 2009). Therefore, it is important to look at the region-specific factors influencing the implementation of e-government services in order to implement successful e-government in Namibia.

2.3.1 The Effect of the Digital Divide

It was noted above that Namibia experiences relatively high numbers of income inequality. Such inequality is linked to a digital divide, and is perceivable in many African countries. Even though the number of people in developing countries reporting to using the internet and smartphones is growing steadily, it is not growing at the same rate among all demographical groups (Pew Research Center 2016). For example, in Kenya, 40% of adults reported to using the internet or owning a smartphone in 2015, but more educated

people were much more likely to do so: the figure among more educated people was 70%, whereas among the less educated, it was only 19% (Pew Research Center 2016). According to Joshi and Islam (2018), especially people with low incomes, low education levels, low literacy levels, or disabilities, and the unemployed, the elderly, people living in rural areas, and women and girls are at a disadvantage in regard to ICT uptake and are also less likely to be aware of available e-government services.

Fröhlich and Peters (2017) see e-government as imperative for socio-political development in Namibia, but point out that if some citizens are excluded from access to e-government, its existance could actually hinder the country's development. UNDESA (2018) supports this view; offering government services in a digital form provides an opportunity for equal access to services and even increased participation in democracy, but there is also a possibility that the digital divide might further deepen if attention is not paid to digital inclusion. This must be taken into account when designing e-government services in developing regions; the services should be designed to be accessible across a range of devices, and even those with no technological devices should have some way to access government services.

2.3.2 A Model for Citizen-Centric E-Government in Namibia

Fröhlich and Peters (2017) studied the problem of e-government social exclusion in the Namibian context. The authors identify five main points for designing more inclusive e-government services in Namibia:

1. The services should be compatible with different types of mobile phones (which are the main media for using the internet in Namibia);

2. An understanding of citizens' information needs is imperative for designing services that meet those needs;

3. Citizens' ICT skills should be improved through education, but services should still be designed to be usable and intuitive rather than requiring training and advanced ICT skills;

4. Partnerships should be established with parties such as public libraries so as to provide citizens with support regarding e-government; and

5. ICT infrastructure should be improved around the country, including access to electricity, since even though internet connectivity is available in many rural areas, power is not always available for charging devices.

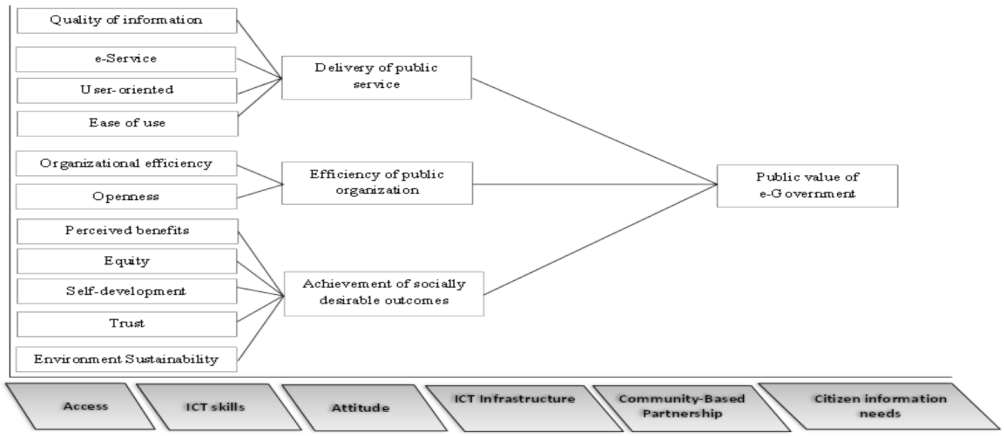

Figure 2.1: A Model for Designing, Implementing and Evaluating Citizen-Centric E-Government in Namibia, proposed by Fröhlich and Peters (2018, p. 8)

In their 2018 paper, Fröhlich and Peters add a sixth factor to this list:

6. Users' underlying attitudes towards using technology need to be understood.

Fröhlich and Peters (2018) go on to propose a model for successfully designing, implementing, and evaluating citizen-centric e-government services in Namibia. The authors base their model on a citizen-oriented model for **evaluating** the performance of e-government in Sri Lanka as described by Karunasena and Deng (2012), but they also incorporate the aforementioned six points on how to **design and implement** citizen-centric e-government into the model. The authors deem this necessary due to the fact that the e-government frameworks that are in place in Namibia have not yet lead to many actual service implementations. The model described by Fröhlich and Peters (2018) is depicted in Figure 2.1.

2.3.3 A Maturity Model for E-Government in Developing Countries

Joshi and Islam (2018) propose a maturity model for e-government implementation, aimed at developing countries in general. The authors give a detailed strategic plan for stage-by-stage implementation of e-government, with the aim of improving e-government sustainability in developing countries. Their model is a synthesis of existing e-government maturity models,

Stage	Implementation	Adoption
Stage 1	Basic services	Awareness and trust
Stage 2	Streamlined services	Know-how
Stage 3	Transaction services	Agile accessibility
Stage 4	Services automation	Involvement

Table 2.1: The Stages of E-Government Implementation and Adoption in Developing Countries as defined by Joshi and Islam (2018)

but in addition to identifying **stages for e-government implementation**, the model describes **stages for e-government adoption**. The stages for both implementation and adoption are summarized in Table 2.1.

According to the authors, the first stage of e-government implementation is to establish basic e-government services and a web presence. In practice, this means creating websites and social media presence on platforms such as Facebook and Twitter to distribute information and answer citizens' queries. This improves trust between government and citizens and builds awareness of e-government services. In this stage, governments should also computerize departments and begin cataloguing information from paper to digital format. (Joshi and Islam 2018)

The second stage is mainly about integrating government databases and services. Governments should have one centre for e-government systems and databases that all departments and ministries would have access to; building fragmented repositories and applications should be avoided. This requires enhancing the connectivity between departments, building a framework for interoperability, and identifying the platform that will be used for integration. While this is being done, efficient communication and training sessions should be conducted to improve stakeholders' know-how about e-government services. (Joshi and Islam 2018)

In the third stage, governments start building transactional services. A user identity verification system and a payment portal should be established before transactional services can be effectively and securely offered online. Legislation regarding electronic data processing should also be created. In order to get citizens to adopt the newly-established services, various factors need to be taken into account in their implementation: accessibility, social influence, availability, reliability, personal circumstances, trust... The authors identify access to technology as the most critical one of these factors, which is why they stress the importance of **agile accessibility**: allowing

citizens to access e-government services through different channels, such as kiosks, telecentres, and private sector partnerships, creating equal chances for everyone to use the services. (Joshi and Islam 2018)

The fourth and final stage is the automation of e-government services. For users, this could mean receiving automatic notifications of passport renewals or unpaid bills. Reaching this stage requires high-level integration both within and between government departments, sharing data across all of the government, creating a single portal for all services, and synchronizing user data with government systems in order to provide more tailored services to users. (Joshi and Islam 2018)

2.3.4 Synthesis: a Maturity Model for Citizen-Centric E-Government Implementation and Adoption in Namibia

The two models discussed above include similar insights. The six points for citizen-centric e-government design and implementation for Namibia identified by Fröhlich and Peters (2018) can be matched with the different stages of e-government implementation and adoption in developing countries as defined by Joshi and Islam (2018). Many of the points could be matched with all of the stages, but here, the points are matched with the stages they have the clearest link(s) to. A synthesis of these two models is presented in Table 2.2.

Based on the findings by Amukugo and Peters (2016) and Fröhlich and Peters (2017), it seems that informational government websites exist, but transactional services do not. According to World Bank (2017*a*), "Namibia is currently working toward last-mile connectivity of its MHAI offices to the government-wide area network", but is having challenges related to internet coverage due to long distances between regions, high cost of electricity, and theft of solar panels and cables (p. 29). These findings would point to Namibia being in stage 2 regarding the **implementation** of e-government. Additionally, Fröhlich and Peters (2017) found that there was a lack of awareness of e-government services among citizens and that only 12% of respondents had used them. They also found that some respondents did not know how to use e-government services. This would point towards Namibia being in stage 1 regarding the **adoption** of e-government.

For Namibia to move forward from stage 1 (adoption-wise), awareness of and trust towards e-government services needs to be established. This is linked with Fröhlich and Peters's (2018) observations of the need to understand citizens' attitudes towards using technology and citizens' information

Stage	**Implementation**	**Adoption**	**Points for Namibia**
Stage 1	Basic services	Awareness and trust	Attitude, Citizen information needs, ICT infrastructure
Stage 2	Streamlined services	Know-how	Community-based partnerships, ICT skills
Stage 3	Transaction services	Agile accessibility	Access, Attitude, Citizen information needs, ICT Skills
Stage 4	Services automation	Involvement	Citizen information needs, Attitude

Table 2.2: A Model for the Stages of E-Government Implementation and Adoption in Namibia, based on Joshi and Islam (2018) and Fröhlich and Peters (2018)

needs. Understanding of these factors makes it possible to build websites that better cater to citizens' needs, which, in turn, contributes again to the attitudes citizens have towards using the services. At this point, along with government department computerization, it is also important to invest in ICT infrastructure to improve basic capabilities to access the services.

Implementation-wise, stage 2 is about integrating government databases. The current level of system integration in the Namibian government is not clear based on the studied literature, so it is hard to say whether the Namibian government still needs to take action towards creating a centralized base for all their services. Adoption-wise, the communication and training sessions needed to build citizens' know-how about e-government services could be achieved in Namibia through the community-based partnerships (e.g. with libraries) that Fröhlich and Peters (2018) suggest are important for providing citizens with e-government support. Similar thoughts have been put forth by Furuholt and Saebø (2018), who state that telecentres still play an important role in providing e-government services to citizens in the rural areas of Tanzania—their view is that mobile phones could be used for completing simple tasks, while telecentres would provide computer and internet access for more complex tasks. Be it through telecentres or libraries, making support available for using e-government services, especially in the rural areas

where people are generally less proficient with technology use, might help in building both know-how about the services themselves and about ICT in general.

In stage 3, transactional services are implemented. The user identity verification system, payment portal and appropriate legislation mentioned by Joshi and Islam (2018) should be created first in order to build up to a spectrum of different transactional services. In Namibia, the agile accessibility that this stage aims to implement could be ensured both through the community-based partnerships established in stage 2 and by making sure that services are compatible with different types of mobile phones. Designing the transactional services so that citizens are likely to adopt them also requires an understanding of underlying attitudes, citizen information needs, and existing ICT skills; in other words, user-centred design.

Stage 4, the high-level integration and automation of e-government services, is still far in the future for Namibia based on the findings of Fröhlich and Peters (2018) and on Namibia's e-government scores defined by UNDESA (2018). Implementing such a comprehensive system requires, once again, understanding citizen information needs so that it becomes clear which services still need to be improved after stage 3 for as smooth and automated service delivery as possible. However, the citizen involvement that this stage aims at—like being able to participate in legislation online—requires citizens to be motivated in such activities. Therefore, citizens' attitudes towards using technology for such a purpose is also linked to this stage.

The above synthesis of the models by Fröhlich and Peters (2018) and Joshi and Islam (2018) is used as a basis for this study. Since the aim of this thesis is to gain insight about the opportunities of mobile devices as platforms for e-government services in Namibia, and about the user-centred design of such m-government services, **it makes the most sense to look at stage 3, where transactional services are built taking into account the attitudes, needs, and skills of citizens as well as the agile accessibility of the services**. The next chapter will look into the practices of user-centred design and how it has been applied to ICT projects in developing contexts such as Namibia.

Chapter 3

User-Centred Design in Developing Contexts

Usability, according to the ISO 9241-210 standard, refers to the "extent to which a system, product or service can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use" (Finnish Standards Association SFS 2010, p. 17). There are also, however, multiple other definitions of the term. For example, Hertzum (2010) defines six different images of usability (universal, situational, perceived, hedonic, organizational, and cultural usability), each with a different take on the meaning of the term. Some of the definitions even contradict each other: for example, universal usability aims at developing systems that are easy to use for anyone regardless of their background (often using principles based on human perception, such as the Gestalt laws), whereas cultural usability proposes that systems should be designed in accordance with the cultural backgrounds of their users, as people from different parts of the world differ in their cognitive processes (Hertzum 2010). Still, regardless of the standpoint, the essence of usability—in the context of ICT—is understanding what makes a system easy and comfortable to use for a given user.

The act of designing systems with a high level of usability—i.e. highly *usable* systems—is called *user-centred design* (UCD). The ISO 9241-210 standard describes the same activity using the term *human-centred design* in order to underline its impact also on other stakeholders that are not traditionally seen as users, while acknowledging that the two terms are often used synonymously. The standard defines human-centred design as the "approach to systems design and development that aims to make interactive systems more usable by focusing on the use of the system and applying human factors/ergonomics and usability knowledge and techniques" (Finnish Standards

Association SFS 2010, p. 15) In this thesis, the term user-centred design will be used with this same meaning when talking about design processes, methods, and cases, due to the thesis' focus on the **end users** of services. Further, the term *citizen-centric* will be used to describe user-centricity in the context of government services in order to underline the viewpoint of **citizens**, who are the end users of government services.

The next sections will explore how user-centred design can be conducted in ICT projects, and more specifically, what to consider when conducting UCD in a developing context such as Namibia.

3.1 The User-Centred Design Process

The ISO 9241-210 standard describes a process for implementing human-centred design. The four main activities of human-centred design are defined as 1) understanding and specifying the context of use, 2) specifying the user requirements, 3) producing design solutions to meet those requirements, and 4) evaluating the resulting designs against the requirements (Finnish Standards Association SFS 2010). Once the evaluation is done, if needed, the process can be iterated starting at any phase until the final design meets the user requirements. This process is depicted in Figure 3.1. Each of the phases of the human-centred design process can be executed using many different methods.

Collecting data about the context of use can be done, for example, using qualitative interviewing, where either groups or individuals are interviewed to gather information about their experiences (DiCicco-Bloom and Crabtree 2006); using rapid ethnography, where a set of field methods is used to gather a reasonable understanding of users and their activities despite time constraints (Millen 2000); or using more creative ways, such as Gaver et al.'s (1999) cultural probes, where objects such as postcards and cameras are given to study participants for the documentation of their daily lives.

Specifying user requirements is done by analysing the gathered data and organising it into the form of requirements. Holtzblatt and Beyer (1993) propose analysing data by organising it into clusters through affinity diagramming and creating work model diagrams for visual representations of contexts, roles, physical environments, and action sequences. Millen (2000) describes analysis techniques such as cognitive mapping, pictorial storytelling, scenario analysis, and computer-assisted analysis of both text-based data and of images, audio and video.

Producing design solutions to meet the user requirements is usually executed with some form of user interface prototyping. Holtzblatt and Beyer

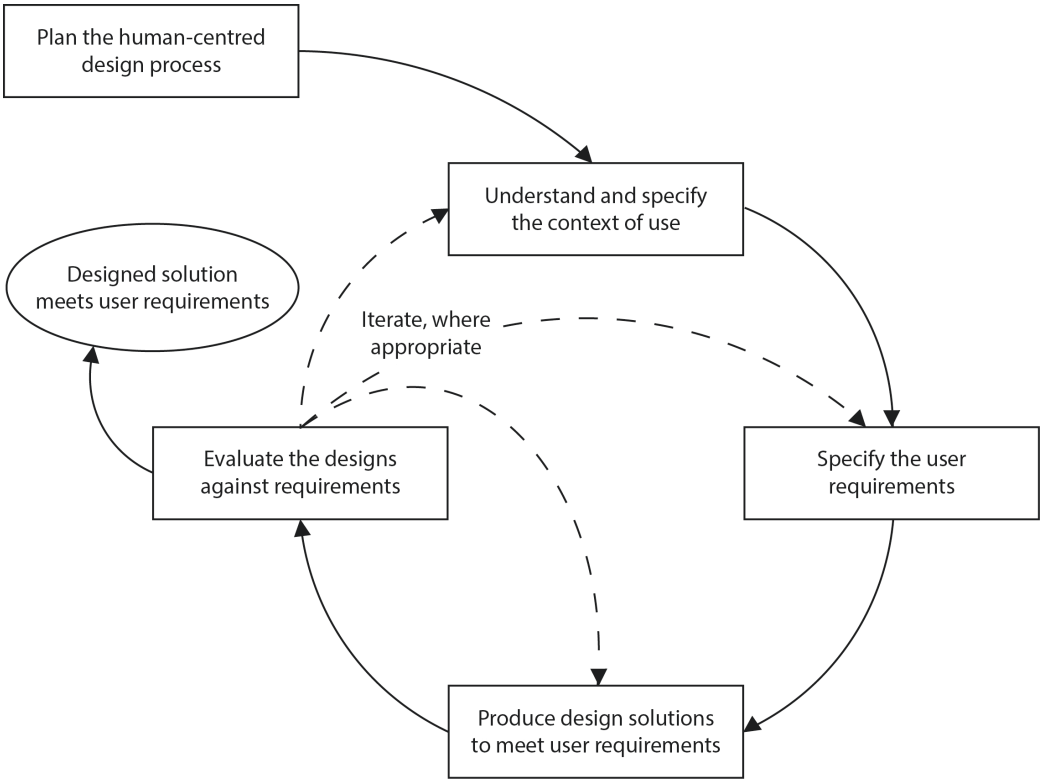

Figure 3.1: The human-centred design process (Finnish Standards Association SFS 2010, p. 29).

