A STAKEHOLDER-CENTRED MOBILE HEALTH IMPLEMENTATION INQUIRY WITHIN THE DIGITAL HEALTH INNOVATION ECOSYSTEM IN SOUTH AFRICA: A PRACTITIONER-RESEARCHER'S PERSPECTIVE

by

IDON NKHENSO SIBUYI

Thesis submitted in fulfilment of the requirements for the degree

Doctor Technologiae: Informatics

in the Faculty of Informatics and Design

at the Cape Peninsula University of Technology

Supervisor: Prof M de la Harpe
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Cape Town
Date submitted: July 2020.

DECLARATION

I, **Idon Nkhenso Sibuyi**, declare that the contents of this dissertation/thesis: A Stakeholder-Centred Mobile Health Implementation Inquiry within the Digital Health Innovation Ecosystem in South Africa: A Practitioner-Researcher Perspective, represents my own unaided work, and that the dissertation/thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

16 July 2020

Signed   **Date**

ABSTRACT

Background: The Internet is a useful interactive and multimedia platform for disseminating and accessing information unconstrained by time, distance and place. To the health care sector's benefit, the advent and proliferation of mobile devices has provided an opportunity for interventions that combine asynchronous technology-aided health services to improve the lives of the less privileged and marginalised people and their communities, particularly in developing societies. In many developing countries in particular, initiatives aimed at enhancing the delivery of health services and disease management are stifled in 'pilotitis' mode. In addition, many technological innovations and initiatives, including mHealth, have not progressed to their intended full capacity of addressing Goal 3 (good health and well-being) of the global Sustainable Development Goals, which succeeded the Millennium Development Goals.

The term 'pilotitis' was aptly coined by Digital Health stakeholders to reflect on the multiplication or preponderance of several health-related pilot projects on the African continent, most of which have not been scaled up for community-wide use, resulting in major health concerns and challenges.

Purpose: The purpose/ aim of the study was to review an existing government mHealth programme and design a re-engineered strategy based on best demonstrated practices (considerations and methods) and learnt experiences from the perspectives of the Digital Health Innovation Ecosystem stakeholders in South Africa.

Methods: The study employed an ethnographic approach involving document review, stakeholder mapping, semi-structured individual interviews, focus group discussions and participant observations to explore, describe and analyse the perspectives of its heterogenous participant categories representing purposively sampled, but different constituencies. Non-probability judgement sampling was utilised for participant selection, while convenience sampling was used for selecting the study's two geographically disparate sites during five phases of data collection.

A total of 80 participants were sampled in the study, in addition to the 6 (six) meetings the researcher attended with senior government officials and members of a government appointed task team and advisory council. Additionally, 46 archived records and reports were consulted and reviewed as part