(1993) propose creating a series of paper prototypes that are refined based on user feedback. It is also possible to use software tools for multi-fidelity prototyping where interfaces can be built at different levels of fidelity (no-fi, lo-fi, me-fi, and hi-fi), as Coyette et al. (2007) suggest. The prototypes can either be created by the designers, using the defined user requirements, or users can be directly involved in co-creating the designs with the designers.

Evaluation of the designs against the requirements is typically done with some form of usability testing. Usability testing means, essentially, "representative users attempting representative tasks in representative environments", using anything from paper prototypes to implemented software (Lazar et al. 2010, p. 252). Different forms of usability testing are expert-based testing, automated testing, and user-based testing (Lazar et al. 2010). Expert-based testing means employing usability experts (preferably not the designers themselves) to conduct e.g. heuristic evaluation or cognitive walkthroughs on the interface. Automated testing means using computer software to compare the interface to usability guidelines. User-based testing can include e.g. asking

the user to fulfil a task and think aloud while doing it, and observing the user while he/she is interacting with the prototype. (Hertzum 2010, Lazar et al. 2010) Less traditional and more innovative methods such as technology probes (similar to Gaver et al.'s 1999 cultural probes) and Wizard-of-Oz testing (simulating human-computer interaction with a human providing the responses) are also considered variations of usability testing. The results of usability tests are analysed to find out which features of the prototype and its interface still need to be iterated. (Lazar et al. 2010)

A comprehensive comparison of methods for the different phases of user-centred design is beyond the scope of this thesis. It is good to note, however, that the human-centred design process of the ISO 9241-210 standard can be conducted in many different ways. There is also a multitude of different research approaches that are very closely related to user-centred design, such as cooperative design, co-design, action research, and participatory design (see e.g. Sanders and Stappers (2008) for a comparison of the different approaches). The borders between these fields remain blurry, and in many cases, the differences are purely semantic. For example, the *early-stage co-design* activities conducted by Ramachandran et al. (2007), which entailed mainly gathering information about users in certain contexts, would be classified by many purely as user-centred design instead of co-design since the researchers did not involve participants into actual design work. In this thesis, the term *user-centred design* is used as an umbrella term for any approach involving potential end users in any stage of the design process.

3.2 Conducting UCD in Developing Contexts

Applying user-centred design to software projects conducted in/for developing contexts is particularly important, because software systems have traditionally been built with developed, Western contexts in mind. According to Brewer et al. (2005), simply taking the solutions that have worked for developed countries and moving them to the context of the developing world has not seemed to work; the technology needs of users in developing contexts differ from those of users in developed contexts. If those needs are not taken into account, projects cannot be sustainable. Indeed, Heeks (2008) states that many early ICT4D (*information and communication technology for development*) projects faced problems regarding sustainability, scalability and evaluation of impact: projects did not survive in the long term, reached a limited amount of people, and could not be objectively evaluated regarding the actual impact they had on people's lives.

Brewer et al. (2005) state that the four main technology needs of ICT projects are connectivity, low-cost devices, power, and appropriate user interfaces. In developing countries, connectivity and power are still not readily available in many rural areas and informal settlements despite the multitude of efforts trying to provide them for all communities around the world. Personal computers are too expensive for the majority of people, but most people all around the world already have access to some kind of personal or shared mobile device (Brewer et al. 2005, Pew Research Center 2016). Traditional WIMP interfaces may be poorly suited for some users due to e.g. illiteracy, and other issues such as gender and ethnic inequalities may impact technology adoption (Brewer et al. 2005). User-centred design—more specifically, conducting user research and designing and evaluating solutions with the target users—can help to take these factors into account.

Several cases of user-centred design activities in developing contexts have been recorded in literature, and some researchers have gone on to develop models on the subject. The following sections will explore some of these cases and one model, along with ethical considerations, in order to give some perspective on how UCD could be applied to the design and implementation of m-government services in Namibia. It must be noted, however, that **pinpointing studies that could be generalised to fit all Namibian citizens is hard, if not impossible**, due to reasons discussed in Chapter 2: not all Namibians have equal access to ICT, which points to there being **different levels of familiarity and proficiency in technology use** in the country. The cases presented below were conducted both in Namibia and in countries with similar profiles, such as Kenya, South Africa, Uganda, and India. The studies are, however, focused on the less technology-proficient groups of the nations.

3.2.1 Cases and Guidelines

Ramachandran et al. (2007) present three cases where **technology artifacts**—a personal communication device, a point-of-sales device, and digital cameras—**were used as facilitators for early stage co-design** in India and Uganda. The aim of the studies was to gain understanding of the tasks, needs, and practices of potential users, and to elicit design ideas from the participants. The three studies were conducted separately, but there were several similarities between the cases, since all of the participants of the studies were characterized by low exposure to technology and a strong sense of community. This lead the authors to draw five generalized guidelines for "engaging local stakeholders in developing regions in the early stages of co-design" (Ramachandran et al. 2007, p. 1094):

1. "Use the artifacts to assess the technology baselines and market expectations of the community,"
2. "Design tasks for participants to perform using the artifacts in order to elicit response,"
3. "Open up the study as a community event in order to attract participants from widespread backgrounds,"
4. "Allow peers to help one another to encourage participation and observe learning dynamics," and
5. "Create opportunities to observe social dynamics at different levels within the community" (Ramachandran et al. 2007, p. 1094-1095).

In a nutshell, even though the participants had limited experience with technology, they **were able to provide valuable feedback and cultural background information for technology design through the tasks they were asked to perform with the artifacts**. It is pointed out that such feedback and information contributes to the design of ICT in the regions in question also on a general level; not only to the iteration of the used artifacts.

Jones et al. (2017) demonstrate another approach to find out about users' needs: they conducted future-focused envisioning workshops with five groups of emergent technology users in India, South Africa, and Kenya, where **participants themselves designed future technologies and interfaces** that would be useful in their own lives and cultural contexts. Here, the term *emergent users* is used to define people "for whom advanced technologies are just within grasp" (Jones et al. 2017, p. 157). Emergent users are characterized by low exposure to advanced digital technologies and low incomes, and in many cases, low personal and/or family education and literacy levels. People from five different target groups were engaged in workshops to design future mobiles and a "magic thing" that could "be or do anything the user wanted in terms of how it helped them communicate with others, access content or provide information and answers to their needs" (Jones et al. 2017, p. 163). The study found that the participants were **skilled and innovative designers** once encouraged not to limit themselves to how current technologies work. The resulting designs reflected each groups' specific needs—like the need for discrete interactions, complex speech interfaces, and obtaining data about others instead of data about oneself (as opposed to Western users, who are often interested mainly in data about themselves)—and ranged from small, concealable mobiles to wearables in the forms of jewellery, gloves and earpiece devices.

All of the studies conducted by Ramachandran et al. (2007) and Jones et al. (2017) were one-time cases, even though some of them took more than a couple of days to complete (such as Ramachandran et al.'s case in India, where the data was gathered over a period of two weeks). Stanley et al. (2015), however, involved the community they were working with into the design process **more comprehensively**. They worked together with a rural Ovahimba community in Namibia to develop a mobile crowdsourcing platform for storing indigenous knowledge. The basic functionality of the platform was for the community members to capture images of cultural objects and dress that would then be opened up for the crowd to model in 3D. The authors simulated a whole crowdsourcing process with the community, asking for tasks to model on their first visit, and for evaluation of the completed models on their second visit two months later. Indeed, the authors themselves point out that the term *early-stage co-design*, which Ramachandran et al. (2007) use, is apt for describing that particular study, but that in their eyes, "co-design goes further when combined with action research and continues to all stages of artefact development and evaluation" (Stanley et al. 2015, p. 3). The authors conclude that **the feedback they received on their second visit was valuable to the further development of the system**: the authors learned, for example, that the precision with which the 3D models were created was not high enough. This led them to ideate on ways in which the platform could support ensuring that no details are overlooked (the platform could e.g. allow community members to annotate the photos they took in order to emphasize important features).

Kapuire et al. (2017) share Stanley et al.'s (2015) standpoint about longer, more comprehensive collaboration: they argue that when conducting ICT4D research with rural communities, **long-term collaboration should be favoured over one-time projects**. Visiting a community as an international researcher, promising things during the research activities, and disappearing without being in any further contact with the communities should be avoided. The authors propose that protocols for engagement should be formalized and trust should be established with the community members before embarking upon the co-design sessions themselves. Other guidelines that Kapuire et al. present include having local researchers join the team, respecting cultural norms, avoiding insensitive questions, explaining research agendas to avoid creating expectations that can't be met, letting community members speak for themselves, ensuring that all voices of the community are heard, informing the community of the status of the project, and taking the data back to them to make sure that the results reflect the community's true position. The authors also share how community members from two villages in Namibia had been happy to be part of the research projects and

even wished that the researchers would visit them more often upon establishing good relationships with them: "for them seeing researchers visit the community is a sign of learning something new" (Kapuire et al. 2017, p. 388).

While the findings of Kapuire et al. (2017) are extremely important and seem to apply especially to marginalised rural communities, it might not always be necessary to establish long-term relationships with study participants in developing contexts. **If trust is established in other ways and study objectives are clearly stated** to avoid creating unrealistic expectations, there is reason to presume that many people might still be willing to participate in UCD activities. For example, in Ramachandran et al.'s (2007) Uganda case, the researchers conducted their activities in conjunction with a piloting project where their local partners already had a relationship with the participants (who were their clients). Additionally, participants can be offered some form of **compensation** for their participation. Jones et al. (2017) offered the participants in all of their cases the possibility to choose the compensation given to them. Three groups chose individual payments, the fourth a group donation for their collective, and the final group wanted to participate without any monetary compensation. An interesting thought is compensating for the participants' time by giving them some of the researchers' time; based on Kapuire et al.'s (2017) statement that the community members regarded the researchers' visit as an opportunity to learn something new, it might perhaps be possible to consider such mutual exchange of information as a form of compensation even in shorter-term collaboration with communities.

So, to summarise, involving users into the design of ICT in developing contexts has been found useful for understanding the needs, cultural contexts, and technology skills of users, and for hearing the end users' innovative design ideas. The UCD activities should, however, be designed to be respectful, and it should be ensured that all voices of the participating community are heard accurately. Sustainable, long-term collaboration with communities should be favoured over one-time events, and establishing trust between the researchers and participants is paramount.

3.2.2 An Environment-Sensitive Framework for User-Centred Design

Based on the above literature, it is clear that many factors need to be taken into account when conducting UCD in developing contexts. Backhaus et al. (2014) propose an **environment-sensitive framework for user-centred**

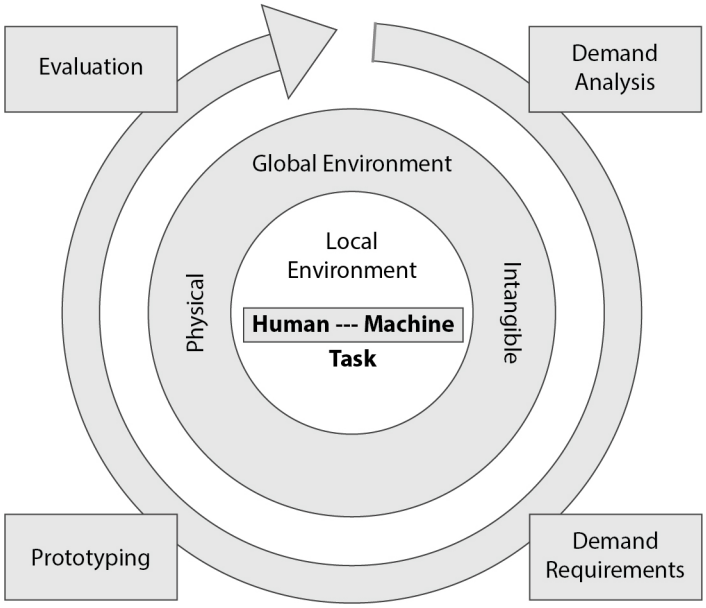

Figure 3.2: An environment-sensitive framework for user-centred design (Backhaus et al. 2014, p. 406).

design with the aim of helping researchers to incorporate a multitude of factors into the planning of their UCD activities for developing contexts.

Backhaus et al. (2014) combine the common user-centred design process (one rendition of which is presented in Figure 3.1) with a socio-technical system approach. The framework is depicted in Figure 3.2. The authors state that even though the direct interaction between a user and a software system happens in a narrow local environment, the large-scale global environment sets "the boundaries for the user and his or her possibilities to accomplish his or her needs in an interaction with a technical artifact" (Backhaus et al. 2014, p. 405). This means that both the local and global environment need to be taken into account when designing the methods to be used in UCD activities.

According to Backhaus et al. (2014), there are both **tangible (physical) and intangible requirements** for the methods used in UCD in developing contexts. Tangible constraints are imposed mainly upon the equipment and research settings: for example, in some rural settings, there might not be buildings to conduct the research activities in, or electricity to charge devices. This means that methods requiring complex setups should be avoided. Intangible requirements arise from factors such as cultural issues, educational backgrounds, language barriers, or even politics. For example, gender roles may have an impact on who is comfortable talking to whom, giving criticism

about a technical artifact may not be considered appropriate, and illiteracy or infamiliarity with technology may affect the participants' ability to interact with questionnaires or technical artifacts. Participants may even be hesitant to state their opinions on some matters due to political pressure. (Backhaus et al. 2014)

Backhaus et al. (2014) identify **qualitative methods** as the best UCD activities for developing contexts, because they allow for more flexibility when navigating a certain situation or working with certain subjects, and because they generate a lot of data even with few participants. Qualitative interviews, group discussions, and ethnographical methods (including observations of the context or the participants' interaction with an artifact) are listed as good options. The cases explored above did make use of these methods; both Ramachandran et al. (2007) and Stanley et al. (2015) used technology artifacts to stimulate discussion on a topic and to observe the participants' interaction with the artifact. Jones et al. (2017) used more participatory methods where participants themselves created designs, which was also a highly qualitative approach. The downsides to qualitative methods, according to Backhaus et al. (2014), are that they require more time, and that their success depends heavily on the researcher's or facilitator's performance; for example, when interviewing people, the interviewer must be empathetic and encouraging towards the participant and be sensitive towards any cultural issues at hand.

Heimgärtner et al. (2014) express views similar to Backhaus et al. (2014): they state that designers must be particularly flexible and empathetic so as to understand the needs of people living in rural areas of developing countries. The authors suggest that using agile principles (see the agile manifesto from 2001 by Beck et al.) supports the user-centred process defined in the ISO 9241-210 standard, because the principles support the iterative nature of usability engineering. Heimgärtner et al. (2014) even suggest practicing *in situ design*—living with the users—as it allows for live user feedback, continuously delivering new releases, and collecting information of user needs in short cycles (among others). This sort of continuous user involvement might help in realising Kapuire et al.'s (2017) and Stanley et al.'s (2015) recommendations for long-term collaboration with communities.

3.3 UCD of E-Government Services in Developing Contexts

There has been little research on applying user-centric methods to the design of e-government or m-government services in developing contexts, but the few

cases that exist are encouraging. Khumalo and Pather (2018) involved a focus group in co-creating a civic engagement mobile application in South Africa. They used a bottom-up, community-based co-design framework where users themselves defined their needs, and evaluated both a paper prototype and a functional prototype created by the developers. The authors found that the method enabled the creation of a product that users stated met their needs, and recommend that government functionaries apply similar approaches to e-service design.

Jacobs et al. (2018) engaged two municipalities in rural South Africa into the co-design of an ICT system related to the delivery of water and sanitation services to communities. The co-design team consisted of users of the ICT system (mainly members of municipal administration), but also beneficiaries of the system, the citizens. The authors state that the co-design activities enabled subtle knowledge exchange between the different stakeholders, allowed hidden issues to surface, and resulted in a solution influencing socio-economic development positively. They, too, recommend that governments consider co-design as an approach to developing ICT systems.

Chapter 4

Research Questions and Design Challenge

The main findings of Chapters 2 and 3 were that the current level of e-government implementation in Namibia is relatively low, and that user-centred design and offering services on a range of platforms (including mobile devices) could ensure better usability and accessibility of e-government services. Based on these findings, the research questions and design challenge for this thesis are formulated below.

4.1 Research Questions

The aim of this thesis is twofold. First, this thesis aims to find out about the opportunities of using a mobile platform for the delivery of citizen-centric e-government services in Namibia. This goal includes both a contextual and an interactional dimension. The aim of the contextual dimension is to find out about current government service offerings and whether there are some problems associated with those services. The aim of the interactional dimension is to find out about how Namibian citizens interact with and perceive such services. Thus, the first research question is formulated as follows:

RQ1: *What opportunities does a mobile platform provide for the delivery of citizen-centric e-government services in Namibia?*

- RQ1.1: *What problems are associated with current government services in Namibia?* (Contextual dimension)

- RQ1.2: *How do Namibians interact with and perceive m-government services?* (Interactional dimension)

So, the aim is to find out about the opportunities of mobile platforms both for solving existing problems related to government services, and in regard to Namibians' usage and perception of mobile services. Answering these questions for all government services at the same time would have been impossible. So, in this thesis, one specific application domain was chosen: identification, i.e. applying for an ID card and using that ID for digital authentication. Two prototypes for mobile services were created and then presented to target users in Namibia as artifacts for raising discussion about the topics of the research questions. The design challenge for creating the prototypes is framed in the next section.

The second aim of this thesis is to see how the chosen method, a combination of design science and user-centred design (detailed in the next chapter), supported the design of citizen-centric m-government services in Namibia. Thus, the second research question is formulated as follows:

RQ2: *How did the selected method support the design of citizen-centric m-government services in Namibia?*

Answering this question required evaluating the method after it had been applied to the design and demonstration of the prototypes. In essence, this meant evaluating how well the method managed to produce information relevant to the design of citizen-centric m-government services.

4.2 Design Challenge

The issue of applying for an ID card and using it for digital authentication was chosen as the application domain of this study for three reasons. The main reason was Joshi and Islam's (2018) statement that when moving on to providing transactional e-government services to citizens, governments should first establish a user identity verification system. Such a system needs to be based on existing identification (like ID cards), so the matter of applying for an ID was thought to be a part of the issue.

The second reason for choosing identification as the application domain was the fact that there was already research available on the existing services provided by Namibia's Ministry of Home Affairs and Immigration (MHAI), which handles identity card applications in Namibia. The author's thesis

advisor, Karin Fröhlich, had conducted much of this research, and she was thought to be able to provide valuable additional insight into the topic. The final supporting factor for the decision was that literature on identification underlined the importance of the issue worldwide. Some background is provided below.

4.2.1 Identification

In this thesis, the term *identification* is used to refer to the act of providing citizens with legal identities, including ID cards and *electronic identification* (or eIDs). An eID is a "credential used to identify and authenticate an individual in a digital environment" (World Bank 2017*a*, p. 4). According to Atick et al. (2014), the three main types of eIDs are smartcards equipped with chips, credentials based on mobile SIM cards paired with PIN numbers, and cloud-based IDs. Authenticating an individual against an eID is referred to as *digital authentication*, a term also used in World Bank (2017*a*).

There are about 1.1 billion people in the world who have no recognised legal identity, most of whom are living in poverty and/or rural areas, or are migrants, refugees, or otherwise disadvantaged (UNDESA 2018). According to the World Bank's Identification for Development (ID4D) program, 40% of the people without IDs live in Africa (World Bank 2017*b*). Providing identification to these groups could reduce financial exclusion and prevent occurrence of corruption and fraud in social services (UNDESA 2018). Identification facilitates the interaction between institutions and individuals, and is linked to "exercising one's basic rights" (Atick et al. 2014, p. vii).

Traditionally, identity documents have been provided in physical form as passports and ID cards, but recently, eIDs have become a part of the e-government service offering of many countries. For example, in Estonia, citizens can provide digital signatures and access the country's e-services using an ID card equipped with a chip, mobile identification based on a special Mobile-ID SIM card, or using the Smart-ID mobile application (e-Estonia Briefing Centre 2018). Digital identification systems are becoming more and more common also in emerging and developing economies; Pakistan, Peru, and India have built advanced identity ecosystems where individuals can be authenticated against databases based on biometrics or other knowledge, such as personal PIN numbers (Atick et al. 2014, World Bank 2017*a*, UNDESA 2018). Advancements have also been made in Africa. In some countries, such as Botswana, Kenya, and Rwanda, ID cards are equipped with biometric information, can be digitally verified using a bar code, and cover the vast majority of the population (World Bank 2017*b*,*a*). However, advanced digital systems with the power to authenticate individuals do not

yet exist in Africa (World Bank 2017*a*).

In general, identification in Africa is characterised by low accessibility; barriers include "high direct and (particularly) indirect costs to users, complex legal and administrative requirements, paper-based records systems that are vulnerable to damage, geographic constraints including difficult terrain and sparse populations, and a lack of demand from users" (World Bank 2017*a*, p. 12). These issues affect especially marginalised and vulnerable groups, such as "the poor, rural and remote populations, the illiterate, speakers of non-dominant languages, orphans and other vulnerable children (OVCs), and refugees and stateless populations", who often live in areas with little to no connectivity and/or state capacity (World Bank 2017*a*, p. 32).

Low birth registration rates affect the low ID ownership in Africa, and are induced by the fact that parents might need to travel far or miss work as they are usually required to visit a government office for obtaining birth certificates (World Bank 2017*b*,*a*). Additionally, unmarried mothers might leave birth registration undone due to fear of the social stigma related to giving the child the mother's surname (World Bank 2017*a*).

According to UNDESA (2018), high mobile penetration rates create better opportunities for developing digital identities because most mobile operators are required to verify the identity of customers who register a SIM card. This holds promise for Sub-Saharan Africa, where mobile penetration rates had reached 74.7 subscriptions per 100 people in 2017 (World Bank 2019). Indeed, in countries such as Tanzania, Uganda, Ghana, and Senegal, the issue of low birth registration has been combatted by involving mobile operators in birth registration systems (UNDESA 2018).

4.2.2 Identification in Namibia

The identity management system in Namibia includes birth, marriage, and ID registration, and is maintained by the Ministry of Home Affairs and Immigration (World Bank 2017*b*). Namibia's identity ecosystem was categorised as relatively advanced in a comparison of 17 African countries by World Bank (2017*a*) due to its foundational nature (civil registry based identity ecosystem instead of multiple functional registers) and its process for establishing uniqueness in registered individuals (fingerprints are checked against existing records with an automated system).

The 2011 figure for birth registration in the whole population was 89%, and 78% for under 5-year-olds (World Bank 2017*b*). In 2013, the birth registration rate for under 5-year-olds was reported to be 87% (UNDP 2018*a*, World Bank 2019). More recent data was not available, but it seems safe to say that the majority of Namibians hold birth certificates. Birth registration

is free of charge, and requires a health card, parents' marriage certificate where applicable, and identification documents of both parents (World Bank 2017*b*). In cases where births were not registered, the main reason was the long distance to the closest registration office (World Bank 2017*a*).

The amount of people holding a national ID in Namibia was unavailable in the study by World Bank (2017*a*). National ID cards are issued free of charge for citizens over the age of 16, and the applications are made at MHAI offices. Only 21 of the 64 MHAI offices in the country offer ID application services, and all applications are sent to the Windhoek office for processing. The MHAI has previously reported inadequate funding leading to difficulties in e.g. printing ID application forms. (World Bank 2017*b*,*a*)

The Namibian national ID card is a plastic card with a bar code that renders it machine-readable, which means that the *credentials* of a Namibian citizen can be digitally verified. (World Bank 2017*b*,*a*) Digital authentication of *individuals* does not yet exist, but the country's e-government strategic action plan includes switching to an eID in the future. A hindrance to using the Namibian national ID for digital authentication is the fact that the fingerprint information on the card is recorded on ink instead of digital capture. (World Bank 2017*a*)

Chapter 5

Methods

In this chapter, the methodology used in this study—a combination of design science and user-centred design—will be introduced, and its application to this specific study will be detailed phase by phase.

5.1 Design Science Research Methodology

Design science is a research paradigm where understanding and knowledge of a problem, its context, and its solution is accumulated in the design and application of an artifact (Hevner et al. 2004). The artifact, in turn, is used to solve the studied problem. What separates design science from a standard engineering process is that the process is conducted with academic rigour; the artifact under scrutiny is one "in which a research contribution is embedded in the design" (Peffers et al. 2007, p. 55).

A methodological framework for executing design science, the *Design Science Research Methodology* (DSRM) created by Peffers et al. (2007), is illustrated in Figure 5.1. The DSRM draws from prior research on conducting design science, and was created because the field previously lacked a commonly accepted framework for conducting and evaluating DS research (Peffers et al. 2007).

The first phase of the DSRM is identifying the research problem and arguing why solving it would be of value. The problem can arise from a theoretical and/or an applied background. Next, the objectives for the solution are inferred from the problem definition. This can be done through explicitly articulating the requirements for the solution, be they quantitative or qualitative. Existing solutions for the problem can also be studied, and the requirements can specify how the solution-to-come would be better or solve different dimensions of the problem than current solutions. (Peffers et al.

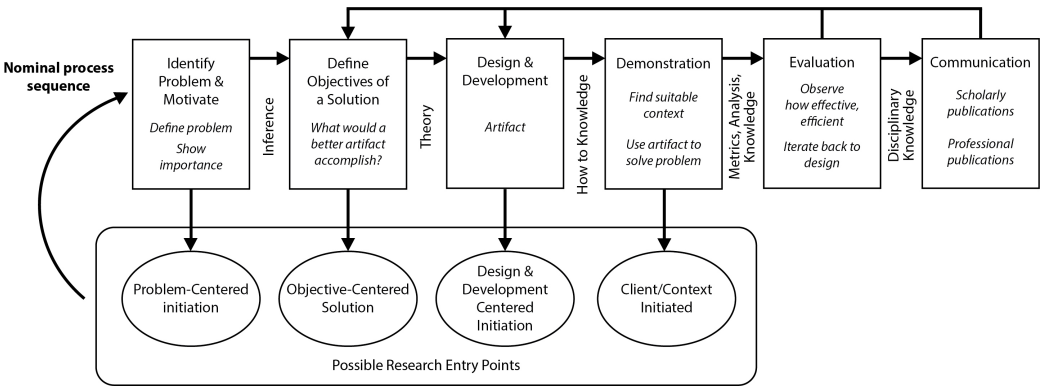

Figure 5.1: The Design Science Research Methodology (Peffers et al. 2007, p. 54).

2007)

When the requirements have been clarified, they can be used in conjunction with existing theory to design and develop an artifact. Then, the artifact's ability to solve the research problem (or part of it) is demonstrated in a suitable context (like a simulation or a case study) with appropriate knowledge of how to use the artifact. Finally, the artifact is evaluated against the original objectives for the solution, and in terms of how well it supports solving the research problem. The results are then communicated to academics and practitioners of the field. (Peffers et al. 2007)

According to Peffers et al. (2007), it is not always necessary to start from the first phase, problem identification; it is also possible to start from the next three phases depending on the case one is working on. A researcher could, for example, start by seeing how an existing solution is used in its context, evaluate the solution, and iterate back to designing a better solution. The possible entry points for design science research are visible in Figure 5.1. Iteration is possible—and encouraged—in all the different versions of the process.

5.2 Research Implementation

5.2.1 Combining the DSRM and UCD

Design science is strongly rooted in information systems engineering. In many cases, the problems studied through design science have not had much to do with human users; for example, Aalst and Kumar (cited in Hevner et al. 2004) studied the problem of automating the exchange of business

process information among multiple organizations, and the artifacts they designed were what they called the eXchangable Routing Language (XRL) along with a workflow management architecture where XRL processes were executed. The authors incorporated research into the design of the artifacts by analysing requirements and identifying existing features of workflow management systems. This is common in engineering disciplines; the engineer is the designer and works with his/her own expertise, not necessarily involving users into the design process (and in many engineering cases, there is no need to do so).

The DSRM created by Peffers et al. (2007) stems from similar backgrounds. Why, then, use the DSRM in a study focusing on user-centred design, when it assumes an engineer-centric approach? Since it was established in Chapter 3 that technology artifacts are useful in UCD in developing contexts, a methodology incorporating the design and creation of such artifacts seemed appropriate—**as long as the principles of user-centred design were to be applied to the process**.

Figure 5.2 demonstrates how user-centred design was applied to the DSRM in this study. Because the author only visited Namibia once during a limited period of time, and the artifacts were needed during the trip, they needed to be created before departure with limited user involvement. Despite not having direct user involvement at every stage, the standard UCD process described in Chapter 3 is clearly visible in the implementation of the study. The link between each DSRM phase and the standard UCD process, along with methods used in each phase, are detailed in the next sections.

5.2.2 Phase 1: Problem Identification and Motivation

The study followed the nominal DSRM process sequence beginning with the first phase, *problem identification and motivation*. This DSRM phase can be matched with both the starting point of the UCD process, *planning the design process*, and its first phase, *understanding and specifying the context of use*.

The broader problem context—citizen-centric e-government in Namibia—and methods for conducting user-centred design in an emerging context were first studied in the **literature review** (see Chapters 2 and 3). The problem, along with the particular case of this thesis, was then properly defined in Chapter 4. In order to include some user involvement in this phase, even though it was not yet possible to interview a range of target users (Namibian citizens) due to geographical distances, a **semi-structured interview** was conducted with an expert, who was thought to be able to give detailed information about applying for and using IDs in Namibia both from an ex-

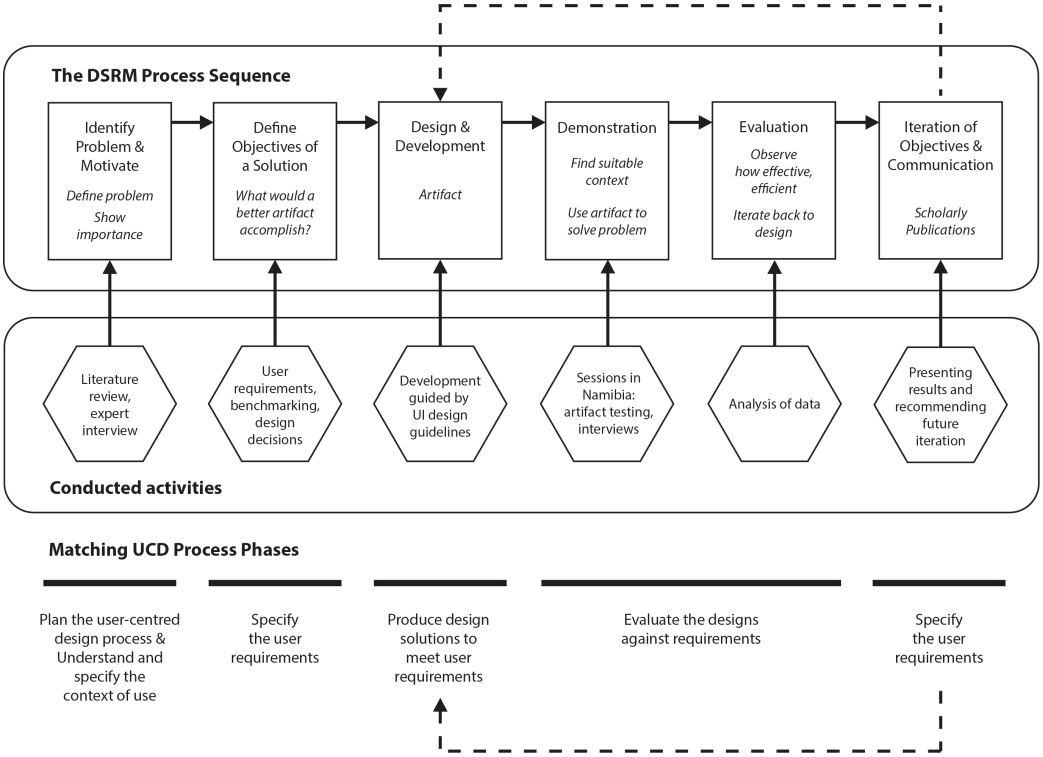

Figure 5.2: Research implementation combining the DSRM by Peffers et al. (2007, p. 54) and the standard user-centred design process defined by the Finnish Standards Association SFS (2010).

pert's and a Namibian citizen's perspective. Semi-structured interviewing was chosen as the method because it allows for in-depth discussion on the selected topic and asking follow-up questions when something unexpected or interesting comes up (DiCicco-Bloom and Crabtree 2006, Lazar et al. 2010). The expert interviewed was the thesis advisor, Karin Fröhlich, a Namibian citizen who has worked at the Office of the Prime Minister in Namibia and studied citizen-centric e-government implementation in the country. The initial interview structure can be seen in Appendix A. The 45-minute interview was recorded and transcribed.

5.2.3 Phase 2: Definition of Solution Objectives

The second DSRM phase, *defining objectives for a solution*, can be matched with the second phase of the UCD process, *specifying the user requirements*. It was established in Chapter 3 that there are many different methods for deriving the user requirements from an analysis of the collected data on the

context of use. However, since the empirical data on the context of use was, at this point, limited to one expert interview, no rigorous analysis of the data was needed; instead, **the relevant points from the transcribed interview were simply divided into categories**. The findings were then used to infer **initial user requirements** for the service prototypes.

Peffers et al. (2007) note that **benchmarking of existing solutions** can be included into this DSRM phase. Since no African countries offer e-identification services to their citizens yet (as found in Chapter 4), the services for benchmarking were selected from countries with high OSI scores that were also familiar to the author. So, services from Finland and Estonia—countries with OSI scores of 0.9653 and 0.9028 respectively (UN-DESA 2018)—were examined. Namely, the digital ID application service provided by the Finnish Police, the Suomi.fi e-identification service provided by the Finnish Population Register, and the e-Estonia e-identity services were examined (see Police of Finland 2018, Population Register Centre 2018, Mobiilivarmenne.fi 2018, and e-Estonia Briefing Centre 2018). The Finnish services were tested by the author since she had access to the services as a Finnish citizen. The Estonian services were only studied using the information provided by the e-Estonia Briefing Centre.

Finally, the user requirements and the ideas gained from the benchmarking were arranged to form some **design decisions** to guide the design and development of the prototypes.

5.2.4 Phase 3: Design and Development

The third phase of the DSRM, the *design and development* of artifacts, can be matched with the third phase of the UCD process, *producing design solutions to meet user requirements*. In Chapter 3, prototyping was mentioned as the typical method for producing design solutions, so that is what was done in this study—**two prototypes of mobile services were created**.

Based on Ramachandran et al.'s (2007) findings on using technology artifacts in early stage co-design in developing regions (presented in Chapter 3), it seemed important that the prototypes that would be taken to Namibia for testing already have some functionality to them, and that they be used on actual physical technological devices. So, instead of creating lo-fi paper prototypes, the prototypes were implemented as hi-fi, semi-functional websites using HTML, CSS, PHP, and JavaScript. The websites were mock-ups that did not save any data input by the user, and they were built with a *mobile first* approach in order to ensure accessibility across a range of devices. The mobile first approach is defined as "the practice of designing a website so that the default layout/configuration is for mobile devices, and layouts and

features for desktop browsers are then layered on top of that default" (MDN Web Docs 2018).

The act of developing the websites was the means for the design; i.e. no separate UI design phase was conducted. This was due to the fact that evaluation of preliminary wireframes with users would not have been possible before the visit to Namibia, where the semi-functional prototypes were already needed. Additionally, the author was proficient with web technologies, and thus did not perceive web development as something where too much effort would be invested before user contact. The UIs were created using the 10 heuristics for user interface design by Nielsen (1994), which are:

1. "Visibility of system status",
2. "Match between system and the real world",
3. "User control and freedom",
4. "Consistency and standards",
5. "Error prevention",
6. "Recognition rather than recall",
7. "Flexibility and efficiency of use",
8. "Aesthetic and minimalist design",
9. "Help users recognize, diagnose, and recover from errors", and
10. "Help and documentation".

It was not possible to pay close attention to all of the heuristics in the development of the prototypes due to timeframe constraints. For example, error prevention (item 5) was largely disregarded; creating prompts such as asking whether the user is sure they want to cancel their application when clicking on "Cancel Application" was regarded as something that would be implemented if there was enough time, and unfortunately, there was not. However, points such as making sure that the systems match the real world (the digital application matches traditional conventions for paper-based applications), supporting user control and freedom (options to undo and redo their actions), and aesthetic and minimalist design (limited information on each page and color-coordinated buttons) were applied.

The created prototypes are described in detail in Chapter 6. In a nutshell, **the ID application prototype consisted of an online form for**

applying for an ID, with functionalities such as taking a photo of your birth certificate to attach to the form. **The digital authentication prototype consisted of a mock government online portal where the user could log in using digital authentication** (tied to their mobile SIM or to their bank details), and then use government services related to IDs, such as updating their surname after getting married or correcting a misspelled name on their ID.

5.2.5 Phase 4: Demonstration

The fourth DSRM phase, *demonstration*, together with the fifth DSRM phase, *evaluation*, can be matched with the fourth UCD process phase, *evaluating the designs against requirements*. The demonstration phase consists of conducting evaluative activities with target users, while the evaluation phase consists of the analysis of the data against the requirements.

In Chapter 3, usability testing was identified as the main means for evaluating designs in the UCD process. Both traditional user-based testing and more innovative methods, such as using technology probes, were listed as forms of usability testing. Since the aim of this study was not so much in testing the *interfaces* of the prototypes, and more in finding out whether the *concepts* of the prototyped services were valid, **using the prototypes as technology artifacts** stimulating conversation similarly as in Ramachandran et al. (2007) was deemed more useful than conducting formal usability testing with the target users.

The demonstration phase was conducted during a period of 1,5 weeks in December 2018 in Namibia. As is appropriate for design science, where knowledge about the problem and its context is accumulated in the design and application of the artifact (Hevner et al. 2004), the demonstration phase—the sole opportunity to visit Namibia during this study—was also utilised to gain contextual information. **The technology artifact approach was paired with semi-structured interviews and observations** to gain as much insight as possible. Two different groups of participants—university students and citizens visiting an MHAI office—were targeted to get viewpoints from people coming from different backgrounds. Bearing in mind the ethical considerations of collaborating with marginalised rural communities presented by Kapuire et al. (2017), no rural communities were involved in the study due to limited time and possibilities to organise sustainable collaboration with such communities.

5.2.5.1 Student Sessions

The author first conducted nine sessions with students of the Namibia University of Science and Technology (NUST). The participants were contacted while the author was working as a student volunteer at the 2nd African Conference for Human Computer Interaction (AfriCHI) organized by NUST in the Safari Conference Hotel in Windhoek (pictured in 5.3). The author contacted mainly people she was already in contact with through the student volunteer team or through other social connections. The participants were aged 23-31; six were females and three were males. There were full-time and part-time students, and recently graduated students; some were working as software developers in various fields, some doing administrative work, and some doing internships or freelance work related to IT.

All of the sessions were conducted in uncontrolled settings where the author took notes and observed the participant while he/she was interacting with the artifact. The author conducted all sessions save one alone; the author's supervisor (Marko Nieminen) and colleague (Pietari Keskinen) were present for the final session. They joined spontaneously because they were interested in what the final student had to say; he was a member of a San community, and he was able to give some rural community perspective for the study in a situation where direct interaction with rural communities was not possible. All sessions were recorded upon receiving permission from the participants.

The students were expected to be highly proficient in using technology, and to be holders and frequent users of IDs. Thus, the sessions were begun with **semi-structured interviews** about the students' mobile use, ID use, and the process they had previously gone through to apply for an ID. The students were also asked whether there had been any problems with the process, or whether they thought the process could somehow be made more efficient or easier.

Next, the students were asked to **perform tasks with the digital authentication prototype**, which was chosen for these sessions (instead of the ID application prototype) since the students, as ID holders, were thought to be target users of such a service. All of the sessions were conducted using a Huawei Y560-L01 phone running on an Android operating system. The students were asked to log in to the mock online government portal using the digital authentication functionality, and then use a government service for correcting a mistake in their ID or changing their surname after supposedly getting married. The aim was to see how the students interacted with the prototype and to find out what they thought of such a service concept.

The session conducted with the San student differed in some ways from

Figure 5.3: The main hall of the Safari Conference Hotel during the AfriCHI conference

the other student interviews. He was asked about his community's challenges regarding identification and how he thought his community might react to the concepts presented. This led the interview to become more in-depth than the other interviews. The student was also asked to test both of the prototypes, since he was thought to be able to look at them also from the viewpoint of his community and people who might be less proficient with technology.

The initial interview structures for the student sessions are available in Appendices B and C. For a list of all sessions, see Table 5.1.

5.2.5.2 MHAI Sessions

In addition to the student sessions, five sessions were conducted with citizens waiting in line at the MHAI regional office in Katutura, which is an informal settlement in the Windhoek area. The citizens were contacted directly on spot while they were queueing to conduct their business with a government officer. Only a handful of those approached were willing to participate. The participants were aged 24-47, and additionally, a 47-year-old woman's son joined one session mid-way. He was estimated to be about 10-13 years old.

Figure 5.4: The author and her colleague in a challenging interview setting at MHAI in Katutura

Two of the participants were females and four were males, and they had occupations such as baker, builder, secretary, and housewife.

The sessions were conducted in somewhat challenging conditions—in the midst of the MHAI office waiting area—because the participants could not be asked to step out of the queue for the sessions. The environment was restless and noisy and there was not a lot of space available. This had been anticipated, so the author had opted to perform the sessions with two extra sets of hands. The author's advisor (Karin Fröhlich) and colleague (Anabel Fischer) helped with the practicalities, such as contacting participants, taking notes, and handling the recording device, while the author focused on facilitating the sessions. Examples of the various set-ups of the sessions are pictured in Figures 5.4 and 5.5. Again, all the sessions were recorded upon receiving consent from the participants.

The citizens contacted at MHAI were expected to be, on average, less educated than the students, and less proficient technology users. They were also expected not to hold IDs yet, because the MHAI regional office in Katu-

Figure 5.5: Another interview setting at MHAI

tura handles mainly ID applications, and citizens having business there were hence expected to be in the midst of applying for an ID. As with the student sessions, the MHAI sessions were begun with **semi-structured interviews** with the aim of finding out about the citizens' mobile use, whether they already held IDs or not, and what the process for applying for an ID had been like for them (whether they were currently going through the process or had already completed it). They were also asked whether they thought the process could be made easier or more efficient in any way, and only after hearing their unbiased ideas, the ID application prototype was shown to them. The citizens were asked to **go through the process of applying for an ID using the prototype**, with the author observing their interaction with it (see Figure 5.6). Afterwards, they were asked for their opinions on the concept. These sessions, too, were conducted using Huawei Y560-L01 phones.

The initial interview structure for the MHAI sessions is available in Appendix D. For a list of the sessions, see Table 5.1.

5.2.6 Phase 5: Evaluation

As stated above, the DSRM *evaluation* phase, together with the previous *demonstration* phase, can be matched with the fourth phase of the UCD process, *evaluating the designs against the requirements*. In this phase, the data gathered in the demonstration phase is analysed to see how well the generated designs match the original (user) requirements, and some new

Acronym	**Session Type**	**Prototype(s) used**	**Length (mins)**
S1	Student contacted at AfriCHI	Digital authentication	17:48
S2	Student contacted at AfriCHI	Digital authentication	16:12
S3	Student contacted at AfriCHI	Digital authentication	17:20
S4	Student contacted at AfriCHI	Digital authentication	15:48
S5	Student contacted at AfriCHI	Digital authentication	19:07
S6	Student contacted at AfriCHI	Digital authentication	32:33
S7	Student contacted at AfriCHI	Digital authentication	20:15
S8	Student contacted at AfriCHI	Digital authentication	16:18
S9	Student contacted at AfriCHI	Both prototypes	48:16
C1	Citizen contacted at MHAI Katutura	ID Application	14:55
C2	Citizen contacted at MHAI Katutura	ID Application	14:18
C3	Citizen contacted at MHAI Katutura	ID Application	10:45
C4(/C5)	Citizens contacted at MHAI Katutura	ID Application	13:22
C6	Citizen contacted at MHAI Katutura	ID Application	12:02

Table 5.1: All Sessions Conducted in Namibia

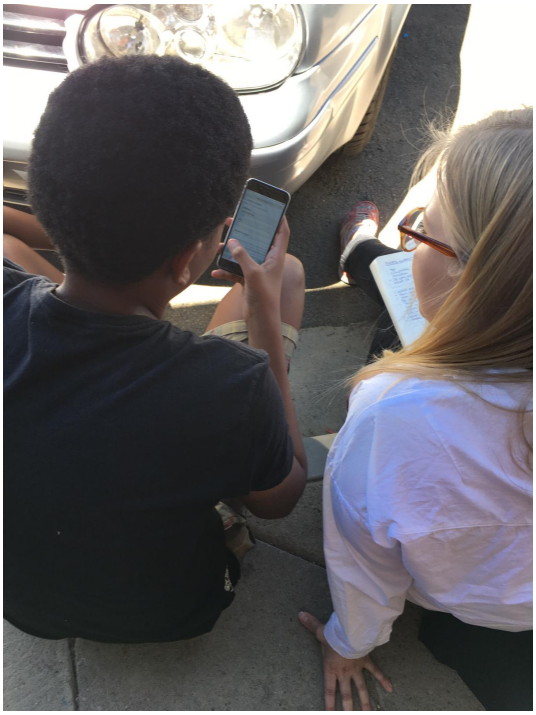

Figure 5.6: Participant interacting with the artifact, author observing

requirements may arise from the analysis.

According to Lazar et al. (2010), "analyzing data from usability testing is similar to analyzing data from any other type of research" (p. 274). This means that a multitude of qualitative data analysis methods could be used. However, Lazar et al. (2010) point out that the aim of the analysis in usability testing is different: the results are used to influence the design of the interface, not to publish papers and influence further research. In the case of this thesis, the usability testing conducted was not traditional testing aiming at solely testing the interfaces, but more about testing the concept and in addition, generating more knowledge on the problem context. So, the data gathered during the sessions was analysed with the aim of influencing *both* further research *and* further design of the services.

Silverman (2000) mentions computer-assisted analysis as one method for analysing qualitative data. Atlas.ti, a program which enables the coding of qualitative data into categories (and is also mentioned by Silverman) was utilised for analysing the transcribed tapes and the field notes of the sessions. The categories used were directly related to RQ1 and its two dimensions: contextual information about current practices and problems of

applying for and using an ID, and interactional information about the participants' reactions to the presented prototypes. Several codes were attached to each category: for example, under *applying for an ID*, there were codes such as *id_application_age*, *id_application_procedure*, *id_application_problem*, *id_application_dev_idea*, and so forth.

Answering RQ2 required additional analysis. The author looked at what data the method had generated, and compared it to the points for citizen-centric e-government implementation and adoption of transactional services in Namibia (see Stage 3 in Table 2.2). The method was evaluated in terms of how well it produced information on issues related to access, attitude, citizen information needs, and ICT skills—and how the use of the prototypes contributed to the generation of the information compared with the semi-structured interviews.

5.2.7 Iteration and Communication

Iteration is encouraged both in the DSRM and the UCD processes to make sure that the resulting designs match (user) requirements. Unfortunately, in the scope of this thesis, it was not possible to go through the whole process all over again—this would have required another round of data collection in Namibia, which was not possible due to both temporal and budgetary restrictions. However, in Chapter 7, the author makes recommendations for the further development of the proposed services for the Namibian context. Possible further development of the artifacts is also represented in Figure 5.2 with a dashed arrow from the last phase, *iteration of objectives and communication*, to *design and development*.

Finally, the results were communicated by the writing of this thesis. At the time of writing, the author also plans on writing a conference paper of the results to complement the thesis.

Chapter 6

Results

This chapter will present the results of the study phase by phase: from the expert interview to the creation of the prototypes, and to the final results of the sessions in Namibia. Some analysis is included in the first two sections in order to reach the design decisions for the prototypes, but the results of the sessions in Namibia will only be analysed and discussed in 7.

6.1 Expert Interview

This section contains the results of the expert interview with thesis advisor Karin Fröhlich, and the inference of initial user requirements based on these results.

6.1.1 E-Government Progress in Namibia and MHAI

The expert, who had previously worked at the Office of the Prime Minister in Namibia, described how e-government was being implemented in Namibia. According to her, a framework for guiding the implementation of e-government had been in place for the years 2010-2018, and she predicted that after the time period had ended, the government would evaluate how far they had come. There had been consultants from countries like Estonia and Singapore giving advice on e-government implementation in the country.

The expert stated that each government office was computerised and had its own IT department. The IT department at the Prime Minister's office had created all of the existing websites for the separate ministries and was still hosting them, but the IT departments at each ministry were maintaining the websites. The expert stated that if something were to go wrong at the IT department of the Prime Minister's office, *'the whole Namibia will be off'*. She

explained that the IT department was the centre facilitating interoperability between the different government bodies.

The expert had been involved with the training of staff at the MHAI for inputting citizens' information into a digital population registry. In essence, this had meant going through boxes full of paperwork, which had been a heavy job—digitising the existing birth certificates alone had taken six months. According to the expert, new information of citizens was now (at least supposedly) input onto computers *'one by one as you come'*. The expert was unsure whether the staff had actually moved to the digital system or whether they had shifted back to using the manual, paper-based system. In her words, *'people are scared of technology'*, and not all of the staff members she had trained had been computer literate.

According to the expert, birth, death, and marriage certificates, as well as IDs, student visas, and other documents could all be input into the digital population registry. All application forms were submitted in physical form and government officers input the information into the registry manually. The expert stated that not all of the offices around the country had internet connectivity so forms were brought to central or regional offices for digitisation. She also said that it was possible that not all forms were being immediately digitised, but being kept in boxes instead.

6.1.2 IDs and Applying for them

According to the expert, the Namibian national ID card is equipped with an ID number that consists of a citizen's birth date (six numbers), four additional numbers, and one separate number at the end. She said that the ID number is commonly used when accessing different kinds of services; *'anywhere you go they just ask you for the ID number'*. Namibian citizens can apply for an ID card when they are sixteen years old, and the ID number is assigned to each citizen only then. Before the age of sixteen, citizens are considered as minors and birth certificates are used as identification. Once a citizen holds an ID, he/she can apply for a passport.

According to the expert, most Namibians hold IDs because an ID is required for opening a bank account, which is common practice in Namibia. However, not all citizens have IDs; according to the expert, this is because *'they have not seen any reason, or they have not come across a service or anything they have to do that require an ID. Until such a time, that's when they rush to do it'*. The expert stated that this might apply especially to people living in rural areas or informal settlements in cities.

Applying for an ID requires going to an MHAI office. A police-certified copy of a full birth certificate (containing details of one's parents and birth-

place) is needed for the application. The full birth certificate is a new requirement; a simple certificate without details about the citizen's parents used to suffice, but that certificate is no longer acceptable. Those who do not hold a full birth certificate need to get one before applying for an ID. At the office, the applicants' fingerprints and photo are taken, and an application form is filled in. According to the expert, in most cases—even when the applicant is literate—an officer fills in the ID application form *for* the applicant instead of letting the applicant fill it in himself/herself. The reasoning behind this is that applicants are thought to leave out mandatory fields. The expert stated that this is a problematic practice, because the officers often make mistakes in spelling the applicants' names. Even when the applicant is allowed to fill the form in himself/herself, mistakes might come into play when officers input the information of the physical forms onto a computer. The expert had some personal experience of this when applying for a surname change on her passport: *'when I changed my surname I filled my application because I cannot miss out anything. But when the passport came in it was misspelled by the officer'.*

The processing time of applications varies; the process might take a week, three months, or six months, depending on when the next batch of IDs is going for printing. There is an SMS service available for checking whether the ID is ready for pickup, but it is not an automatic system that would send the applicant a message when the ID is ready; the applicant has to send an SMS to a certain number for getting the information, and messaging the number costs about three Namibian dollars, which is considered expensive compared to sending a normal text message (which costs about 50 cents). The expert had tested the functionality of the service for research purposes, and enquired for the state of her ID application (even though she already held an ID and had not applied for a new one). The service had informed her that her (nonexistent) ID was ready for collection in the Kunene region. This had led her to believe that the service was not entirely trustworthy.

The expert also stated that if someone applies for a new ID after losing their original one, he/she would have to declare the ID lost at a police station and go through the whole ID application process all over again: *'Once you get a declaration you now start from square one. But the problem is why do you need to start from square one if they have the information?'* She stated that the applicant would also have to get a new police-certified copy of his/her full birth certificate. Additionally, she mentioned that the birth certificates in the population registry could not be used by other ministries like Foreign Affairs if needed: *'They don't have access, cause the interoperability is not yet in place although we are talking about it in government'.* So, citizens have to acquire new certified copies whenever they apply for something, even if a

certified copy has already been saved in the MHAI database.

Another case when citizens might need to apply for a new ID to replace the existing one is after getting married. According to the expert, if a woman gets married and wants to change the surname on her ID, she would have to take her marriage certificate and her existing ID to MHAI, and fill in a form with her new surname. The existing ID is taken away from her and exchanged for a temporary paper ID while she waits for a new one. Keeping both surnames when getting married requires a court order, so getting a new ID in that case takes a longer time.

According to the expert, there had also been problems with providing accurate and up-to-date information of government services. For example, the government websites might state that if you lose a document that you have applied for previously, the document can easily be duplicated and printed at a MHAI office, but in reality, you still need to go through the whole process of applying all over again. The expert also mentioned that the documents required for a certain application might change from time to time because the government processes are being reengineered, but citizens are generally notified of these changes only once they visit a government office.

Finally, when asked about whether there was some digital authentication service already in place in Namibia, the expert replied that there was not.

6.1.3 Technology Use in Namibia

Even though the expert repeatedly stated that *'people are scared of technology'*, she also mentioned that the younger generation have handsets and *'are able to manoeuvre things'*. She said that many people are using smartphones and apps like WhatsApp and Facebook. However, she also said that *'if you give them a computer of course they might struggle because it's different'*. According to her, people who are handy with smartphones and apps might still not know how to look up information about, say, opening up a business on the Ministry of Trade and Industry website.

The expert, having stated that the majority of Namibians have bank accounts, also said that online banking and cellphone banking are available in Namibia, and they work well: *'I can't remember when last I've been physically in the bank myself'*. Her e-banking service is based on a username and a password that needs to be changed every three months or so. For mobile banking, an app is needed. There is also a separate service called MobiPay that can be used for paying bills instead of a bank account.

6.1.4 Initial User Requirements

Some initial user requirements for the service prototypes could be inferred from the above statements by the expert:

1. When applying for an ID, citizens should be allowed to submit their details by using an electronic form that they fill in by themselves
   (a) Solves problem where officers make mistakes when filling in the citizens' application forms for them
   (b) Solves problem where officers make mistakes when inputting the citizens' details onto a computer
   (c) Solves problem where officers are worried that citizens won't fill in all required information (fields can be made mandatory)
   (d) Solves problem where forms need to be brought from rural areas to Windhoek for digitization
   (e) Solves problem where documented information available online is not aligned with the actual procedure (if the required attachments etc. are changed, this is immediately reflected in the system)
   (f) Eliminates the need for filling in a new form when applying for a new ID (if original is lost or needs updating), because information is saved in a database
2. Citizens should be able to attach a copy of their birth certificate into the electronic application (photo or scanned document)
   (a) Eliminates the need for getting a certified copy of birth certificate when applying for an ID
3. Citizens should need to visit the MHAI office only once for giving their fingerprints and signature, and having their photo taken
   (a) After verifying fingerprints, signature and photo once, they should not need to be verified again when applying for a new ID if no information has changed and not so much time has passed that a photo update is needed
4. Citizens should be able to use the information saved into the MHAI database when applying for a new ID (if original is lost or needs updating)
   (a) Solves problem of having to start from square one every time

5. Citizens should be automatically notified via SMS or e-mail when their ID is ready for pickup

    (a) Removes the current cost for requesting information of application status

6.2 Benchmarking, Design Decisions, and the Prototypes

This section will present all the practical design work that the author conducted. First, the author benchmarked Finnish and Estonian e-government services related to identification. Next, she made some design decisions based on both the benchmarking and the initial user requirements detailed above. Finally, the two prototypes were created.

6.2.1 Benchmarking of Finnish and Estonian Services

In Finland, citizens can apply for ID cards online using the Police e-service (or by physically visiting a Police license service point). The applicant should first have his/her photo taken at a photography studio that has the permission to send the photo directly to the Finnish Police. The applicant receives a photo retrieval code from the photographer. The code can then be input into the online application form available on the Police website, which is accessed using the *Suomi.fi e-Identification* service. (Police of Finland 2018)

The author tested the application service, and found that the information required in the form included

- Basic details (which had already been retrieved from the database for the author as she already held an ID),
- Contact details (phone number or e-mail address),
- Selection of documents being applied for (ID/passport/both),
- Photo retrieval code,
- Selection of how the applicant's signature would be provided (use of existing signature from database/use of new signature given at a Police license service point), and
- Delivery method.

Finally, the system asked for verification of the provided information and online payment. The author did not go through with the whole process because she did not need a new ID card, but according to the Police website, the system finally tells the applicant whether they need to visit a Police license service point after submitting the application. A visit is not required when the applicant holds an ID card that has been issued no more than six years ago and the applicant was at least 12 years old at the time; if the name on the new ID card is the same as on the last ID; and if the Police is able to verify that the applicant's new photograph is of the same person as the old photograph associated with the applicant's existing ID. (Police of Finland 2018)

The Suomi.fi e-Identification service used for logging in to the ID application system (and to multiple other government systems) offers four options for authentication: using personal online banking codes, a mobile certificate, a certificate card, or eIDAS identification (Population Register Centre 2018). The four options are used in the following manners:

1. Using personal banking codes for e-identification requires signing an agreement with one's bank. This allows citizens to authenticate themselves online by selecting their bank and signing in using their personal bank log in codes. Using the banking code option is free for the user. (Population Register Centre 2018)

2. Using a mobile certificate requires activating one's SIM card with a mobile certificate at one's mobile phone operator. Some operators also allow the activation of the mobile certificate via an online service that utilises the e-identification banking code option. When authenticating oneself online, the mobile certificate allows the citizen to 1) input their phone number online, 2) accept the authentication request showing up on their phone, and 3) input the PIN number they have chosen for the authentication. Phone operators charge a fee for the use of the mobile certificate. (Population Register Centre 2018, Mobiilivarmenne.fi 2018)

3. Using a certificate card requires a physical card reader and an ID card, organisation card, or a smartcard meant for social or health care professionals. (Population Register Centre 2018)

4. Using the eIDAS token option is meant for citizens of other countries for cross-border authentication. (Population Register Centre 2018)

In practice, it is well known that the most popular option for e-identification in Finland is the banking code option. The reason for this is likely that most

Finns already use e-banking, so the option is easy to take into use. Also, the banking option does not impose extra costs upon the user, as the mobile certificate service does.

The author also studied the Estonian e-identity services, even though she was not able to actually use them since she was not an Estonian citizen. The Estonian e-identity can be used for the same purposes as the Finnish one: identifying oneself online and using e-services (e-Estonia Briefing Centre 2018). The three e-identification methods in Estonia are the ID card equipped with a chip, the Mobile-ID SIM card, and the Smart-ID mobile application (e-Estonia Briefing Centre 2018). The methods are used in the following manners:

1. Using the ID card for e-identification requires a card reader for validating the card's chip.

2. Using the Mobile-ID requires getting a special SIM card from one's mobile phone operator. The card holds private keys and an application for authentication. When a user selects the Mobile-ID method while identifying themselves online, their phone beeps and indicates that a connection is being made. The user is then asked for a PIN code for authentication, and after the user inputs the code, they gain access to whatever service they were about to use.

3. Taking the Smart-ID mobile application into use requires downloading the application and creating an account. The user's identity is verified via a bank log in or with Mobile-ID. Next, the user chooses a PIN to use whenever they need to identify themselves using the Smart-ID application.

(e-Estonia Briefing Centre 2018)

6.2.2 Design Decisions

The Finnish and Estonian services are good examples of comprehensive e-identity services, but they need to be adapted to the Namibian context; it was found earlier that e-government systems and ICT solutions in general should not just be transferred as such from developed, Western contexts to developing or emerging economies, because needs of end users may differ (Brewer et al. 2005, Maumbe et al. 2008). The initial user requirements listed above, as well as Fröhlich and Peters's (2017) recommendation to offer Namibian e-government services on mobile platforms, give direction for the design.

The requirements point towards the need for two services: an electronic form for applying for an ID and a digital authentication service. Applying for an ID in Namibia seems to be, in essence, quite similar to the Finnish practice—a form is filled, and the citizen's signature, fingerprints and photo are taken. In Finland, the photo is taken at a photography studio, whereas in Namibia, the photo is taken at the MHAI office in conjunction to submitting the application. A birth certificate is required for the Namibian application, while in Finland, it is not. So, if small changes are made to the functionality of the Finnish ID application concept, the service *might* also be suitable for Namibia. This is explored in the created ID application prototype.

In order to transform the Namibian system so that citizens would not need to start from square one each time they apply for a new ID, citizens should be able to access their information in the MHAI database and use that information for the application. This requires digital authentication of individuals. The Finnish and Estonian services offer multiple ideas for implementation of digital authentication. The smartcard-based option is perhaps not the most practical one, because the Namibian ID card does not yet hold a chip, and because reading the chip would require citizens having their personal card readers. The mobile authentication option based on SIM cards, however, seems feasible for Namibia, where mobile penetration rates are high. Similarly, the bank authentication option might be feasible, since the expert stated that the majority of Namibians have bank accounts and e-banking already exists and works well. The smartphone application might work if its functionality across a range of smartphones was ensured.

The question of the platform is a relevant one for ensuring inclusivity of the services. While mobile penetration rates are high, the amount of people owning smartphones is not known. The expert did state that many people own smartphones, but on the other hand, Amukugo and Peters (2016) also found that many people only had access to the internet via basic feature phones. This would rule out a smartphone application as the basis for digital authentication. So, in the created authentication prototype, the options explored are the mobile authentication based on SIM cards, and the bank authentication which can (at least in principle) be used on any phone that has internet access.

Internet access is a key question for both of the services. Both of the prototypes in this thesis were created with the assumption that citizens have access to internet, even if it is on a feature phone with limited functionalities. This seems to be often the case in Namibia, since mobile broadband subscriptions rates had reached 64.98 per 100 people in 2016 (UNDESA 2018). But what about citizens living in areas without connectivity? One idea that the author had was that the government could organise campaigns where offi-

cers would move around the country, visiting rural communities for taking their fingerprints and filling in the digital applications with them directly on MHAI-owned devices. This would help with the rural communities' lack of smartphones and internet access to use the services, and eliminate the practice of sending physical forms from regional offices to Windhoek. Options for providing identification services without internet access are discussed in more depth in Chapter 7.

6.2.3 The ID Application Prototype

The ID application service prototype consisted of a form in which users could input their details and attach their birth certificate (either by uploading a scanned document or taking a photo of it). The form was divided into the following steps for clarity:

1. Basic Details (name and date of birth),
2. Gender and Marital Status,
3. Contact Details (address, phone number, e-mail address),
4. Birth Certificate,
5. Confirmation.

The user could move forward and backward between the steps by using navigation buttons. Cancelling the application was also possible. Some screenshots of the prototype are presented in Figure 6.1.

In the confirmation step, the service informed the user that they would still need to give their fingerprints and signature and take an ID photo at an MHAI office, and that by submitting the form, the user declared the given information correct and truthful. This step did include one known weakness: the user was not asked to check that their information was correct before submitting. This would have required creating a database where the participants' information would have been saved, which would have been ethically questionable; or showing static example data for the participant, which the author suspected might have confused some participants (as they had previously input different data into the form).

At this stage, it was not yet determined how the service would verify the user's identity, since the target user of the service does not yet hold an ID and thus, could not use the digital authentication service. Since the users would have to visit an MHAI office anyway for giving their fingerprints etc.,

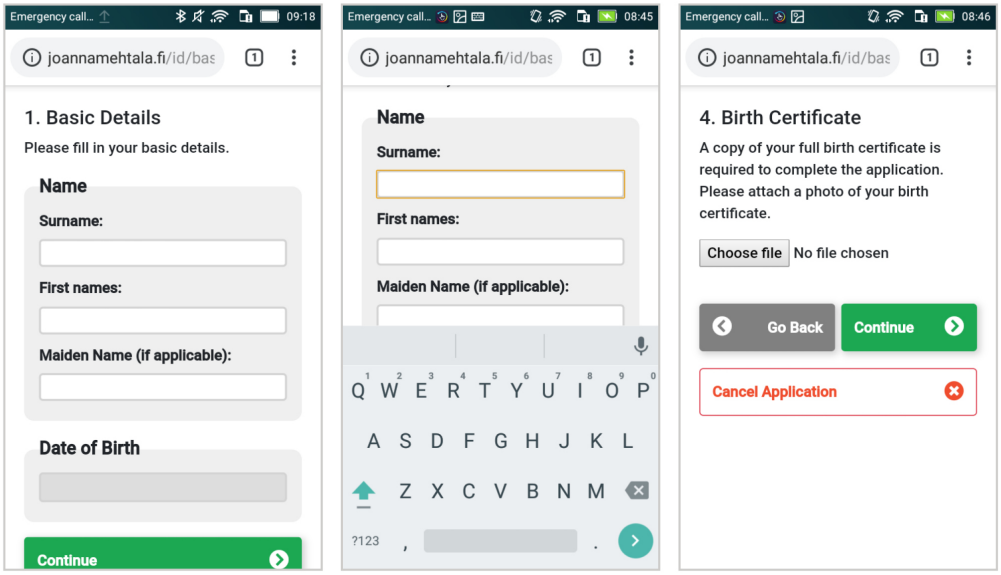

Figure 6.1: Screenshots of the ID Application Service Prototype

one idea was that the service could be used at the MHAI office using an MHAI-owned device. A government official could then manually mark the user's identity as verified into the system.

6.2.4 The Digital Authentication Prototype

The digital authentication service prototype assumed that the user of the service would already hold an ID that could be linked with either the user's mobile SIM or bank credentials for enabling digital authentication. The prototype consisted of a mockup of an MHAI online portal where a user could use government e-services (such as apply for a change of information on ID or replacement of a lost ID) after logging in with the digital authentication service dubbed "Namibia Secure Identification". The steps in the prototype were the following:

1. Front page of the MHAI online portal, option to log in;
2. Log in page, options for mobile and bank identification;
3. Logging in via selected identification method;
4. Acceptance of retrieved identity;

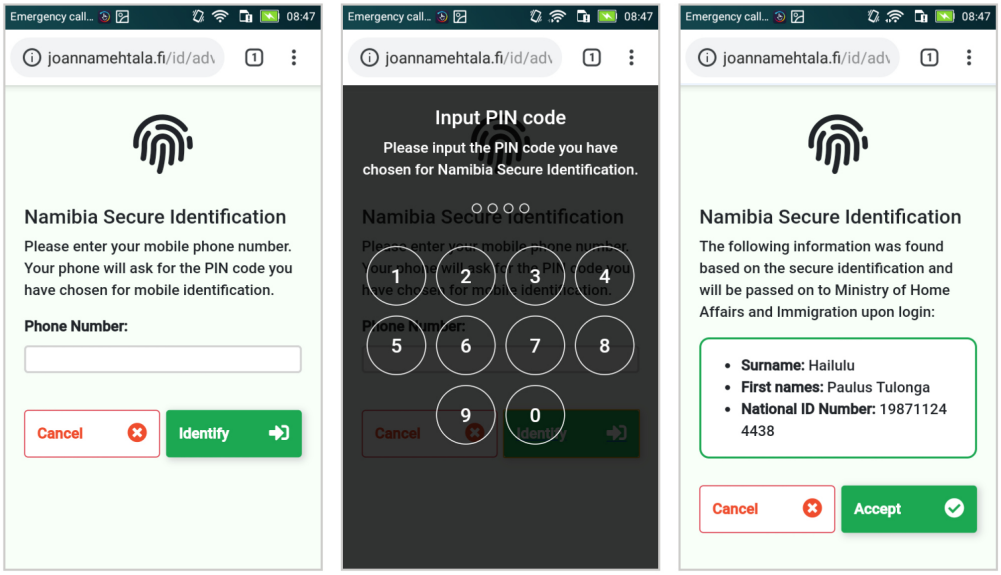

Figure 6.2: Screenshots of the Digital Identification Prototype (Mobile Identification Method)

5. Service selection page, options for updating information on ID and replacing a lost ID (only information update service was functional);

6. Information update form (somewhat similar to the ID application form in the first prototype); and

7. Returning to the service selection page after submitting the form.

The user could always cancel whichever step they were doing, and even log out from the service to start over.

The mobile authentication followed the Finnish and Estonian examples: the user would input their phone number into the online service, receive a PIN prompt on their phone, and gain access to the online service after a correct PIN was entered (see Figure 6.2 for screenshots). The bank authentication followed the Finnish example: the user would select their bank service provider, be (seemingly) redirected to the bank log in page, enter their log in details, and gain access to the online service.

The e-government services available on the online portal were chosen based on the expert's accounts on the problems that citizens had encountered when applying for IDs; the service for updating information on one's ID was based on the account that citizens received IDs with incorrect information due to officers' spelling mistakes, and so as to make changing one's

name after getting married easier; and the service for replacing one's ID after losing the original one was based on the account that citizens currently had to declare the ID lost at a police station and then start the application process all over.

In this prototype, too, there were some known issues: there was, again, no possibility to check the input information in the information update form, and there were no restrictions as to what information could be changed.

6.3 Results of Sessions in Namibia

This section will present the results of the sessions conducted in Namibia: the interviews and the testing of the prototypes. The section is organised according to the two dimensions of the first research question.

6.3.1 Context: Practices and Problems Related to Identification in Namibia

All of the nine students interviewed held IDs, but one student had had to correct information on her ID and still needed to collect it from MHAI. Two of the citizens contacted at MHAI held IDs; one was visiting the office for getting a full birth certificate for a passport application, and the other was correcting information on his ID. The other three citizens contacted at MHAI were visiting the office to collect their IDs: two were waiting for their first IDs, and one was waiting for a replacement of a lost ID.

Those who held an ID described using it for applying for a bank account, making deposits or withdrawals at banks, applying for university studies or jobs, applying for a driver's license, or traveling and passing road blocks. Indeed, one of the citizens who was waiting to collect his ID at MHAI said that he was applying for an ID specifically for opening a bank account. Two participants also mentioned that applying for a phone contract and a SIM card (not a pre-paid one) required proving one's identity.

None of the participants had ever had their ID card machine-scanned, but participants were aware of the bar code at the back of the ID: *S6: 'I have never seen anyone scanning it, to be quite honest, I mean no one usually use that bar code. Or if it even works'*. However, one participant mentioned that the Namibian passports could be scanned. Two participants also said that the ID number was asked in some online applications, like applying for government loans.

6.3.1.1 Application Procedure

When asked what the procedure for getting an ID had been like, 11 participants described a process more or less similar to the one described by the expert: going to an MHAI office, filling in forms, providing a copy of their birth certificate, and having their ID photo, fingerprints, signature, height, and eye color recorded. Some had filled the application form in themselves; for some, an officer had filled in the form; some did not remember. Participants had had to wait one to three months before collecting their IDs. Three participants also mentioned getting a receipt for proof of application, and having to take that receipt back to the office for collecting the ID.

Two participants described a somewhat different procedure for applying for their ID: they had been able to apply at school. In grades 10 or 11, at the time when the participants had been about 16 years old, MHAI officers had come to their schools on a specific day and helped them with their applications. The participants had had to bring their birth certificates, and one described filling in information into a full birth certificate based on the simple birth certificate. Both had filled the forms in themselves with an officer supervising them. Both mentioned having their ID photos taken, and one also mentioned her height and weight being recorded. Both had had to fetch their IDs at the MHAI office.

6.3.1.2 Application Problems

When asked about whether the process of applying for an ID had been straight-forward or whether there had been some problems, eight participants described one or more problems with the process. Four participants stated that they had not had any problems with the application, but went on to mention problems others had had. Two participants first stated that they had not encountered problems, but came up with some later on.

The most common problem—mentioned by nine participants—was the amount of queues at the MHAI office in Katutura: *S1: 'There is always a long queue when you have to fill in forms'.* Some mentioned that the queueing could take up the whole day: *S5: 'you need to wake up early in the morning and then you have to stay in line the whole day'; S3: 'Sometimes you have to wake up early, otherwise you'll be there for whole day'.* Two of the citizens waiting to collect their IDs at MHAI mentioned having arrived at the office at around 6 or 7 that morning, and when interviewed at around 11 a.m., they were still not much closer to being served. Two participants even described the queuing as such an exhausting experience that they were almost discouraged to visit the office altogether: *C4: 'sometimes people think*

about it, they have to come here, they sometimes feel so disappointed, you know that sometimes I don't feel like going. -- I push myself today to come here'; S2: 'Honestly speaking, it's exhausting. -- I'm even thinking about go... getting mine in December when everyone is on holiday'.

Four participants mentioned that the process was just slow in general. One participant said: *S8: 'our passport also used to take a few months to finish and then Home Affairs changed their process, their structure, and now it takes three to four days for the passport to finish. So if that could happen with your ID, it would also be very cool'.* Another participant pointed out that *S6: 'I know for people renewing it still takes the same time for someone actually getting a new one. Which is for me very tedious, if I'm just renewing, I'm in the system already, why should it take so long?'* Three participants commented on renewing an ID when the original was lost. It seemed that MHAI could use the applicant's original photo and fingerprints, but the applicant would still have to go to the police for declaring their ID lost and to the MHAI office for filling in a new application.

Another common theme were the mistakes on IDs. Three participants had personal experience of their name being spelled incorrectly on their ID. One participant explained his experience: *S4: 'instead of you filling in a sheet somebody sits and asks you questions and then they fill in the sheet, and that's where the spelling errors come in'.* He had never corrected his ID, because *S4: 'it's too much of a hassle'.* Another participant, who had filled in her form herself, had still had her name spelled incorrectly on her ID (apparently due to an officer inputting the information incorrectly into the system): *S2: 'and they still blame me for it. Imagine how can you write your name wrong.'* After she had corrected her name, the new ID had come in with her date of birth recorded incorrectly, and she had still not collected the ID from MHAI due to queues. One other participant also described how her friend had had her date of birth incorrectly recorded, and she could not even have it corrected: *S6: 'I have a friend, she's born 90, but her birthday says she's born 89. Then I asked her why didn't you ever go back, she said I have no proof -- that I'm born 90'.*

Participants also described issues related to ID collection. The three citizens contacted at MHAI, who were there to collect their IDs, all said that they did not know whether their IDs were ready for collection. One participant mentioned he had visited the office the previous month to see if his ID would have been ready for pickup, but since it had not been, he was visiting the office that day—again, without knowing his ID's status: *C3: 'Now I'm waiting for if I get it or if I not get it'.*

There were also other problems that were mentioned by single individuals. One participant mentioned not knowing which MHAI office to go to for which

service: *S2: 'you never know which one to go to for what, because if you go give it, you give it in town, but you receive it in the other one. So it's a lot of logistics involved'.* Another described how an officer had sworn at an applicant next to him for not knowing how to give their signature. One participant also described how her son had applied for an ID, and once he had gone to collect it, he had been told that something had been missing from the application and that he would have to reapply.

6.3.1.3 Problems Related to IDs in Rural Communities

The San student explained about rural communities' problems related to IDs. He said that not all of his community members held IDs due to multiple different reasons. Mainly, people in his community would have to travel far to reach government offices. Those who did not work in towns and gained their livelihoods in their home villages often had difficulty traveling, because it might take several days and impose extra costs upon them. The student also stated that community members might try applying for an ID at a government office in one town, and be sent to another; or they might travel all the way to town only to be told they need to bring some document they do not have, or bring a village elder to testify on some matter.

According to the student, not having a birth certificate was an issue for some people (even though he mentioned that the majority of his community did have birth certificates): *S9: 'not all have the IDs 'cause sometimes some lives apart from their families and once you, when you need to write an birth certificate, you need to have your both parent or someone that can stand for you. So it's not all that have birth certificate as well.'* The lack of birth certificates in rural communities was also mentioned by another student.

The San student said that despite the difficulties, *S9: 'everyone wants an ID'.* He also stated that having an ID was good for his community members, because IDs were needed for applying for jobs, for getting treatment at clinics, and for travelling. Additionally, he mentioned that elders needed IDs for getting their pensions. Two other students also mentioned that the elderly in rural areas needed IDs for pensions, but their views on people wanting IDs in rural areas were different; both said that some people might not see the importance or benefit of getting one, because they did not need it for anything else other than pensions in old age. One said that there had even been campaigns similar to the ones the author had been thinking about, where government officers had visited villages to promote identification. They mentioned alternative forms of identification for accessing services. *S1: 'If you have an identification from church, you can obviously get treated. So at hospitals and whatnot, so ID's not really that important.'* The other student said

that people had little booklets with their whole medical histories written on them, which they would take with them when seeing a doctor. The San student, too, mentioned that some government services could be accessed using just a birth certificate.

6.3.1.4 Application Procedure Development Ideas

Before showing the prototypes to the participants, they were asked if they thought the procedure could somehow be made easier or more efficient. One participant commented on the training of the staff: *C4: 'Train the staff, that's most important, train the staff, so that they can do the job well.'* She also mentioned that the employees should have compassion, be hard-working, and love their job. Most of the ideas, however, were related to some form of digitisation of the process.

Three students had concrete suggestions for digital services. One suggested a system for booking appointments at MHAI for filling in the paperwork to eliminate the queues. Another suggested *S1: 'a cell service of some nature that has a certain verification'.* A third participant suggested an online application system with fingerprint verification at the office: *S3: 'I feel like there could be an online application system, where you fill in your details, and then umm maybe they can just let you know when you can go there. Because they have to take like the fingerprints, that has to be accurate and they have to make sure it's your fingerprints, so perhaps after you've submitted your application they can, they just call you to just go and give the most important thing that they have to verify.'*

Three of the citizens contacted at MHAI also revealed hopes for digitisation of the process; although they were not as elaborate in their suggestions. One participant mentioned the existing SMS service for enquiring about ID status; he said he had read about it in the newspaper or heard about it on the radio, and thought it might make the process easier: *C6: 'that service, maybe it would be easy for people -- like now I dunno maybe is my ID already there or no'.* He had not tested the service, though. Another citizen, who was applying for a full birth certificate, said that she was under the impression that the process would already be quicker since it had been computerised. A third citizen said that the government should buy a machine to make the process quicker and eliminate the queues.

6.3.2 Interaction: Reactions to the Prototypes

Participants were asked about their overall mobile use in the beginning of the interviews to get some background on how familiar they were with technol-

ogy. The author did not ask the participants directly which type of phones they owned in order to avoid being insensitive, but only smartphones were observed in the students' hands. The students described using their phones for many purposes, such as calls, texting, WhatsApp, accessing the internet, searching, e-mail, e-banking, social media, and writing notes. The citizens contacted at MHAI gave partly similar responses, but were not as homogenous a group as the students. Only one of them was observed to hold a smartphone; two had feature phones; and one mentioned losing her phone (type unknown) twice and now using her son's phone for communication. The citizens described using the internet, search engines, WhatsApp, and social media sites either on their own phones or on smartphones whenever they had access to them.

Additionally, the San student described the technology situation at his village. He said that the majority of people had cellphones, especially those who were working, but not all were able to afford them. Some were not literate and used the phones mainly for calls and for music. On the other hand, the student said that the younger people had smartphones and used them for internet browsing and Facebook. His village had mobile coverage, but no power grid, so those who used cellphones would charge their phones at the only spot that had electricity: the school. The student also mentioned that computers were rare, and mainly teachers had them. Villagers had the possibility of printing or making copies at the school, but it was an expensive service, costing more than 15 Namibian dollars per copy.

6.3.2.1 Reactions to the ID Application Prototype

The ID application prototype was used in the sessions with the citizens contacted at MHAI, because they were thought to be target users of such a service. When the author first explained the concept of the service to the participants—explaining that the idea was that the service could be used either on a personal device or at the MHAI office on their devices—the response was mostly positive. One participant stated that he thought that such technologies were on their way, and that *C1: 'this is the way we're waiting for from you guys'*. Another participant said that he thought it would make applying for an ID easier and faster. One participant, who was of an older age group (aged 47), was a bit more hesitant; she said, *C4: 'it's possible'*.

One of the participants, after first stating that the idea was great, immediately came up with issues to take into account. She mentioned that the service should be available in the various languages of Namibia, because not everyone spoke English. She was also wary of what she called *backlog*—online forms never actually making it through to verification. She also pointed out

that the service should come with proper instructions. Still, all in all, she thought such a service would make the process quicker and cut down on paper wastage.

When asked if she wanted to actually test the prototype, the same participant expressed some concerns: she pointed out that she did not have data on her phone at that moment, and she asked whether it would be safe to input her personal details onto the prototype. Once she was told that she could use a separate test phone instead of her own, and that she could input fake information, she accepted the invitation to test the prototype. After this, it was stressed during each session that the participant would not have to input their own details onto the prototype (and that even if they did, the information would not be saved). Still, two participants seemed to need some reassurance while testing the prototype that they could, in fact, input fake information into *all* fields.

Additionally, one participant—the lady from an older age group—did not want to test the prototype at all; she was apparently not entirely comfortable with using technology. She immediately asked her son to do the testing in her place: *C4: 'Oh no I don't know what exactly about a form. -- Can I use my baby, my son? [Son's name removed]? My son he will come and help you. -- He knows about mobiles.'* While her son was testing the prototype, she slowly warmed up to the concept: she said, *C4: 'But I think that maybe it's gonna be easy to do something like that -- maybe people will, uh, will take, go for that, because now is the time for, for you know this te– how do you call that? The internet and that? [discusses with a bystander in the background] Technology.'*

The biggest cause of confusion that came up while the participants were testing the prototype was the feature for adding a birth certificate as an attachment. Two participants skipped the phase altogether; two hesitated, and the author proceeded to explain the feature to them; and one was misled by the label of the button, which read "choose file" instead of "take photo" (due to the default HTML label). However, once the author explained the feature to the participants, reactions were positive—some were even mildly impressed, and exclaimed *C2: 'oohh that's nice'*; or *C1: 'Ooohh. Upload it, yes, this is very nice.'*

Several smaller usability issues were also detected. Three participants hesitated at the field "Maiden name", leading the author to explain what it meant. When adding the date of birth, three participants were somewhat thrown off by the calendar feature; as the participants were given an Android phone for testing, the calendar was displayed as the default Android/Google Material Design calendar, which differs interface-wise from standard browser calendars. Some asked for help on how to use the calendar, some settled

for changing the day and leaving the month and year unchanged. Single participants also had issues with noticing the "Continue" button (when it was only partly visible at the bottom of the screen without scrolling) and with accidentally cancelling the application (because clicking on the "Cancel Application" button immediately resulted in cancellation instead of it leading to a dialogue asking to confirm the cancellation).

Apart from the issues mentioned above, no participant had greater trouble in using the prototype. All of the participants entered information into the form intuitively and with ease; they all seemed to know how to interact with a smartphone. This is, of course, excluding the older woman who preferred giving the prototype to her son for testing.

Finally, when the participants were asked for their comments and opinions after they had completed the task with the prototype, all seemed rather positive. One participant asked the research team if *this*—meaning digitising government services—was truly what we were studying, and seemed to almost be in disbelief about it: *C1: 'You serious? Is what you guys– is what you guys study for? -- Serious?'* He laughed that there would be no more job for the officers if the service was implemented, and said that it would *C1: 'save the nation'* by eliminating the time spent queueing. Another participant said that the prototype was easy and fast, and that *C6: 'Home Affairs need to bring that system'*. Two other participants were not as loquacious, but said that the prototype was *C3: 'very good'*, and *C5: 'quick and easy'*.

One participant, who said that she liked the idea and the fact that you could apply for an ID quickly whenever it suited you, also gave some critique. She asked whether we had taken government finances into consideration, and said that actually implementing the service was a *C2: 'far cry from reality'*. When the author's colleague pointed out that the government was interested in reaching people living in rural areas who were sometimes unable to travel to MHAI offices—implying that this might make the government willing to invest in the service—the participant pointed out that rural areas did not have internet access. She suggested that we start in cities, but said that *'it's gonna take a lot of convincing people'*.

6.3.2.2 Reactions to the Digital Authentication Prototype

The digital authentication prototype was used in the sessions with the students, because they, as ID holders, were thought to be target users of such a service. When the concept (mobile or bank authentication to access e-government services) was first introduced to the students, they were generally somewhat hesitant, and mentioned some issues related to the concept.

Three participants immediately mentioned security. One of them asked

about cellphone theft—which she said was common in Namibia—and whether the thief could gain access to the phone owner's identity. Another participant pointed out that young Namibians needed to help their older relatives, and someone having access to another person's identity would be an issue: *S5: 'if you see the literacy rate for let's say everybody who's maybe 45 and older, we still have to help them a lot, like the youth that live with them, with regards to like technology and stuff like that, so if somebody has access to umm their credentials, -- they can do stuff without permission, you know? You know what I mean? So security is an issue'.*

One participant was not convinced of the bank authentication option. She said, *S8: 'I think they [Namibians] will be scared to go use their bank details'*, and continued that the mobile authentication option would be better: *S8: 'I think there is a culture in Namibia of applying for things with your number. So that's something that I think they'll be willing to do. But not the bank'.* Another participant pointed out that people living in rural areas would not have access to government e-services due to lacking infrastructure.

However, one participant had a rather positive first reaction to the concept. She said that the current system of having to give your ID number everywhere was bad, and that banks and educational institutions should be linked to MHAI. She also implied that such a system might already be planned. *S6: 'the moment I provide my ID everything else -- is retrieved. So I think that's a whole approach we're really trying to have with this e-governance. Where I don't need to give my ID number everywhere.'*

When the participants tested the prototype, it became clear that there was deep mistrust towards using bank details to log in to a third party service; not a single participant chose the bank authentication option, but went for the mobile authentication instead. When asked about this choice, six participants revealed their apprehension: *S8: 'I'm just skeptical of giving up my bank details'*; *S5: 'I'm not very comfortable with my bank details being shared at the ministry'.* Many also said that they thought most Namibians would feel the same way, and that many had not even started using online banking per se: *S4: 'I mean most people don't even trust the online banking to be honest with you. -- Most people prefer to stash their money under their mattresses'*; *S6: 'So I work for the bank, -- we are really trying to push um customers to start using online banking, or cellphone banking, -- but we still have clients that have trust issues -- just entering their banking details onto the app'.* Other reasons for not choosing the bank option were related to misconceptions of its functionality: one participant said she did not remember her bank account number, and another said he used three different bank providers, and would not know which one to use for the authentication.

Two participants, who both worked as software developers, returned to

test the bank authentication out of curiosity after completing the testing of the prototype. This cleared up some of the confusion related to the feature's functionality. However, both of the participants remained hesitant about the option. One said that it would be a *S4: 'close to impossible battle'* to get banks to share their data. The other, who worked at a bank, directly suggested leaving out the bank option.

The mobile authentication also received some comments from the participants. One participant suggested auto-generated codes sent by SMS instead of a PIN code, because *S3: 'to have one code that you use for the rest of your life is not so convenient, some people forget, someone else can get access to it'*. Another participant seemed to think that this *was* the case with the prototype. The participants could input any PIN code that they wanted into the prototype, and it was perhaps not explained clearly enough that in reality, the PIN code would be a code specified at one's mobile operator while activating the authentication for one's SIM. Two participants also suggested authentication via e-mail.

When the participants moved on from the authentication feature to the online portal service offering and tried out the service for updating or correcting information on one's ID (such as one's name or date of birth), another critical conceptual issue surfaced. Three participants expressed concerns related to how the information provided by the user could be verified to be correct by MHAI. One participant said, *S6: 'You should look at the aspect of what can I change, what can I not change. -- Today I want to be very young, I'm going to this system, I'm changing my birth of date* [sic]'. Similarly, she stated that if citizens were allowed to change their names just like that, it would allow them to *S6: 'get away with fake IDs'*. The author then clarified that the citizen's application would either be accepted or rejected by the ministry, so citizens would not be able to immediately change their details using the service. The participant then said that the current practice for providing verification e.g. to change one's date of birth was tricky: citizens had to have witnesses make police declarations to verify the information. Another participant, also concerned about verification, suggested remedying the problem by adding a possibility to attach a marriage or birth certificate as proof into the application.

There were also many more minor, usability-related issues that came up during the testing. As with the ID application prototype, the Android calendar interface proved hard to navigate. Some participants quickly dismissed the final information screen informing the user of how to expect information about when their ID would be ready for pickup, and then asked the author about that exact matter; pointing to the need for more explicit instructions. One participant also pointed out that there was no phase for confirming the

information input into the application. One participant requested the ability to move between form fields using the keyboard's enter button, and another pointed out that it would feel more intuitive to have the "First Names" field before the "Surname" field.

After finishing the testing, all participants stated in one way or another that the service could work, but with varying degrees of enthusiasm. Some were very impressed; the participant who had had to correct her ID multiple times said, *S2: 'this service was probably just meant for me, girl'*, and that it was *S2: 'really really cool'*. Another said, *S1: 'I think I will definitely use it, and I don't think it's only me, I think a lot of people will appreciate it'*. She mentioned that it sometimes took a while for people to adopt new services, but pointed out that there was e.g. a system for checking one's grade 12 final results online, and even though people had initially been hesitant to use it, now they depended on it. Others said things such as *S3: 'it's lovely, I would really love to see it implemented'*, but stressed the importance of verifying the information input by the user. Two students in particular underlined the issues related to the service—*S6: 'there are certain things really, to be quite honest'*—but were accepting of the overall concept.

6.3.2.3 Rural Communities' Perspective on the Prototypes

The San student, who was thought to be able to give his community members' perspective on the prototypes in addition to his personal opinion, was given both of the prototypes for testing. The author explained her idea of government campaigns where officers would visit rural communities to help with taking fingerprints and ID applications, using MHAI-owned devices to fill in the digital application form (eliminating the need of sending paperwork to Windhoek).

The San student thought that such an approach would make applying for an ID faster and less costly for his community. Of the ID application prototype, he said that it was a quick process and would save time. When he tested the authentication prototype, he mentioned that only some of his community members had bank accounts, and he went for the mobile authentication option. Overall, he said that he would use the services, and recommend them to his community; but he also stated that his community members would need help to use them. *S9: 'It will need somebody trained that can help them, cause my community members, especially the olders and even the younger ones, they do not go to school, it's a problem'.* He also said that many did not speak English. When asked if he thought that the services should be offered in the San language, he agreed, and said that it would be good to offer the services in all the different languages of Namibia.

He was also planning on setting up a campsite for tourists in his village, and thought that it could act as a help spot for the villagers.

Chapter 7

Discussion

In this chapter, the implications of the results will be discussed in accordance to the research questions. The chapter will also look at the limitations of the study, along with ethical considerations related to its conduction. Finally, recommendations for the Namibian government will be made, and possibilities for future will be suggested.

7.1 Opportunities of Mobile Platforms

This section will discuss the opportunities of mobile platforms for the delivery of citizen-centric e-government services to Namibian citizens. The subject will be discussed in accordance to the two dimensions of RQ1—opportunities related to solving problems of current government services, and opportunities related to Namibians' interaction with and perception of m-government services.

7.1.1 Problems Associated with Current Government Services

From a functional point of view, the process of applying for an ID in Namibia is very **inefficient**. Citizens spend hours queueing at a government office while they could be working, fill in paper forms once their turn comes (if an officer does not insist filling the forms in for them), and officers input the information on the forms manually onto computers. This often results in errors, and repetition of the application process. If application forms are filled in regional offices, they are transported to Windhoek for digitisation. Sometimes parts of the applications are lost.

From a citizens' point of view, the process is inconvenient or even **discouraging**; the results show that all participants had either had problems with the process or knew of others who had had problems. Some had been on the brink of abandoning the process, while one participant had completely given up on correcting his ID. The long queues were perceived exhausting and a waste of time. Information of the requirements for the application was not available easily enough, and applicants spent days queueing at the ID collection point, only to find out that their ID had not yet been finished.

The rural communities' issues are even deeper, because they have to travel long distances to government offices, requiring extra effort, and resulting in extra costs in addition to wasted time. Citizens might not know which town to go to for applying, and might be pointed to another destination after reaching one office. Citizens might also not be aware of which documents are needed when applying for an ID.

The findings are in line with the findings of World Bank (2017*a*), stating that identification in Africa is characterised by low accessibility; and with those of Ngulube (2007) and Schuppan (2009), stating that government functions in Sub-Saharan Africa are often manual and paper-based, and inefficient. Bwalya (2009)'s statement of e-government holding promise for the transparency, responsiveness, and efficiency of government functions seems to apply to Namibia's ID application process. The existing digital population registry is a step in the right direction, but it is not being used to its full potential. **Digitisation of the services offered to citizens would eliminate much of the manual work, the errors, and the time wasted queueing, and enable the citizens to interact with the government flexibly. This might encourage citizens to get their IDs.** Indeed, the results show that even before being presented with the prototypes, some of the participants—both highly educated students *and* less educated citizens contacted at MHAI in Katutura—expressed hopes for the utilisation of technology to ease the application process.

Yet, not all of the problems associated with the process could be eliminated by digitisation. When citizens apply for their first IDs, verification at an MHAI office is needed; the applicants' fingerprints, signature, and photo would need to be verified in person. So, digitisation of the process alone could not fully eliminate the travel associated with applying for one's *first* ID in rural communities, but digital authentication would eliminate other travel associated with interacting with the government once an ID has been acquired. To make identification more accessible for rural communities, more comprehensive measures are needed; such as campaigns where officers visit villages directly from time to time for taking fingerprints.

7.1.2 Namibian Citizens' Interaction with and Perception of M-Government Services

The results show that all of the participants who tested the mobile service prototypes interacted with them **intuitively and with ease**. It came as no surprise that the highly educated students were proficient with technology, but the author was initially not sure what to expect of the skills of the citizens contacted at the MHAI office in Katutura. They, too, turned out to be familiar with using a smartphone (despite not necessarily owning one), as none of the participants was observed to have any significant difficulties with the interaction. Minor usability issues came up with both test groups, but all participants were able to continue the use of the prototypes in spite of them.

However, the results also show that there are people in Namibia who are **not comfortable or familiar** with using mobile devices or technology in general. Most of the participants who tested the prototypes were in their twenties; three were in their thirties; and one was estimated to be about 10-13 years old. The child tested the prototype only once his mother, a 47-year-old woman, asked him to test the prototype in her stead. Additionally, one participant stated that young Namibians still needed to help their older relatives with technology. She estimated that specifically those above 45 were the ones to need help, which fits to the incident with the mother and the son.

The gap between the urban and rural populations was not studied first hand, because no participants living in rural locations were interviewed. The San student gave an account of his community members' technology use, and stated that the majority had cellphones, and some of the younger people had smartphones. Still, he mentioned that many were illiterate, and used their phones only for calls or music; and that his village did not have electricity and few had computers. Since there exist even more remote communities in Namibia than the one the student was from, the level of technology proficiency in his village might not reflect that of all rural villages in Namibia.

So, the digital divide described by many sources (e.g. Pew Research Center 2016) seems to persevere in Namibia. The younger, the urban, and the educated have better ICT skills and more opportunities to access technology than the elder, the rural, and the uneducated. **However, the results indicate that the gap between different urban groups—at least concerning the use of mobile phones—might not be as wide, since both educated and less educated citizens were able to use the prototypes fluently.**

Fröhlich and Peters (2017) suggested using mobile platforms for the de-

livery of e-government services to promote social inclusion, since their popularity in the country is growing. Indeed, the fluency the participants showed in using the mobile service prototypes is promising for the future of m-government services in Namibia. **The overall positive reaction to the prototypes is another encouraging factor**. Some participants were downright enthusiastic, and even the more hesitant participants were open to the idea of delivering identification services on mobile platforms—as long as the issues they highlighted would be taken into consideration. The participants' main concerns were related to security, universal accessibility, and the implementability of the services. The main security-related issues were the mistrust towards the bank authentication option and the concerns related to the verification of information input by applicants. Regarding actual implementation of the service, some participants brought up the governments' financial capability to implement and maintain the service.

The lack of internet access in rural areas came up in many sessions. Building m-government services that would not require internet access is possible; the USSD-based M-Pesa mobile payment service is hugely popular in Kenya, and the technology has also been utilised to create a birth registration system in Uganda (Csikszentmihalyi et al. 2018). In order to ensure the agile accessibility that Joshi and Islam (2018) identify crucial for the adoption of transactional e-government services, **the services should be available on different kinds of platforms**; web-based services could be used both on computers and on mobile devices when designed in a *mobile first* manner, and USSD services could be used on mobile devices without internet access.

Still, improving internet access in rural areas is important for social inclusion. Namibia might benefit from a similar approach as the Ghanaian project for providing connectivity for rural areas through solar-powered base stations instead of traditional power grids (see UNDESA 2018); or the community network approach suggested e.g. by Rey-Moreno et al. (2014) and Saldana et al. (2017).

7.2 How the Method Supported the Design

Based on the related work on e-government implementation and adoption in Africa, user-centred design was thought to provide insight into how to ensure the citizen-centricity of e-government services in Namibia. Once previous user-centred design cases in developing contexts were studied, it was found that using technology artifacts for facilitation of collaboration had allowed researchers to learn important contextual information and get valuable feedback (see Ramachandran et al. 2007 and Stanley et al. 2015). The

environment-sensitive framework for user-centred design in developing countries presented by Backhaus et al. (2014) also supported the use of qualitative methods, including observing participants' interaction with an artifact.

So, design science was chosen as the research approach in order to be able to create and test such an artifact while accumulating knowledge of the opportunities of m-government services in Namibia. User-centred design methods were incorporated into the Design Science Research Methodology created by Peffers et al. (2007). The combination *did* support the author in the design of citizen-centric m-government services for Namibia, because **it allowed her to find out new information about the four specific points of Stage 3 (access, attitude, citizen information needs, and ICT skills)** in the model synthesised in Chapter 2 (see Table 2.2). However, based on the findings, *citizen information needs* might be better labeled simply *needs*, because some of the identified needs were not simply related to information, but to service delivery in general.

The time available during the visit to Namibia was so short that all of the phases of the traditional user-centred design process could not be executed during the visit. In order to have artifacts for testing when visiting Namibia, the author chose to create the prototypes before the visit. This meant that user contact could not be incorporated into the first stage of the process as comprehensively as the traditional user-centred design process model demands; only the expert interview served for informing the author about the context of use before creating the prototypes. However, **if the author had not had artifacts to use in the sessions in Namibia and would have simply conducted interviews to understand the context, many important insights may not have been formed**. Particularly with the less educated citizens contacted at MHAI, the ID application prototype opened a mutual understanding between the author and the participants that might not have been established without it; language barriers and a lack of common conceptual terms made communicating about the subject hard in the beginning, but once the artifact was presented to the participants, they understood what the author was aiming at and were able to state their opinions on the concept; and the author, in turn, was able to understand them.

This kind of facilitation of knowledge sharing across boundaries has been studied e.g. by Carlile (2002), who describes the use of *boundary objects* in cross-disciplinary product innovation. He states that knowledge is structured in a certain way in a certain discipline, which makes working across boundaries challenging. Further, he describes a boundary object as something that creates common ground between people coming from different disciplines, and a) "establishes a shared syntax or language for individuals to represent their knowledge"; b) "provides a concrete means for individuals to specify

and learn about their differences and dependencies across a given boundary"; and c) "facilitates a process where individuals can jointly transform their knowledge" (Carlile 2002, p. 451-452). In the context of this study, **the prototypes can be seen as boundary objects for cross-cultural knowledge co-creation**, as they allowed the author and the participants to build a joint understanding of the m-government service concepts and their opportunities despite the many boundaries between the two parties.

So, the combination of design science and user-centred design did indeed support the design of m-government services in the context of this study. It seems that **the design science aspect becomes increasingly important when there is little time at hand**; creating artifacts based on the initial knowledge available and using them for additional knowledge co-creation allows for more insight to accumulated in a shorter time period. Parallels could perhaps be drawn to Millen's (2000) rapid ethnography and to agile methods (see e.g. Beck et al. 2001). However, sticking to the traditional user-centred design process model and learning about the users' context first-hand before building prototypes is undoubtedly useful when more time and opportunities to interact with users are available. Also, the artifact approach may not apply to studies where the aim is in trying to innovate completely new ways of using technology and finding out about needs that researchers and designers have not even thought about before. This is evident from Jones et al.'s (2017) findings related to innovating future mobile devices with emergent users; they argue that not being limited to existing technologies allows emergent users to be innovative designers.

7.3 Limitations

7.3.1 Generalisability

The participants of the study were all living in Windhoek, the biggest city in Namibia (although most had roots in the northern parts of the country). This means that they represented the urban population of the country, which accounts for about half of the Namibian population (World Bank 2019). Even though some perspective of rural communities was gained through the San student's (and a couple of other participants') accounts, the rural population was not truly represented in this study and understanding their views requires further research.

All but one participant were under the age of 40, so the study mainly represents the younger generations' views. However, the 47-year-old woman's unwillingness to test the prototype (and her passing the smartphone to her

son for testing) matches with a student's account of young Namibians having to help their older relatives with technology. The San student also explained about his community's older members' technology use. So, some insight into older generations' possible perceptions of m-government services is included in the study, but it still requires further investigation.

The majority of the participants were highly educated, but some less educated citizens were also involved in the study. Thus, the overrepresentation of highly educated participants was less of an issue compared to those of the young and the urban participants.

So, the study mainly accounts for young, urban Namibians' perspective on m-government services. It does, however, give some indication also of other groups' perspectives. Also, even though this study found certain issues related to mobile identification services, it does not mean that all issues were uncovered; nor does it mean that other m-government services could not face different issues. General tendencies, however, can be inferred: the organisational culture in other Namibian government ministries is likely quite similar to that of MHAI's, and their services could likely benefit from similar digitisation and mobile accessibility than those of MHAI's.

Even though it was found in Chapter 2 that many Sub-Saharan African countries face similar challenges related to e-government, it cannot be directly stated that the results of this study would also apply to other countries. Africa is a huge continent with a multitude of different cultures, so making generalisations between African countries is dangerous. Namibia's profile is quite unique in Africa, since it has a small population spread over a great landmass with significantly higher inequality rates than the Sub-Saharan African average. This is but one reason why generalising the results to a larger African context should be approached with caution.

7.3.2 Reliability

Many factors may have affected the reliability of the data. The main factors were related to the context—both physical and cultural—that the study was conducted in. Indeed, Backhaus et al. (2014) state that both tangible and intangible factors may impose constraints upon UCD research in developing countries.

The tangible constraints that were present in this study were related to the environment in which the sessions at the MHAI office were conducted. Even though the research setting was kept simple, as recommended by Backhaus et al. (2014)—the sessions only required a smartphone, a recording device, and a notebook—the crowded environment at the MHAI office and the lack of benches and tables made conducting the sessions more challenging. It

was always not possible to hear everything the participants were saying due to background chatter, which particularly affected the quality of the tapes. Fortunately, the notes taken by the author's colleague, Anabel Fischer, made up for some gaps on tapes.

It is also possible that some intangible constraints affected the results, even though they are more up to implementation. Backhaus et al. (2014) mention that giving criticism about a technical artifact may not be considered appropriate in some contexts, and that participants may even be hesitant to state their opinions due to political pressure. It is possible that not all of the participants dared to give criticism about the author's prototypes; especially some of the citizens contacted at the MHAI office (but not all) seemed a bit too positive about the prototypes, and did not give any criticism. The reluctance to give criticism is not only a cross-cultural matter; Lazar et al. (2010) state that functional prototypes are less likely to be criticised than paper prototypes. However, giving criticism did not seem to be an issue with the student participants: many of them pointed out issues related to the concepts. The students may have viewed the author more as a peer and felt more comfortable in giving open feedback, since both the students and the author were part of the student volunteer team at the AfriCHI conference.

Even if the citizens at MHAI might not have been comfortable giving criticism on the *author's* work, they seemed comfortable enough to point out the *government's* shortcomings. The thesis advisor, Karin Fröhlich, said that the citizens seemed comfortable talking to the author, and speculated that this might have been due to the author looking clearly like a foreigner; the author may have been viewed as not being associated with the government, and the citizens may have felt that they could freely criticise the government's actions in her presence. Fröhlich is a Namibian herself, so her judgement on the matter is likely to be reliable.

Another factor that may have affected the results was the author's lack of experience in conducting interviews. The author's facilitation of the sessions varied due to nervousness and, in some cases, fatigue. This resulted in differing wordings of the interview questions and the tasks the participants were asked to perform with the prototypes.

7.4 Ethical Considerations

The sessions in Namibia were conducted under thesis advisor Karin Fröhlich's research permit (she, too, was researching e-government in Namibia and utilised some of the data gathered during the sessions). All but one of the interviewees were adults and gave their consent for participation and for the

recording of the interviews. The one underage interviewee only joined the session once his mother urged him to, and in addition to his mother's consent, he, too, was asked whether he personally was fine with testing the prototype. No information entered into the prototypes was saved, since the prototypes were only mockups and were not linked to a database.

The student participants were familiar with research and seemed to view the author as their peer due to their mutual participation in the student volunteer team at the AfriCHI conference. However, with the citizens at MHAI, explaining the purpose of the interviews took some more effort and the author did her best to ensure that the participants felt comfortable in the situation. Because the dynamics between the author and the citizens were inherently different than with the students due to no pre-existing relationship, the thesis advisor—a local—helped with the contacting of the citizens. This was thought to be important for establishing some initial trust. Still, as stated above, the citizens probably viewed the author differently than the students and the dynamics may have affected the results of the sessions.

Taking into account Kapuire et al.'s (2017) recommendations for conducting research with rural, marginalised communities in Namibia (discussed in Chapter 3), it would have been questionable to involve such communities in the study without local partners and proper trust-building. Since our local partners were busy organising the AfriCHI conference and the Christmas holidays were starting afterwards, there were no opportunities to organise sessions with rural communities in a sustainable way. Thus, no rural communities were involved in the study.

7.5 Recommendations for the Namibian Government

Based on the results, it seems that mobile platforms offer a multitude of opportunities for improving government services in Namibia. The results of this study provide a good basis for service design. The prototypes could be iterated further based on the comments and suggestions of the participants, and tested again with target users for validation as many times as needed. The first service to be implemented should be the ID application service in order to make identification more accessible for citizens and increase the amount of people having IDs. The service does not necessarily require online authentication, as applying for an ID requires a visit to the MHAI office and authentication can be conducted on spot. However, in order to build other e-government services for citizens, the digital authentication service is needed

for strong authentication of individuals. So, the digital authentication service should be next in line.

The ID application form should be complemented with a service to book an appointment at the MHAI office for giving one's fingerprints, signature, and photo, and citizens should get an automatic notification when their ID is ready for collection. This would make the process clearer and more efficient, and eliminate queues at offices. The digital authentication service should be based on the mobile option—credentials activated on a SIM card at the user's phone operator and linked to a personal PIN. This seems to be the best option, because it works on all types of phones; because Namibians are used to using their phone numbers for access to services; and because phone contracts are already linked to identities in Namibia. The bank authentication option should be left out, at least for the near future, because the participants did not feel comfortable using it. The service for applying for an update or correction of one's ID should be enhanced with the option to add birth and marriage certificates for verification of submitted information. All of the services should be available in the different languages of Namibia, and provide clear instructions and simple dialogue for interaction.

To improve the accessibility of identification services for rural communities, the government should work towards increasing connectivity of rural areas (e.g. by establishing community networks) and look into possibilities of offering services via the USSD technology. The government should also conduct campaigns where officers visit communities directly for helping villagers with ID applications and taking their fingerprints, signatures, and photos, in order to reduce the travel associated with applying for an ID in rural areas.

7.6 Future Work

The results describe in detail problems related to identification among the urban Namibian population, along with their habits for technology use and their perceptions of using mobile platforms for the delivery of identification services. The rural population's perspective on these issues is only touched upon, and needs further research; as does the perspective of older urban generations.

The method used in this study proved an interesting one. The use of technology artifacts turned out to be important for knowledge co-creation across the cultural and language boundaries that existed between the author and (at least some of) the participants. The created combination of design science and user-centred design could be applied to other ICT4D research efforts to see how it functions in other contexts. The method might be useful

especially to projects where there is limited time available to interact with target end users of services under design.

Chapter 8

Conclusions

E-government services are readily available to citizens of many developed countries, but implementation remains low in developing countries; particularly in Africa, which has the overall lowest e-government development index in the world (UNDESA 2018). However, African governments have begun to see the potential of e-government for the region: increasing the transparency, responsiveness, and efficiency of government functions, and empowering citizens through the increased availability of information (Bwalya 2009).

At the Namibian Ministry of Home Affairs and Immigration, informational websites exist, but transactional services are mainly limited to downloading forms. There is a mismatch between the format in which the services are offered and the platforms the citizens are using for accessing them—citizens often have feature phones with small screens, and the websites have not been designed to be navigated with them. (Amukugo and Peters 2016) Other factors influencing the adoption of e-government services in Namibia are low awareness of services, lack of infrastructure, and high costs of internet access (Fröhlich and Peters 2017). A digital divide persists in the country: only 31% of the population reported to using the internet in 2016, and about half of the population do not have access to electricity (UNDP 2018*a*, World Bank 2019). The income inequality rate in Namibia is 53.6%, which is extremely high compared to the Sub-Saharan African average of 27.7% (UNDP 2018*b*).

To increase social inclusion in access to e-government services in Namibia, several courses of action have been suggested. Fröhlich and Peters (2017, 2018) have suggested offering services on mobile platforms, since mobile penetration rates in Namibia are relatively high. They have also emphasised the importance of developing an understanding of citizens' information needs and underlying attitudes towards using technology, and designing intuitive user interfaces for the services. Both activities are strongly related to user-

centred design—the practice of involving users into the design of ICT systems in order to produce solutions that meet users' requirements and suit their contexts (Finnish Standards Association SFS 2010).

The aim of this thesis has been to explore the opportunities of using mobile platforms for the delivery of citizen-centric e-government services to Namibian citizens, and to see how a combination of design science and user-centred design might support such a venture. Design science was selected as the method since it enabled creating technology artifacts, which Ramachandran et al. (2007) suggest are useful in finding out about participants' backgrounds and needs in developing contexts. User-centred methods were applied to the approach in order to increase the citizen-centricity of the design process. Two prototypes of mobile services related to identification were created: one for applying for an ID online, the other for digital authentication of individuals. The prototypes were then tested with target users in Namibia, paying attention to the particularities of conducting UCD research in developing contexts—namely, tangible and intangible constraints arising from research environments and cultural and societal issues.

It was found that the opportunities of mobile platforms for delivering citizen-centric e-government services in Namibia are numerous. In regard to solving problems related to current government services, mobile platforms can make service delivery more efficient by eliminating time wasted in queues, manual work, and errors. Many participants found the existing ID application process discouraging due to these issues, so offering the service on mobile platforms could even encourage more people to apply for IDs. Indeed, some participants expressed hopes for some form of digitisation of the process even before the service concepts were introduced to them. In regard to Namibians' interaction with mobiles, the results indicate that at least the young, urban Namibians are proficient and comfortable with using mobile services, and tend to use them intuitively and with ease. The overall reaction to the prototypes was positive, but the participants also highlighted security and verification issues, and commented on rural communities' possibilities to access the services. This study provides limited insight into the perspective of rural communities and older generations, but it seems that additional attention to both groups would be needed in order to make the services accessible for them. In rural communities, internet connectivity, language skills, and illiteracy are challenging; and for older generations, help from younger relatives is needed, which poses security issues because of sharing of personal credentials. Recommendations for the Namibian government for the way forth were presented.

The applied method—the combination of design science and user-centred design—was found to support the citizen-centricity of the design work be-

cause it allowed for additional information related to access, attitude, needs, and ICT skills to surface that may not have been found without the use of the prototypes. The prototypes ended up acting as boundary objects for cross-cultural knowledge co-creation, since they helped in establishing a common understanding and communicating in shared terms despite barriers related to language and a lack of common conceptual terms. This can be seen as parallel to Carlile's (2002) descriptions of boundary objects in cross-disciplinary new product development. The creation and application of the combined DS and UCD method is the main theoretical contribution of this thesis. The method could be applied to different contexts in future work, especially to ICT4D projects where there is limited time or opportunities to involve users into the design process.

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Appendix A

Structure for Expert Interview

19.11.2018, Aalto University, Espoo, Finland

- So, you've told me that before, you worked for the government in Namibia. What did you do?
- What was the level of e-government like at your workplace?
  - Was the office computerized?
  - Was information catalogued in a database or were papers still mostly in use?
  - Do government offices/ministries communicate with each other online or offline?
  - What systems do they have?
  - Do Namibian ministries have a shared database where information about citizens is stored, or does each office have their separate database?
  - Is there a way for digital identification in Namibia?
  - What kind of transactional services exist for citizens?
- Describe the process of getting a national ID card currently in Namibia (if you don't have one at all).
  - What about if you have to get a new card because you lost the old one?
  - What if you need to update information?
- Are there people who don't have NIDs? How many approximately would you say?

- What information is on the NID? Can you show me yours?
  - When is the identification number (sotu) granted? At birth or with the NID application?
- You mentioned in your 2016 paper that there was a two-way SMS service in place for NID applications. What is it like?

Appendix B

Structure for Student Sessions

- How old are you?
- Are you originally from Windhoek or somewhere else?
- What is your current occupation?
- What do you use your phone for?
  - Do you use it for any administrative services?
- Have you ever applied for an ID card?
  - If yes:
    * When did you apply?
    * Can you remember what the process of getting it was like?
    * Do you remember if there were any problems with the process or was it straight-forward?
    * Do you think that the process could be made easier of better in some way?
    * What do you use your ID for?
    * Do you know if there is some form of digital identification available in Namibia?
  - If no:
    * Is there some reason why you haven't applied for one?
    * Do you know how you could get one?
    * What would make you get an NID? Do you see some benefits from getting one?

I have been thinking about two different things:

1. Offering government services online, like for example, applying for a new ID card if you've lost your original one
2. How to securely identify the user of these services to make sure the data is handled securely and the service provider can be sure of the user's identity.

My idea for the identification is that once you have an ID card, you could go to your mobile operator to link your ID with your mobile SIM. In practice, you would then choose a PIN number for the digital identification. The other possibility is that you could link your bank credentials with your ID, and use the same bank credentials provided by your own bank for digital identification in government services. What do you think?

I have created a little prototype that I'd like you to test, if that's ok with you! Have you ever done a user test before?

The idea is that I'll ask you to do a task with the prototype, and I'll observe how you interact with it. If you don't understand something right away, remember that it's not your fault, it's the prototype's fault and that gives me valuable information on how to make it better. So I'm not testing you, I'm testing the prototype. You can talk about anything that comes to your mind while testing it, and I would encourage you to think aloud when you use the prototype. Keep in mind that this is not a real service, it is not actually related to the government, and no information you input will be saved.

Tasks:

1. Log in to the government online portal
2. Submit an application to update the information on your ID

Comments, ideas, feedback?

Why did you choose the method you chose?

Free conversation about identification, benefits, situation in Namibia

Appendix C

Structure for Session with San Student

- How old are you?
- Where are you originally from?
- What is your current occupation?
- What do you use your phone for?
  - Do you use it for any administrative services?
- Could you tell me about the state of ID cards in your village?
- Can you distinguish if it's more popular for the older ones or the younger ones to have IDs?
- What is the main reason for getting an ID in your village?
- What is the main reason for not getting one?
- If a person from your village wanted an ID card, what would they have to do? Please describe the process.
- What are the problems related to not having an ID?
- What is the literacy level?
- What is the technology level in your village?
  - How many own phones?
  - Do any own smartphones?

- Does every household have access to a phone/smartphone?
- Is there a will to use technology, or would people rather stay away from tech?
- Are there computers?

My first idea is that for getting your first ID, there could be a MHAI minibus going around to reach people with no IDs, and they could record the details on a digital form so that the data is input immediately into the system and e.g. no papers would be lost on the way to Windhoek, and citizens could check that their names are written correctly on the form (so the officer won't misspell anything when moving the data from paper to digital form). This would eliminate travel related to IDs, and the need of doing the process all over again due to misspelling of data. I have a prototype of the online form, would you be willing to try it out?

Would people be able to use this kind of a form? Either alone or with assistance from younger villagers/from officers? Of course, if the officers come to the village to take fingerprints and photos, then they could help in filling the forms.

My other idea is that there could be a communal computer or communal smartphones at a village hub where people could then access government services online after getting an ID. Logging in to an online government portal requires some strong authentication, though. For people who own phones, I have been thinking about linking the ID card to their SIM card, so that people could use mobile verification with a PIN number prompt coming up on their phone when they try to log in to a government service. However, if people don't have unique phones, I'm not sure how this would work. I don't know if it's possible to link one communal phone with multiple IDs and PINs—I have to look into that. The other possibility is that you could link your bank credentials with your ID, and use the same bank credentials provided by your own bank for digital identification in government services. So the idea is that after identification, people could then access a range of government services online without having to travel to a government office. Like applying for a duplicate ID if the original one is lost, or applying for their pension money.

I have a prototype for this, too—would you like to try it out? What do you think people in your village would think about this kind of a service?

Appendix D

Structure for MHAI Sessions

- How old are you?
- Are you originally from Windhoek or somewhere else?
- What is your current occupation?
- Do you use a phone?
- What do you use it for?
- What are you here for?
  - If ID:
    * Why did you decide to get an ID?
    * How has the process been so far, what have you had to do?
    * Have there been any problems?
    * Do you have any suggestions on how to make the process better or easier?
  - If something else than ID:
    * What has it been like?
    * Have you ever applied for an ID?
    * How did the process of applying for an ID go?
    * Have there been any problems?
    * Do you have any suggestions on how to make the process better or easier?
    * Did you have any problems or was the process straight-forward?
    * Can you think of any way to make the process better of easier?

    - What do you use your ID for?

- What would you think about the idea that you could actually input your data on a computer or your mobile when applying for an ID?

I have actually created an application like that. Would you like to try it out? It is only a test version, so it doesn't save any data and it isn't actually related to the government in any way.

The idea is that I'll ask you to do a task with the application, and I'll observe how you interact with it. If you don't understand something right away, remember that it's not your fault, it's the application's fault and that gives me valuable information on how to make it better. So I'm not testing you, I'm testing the application. You can talk about anything that comes to your mind while testing it, and I would encourage you to think aloud when you use the application.

Comments, ideas, feedback?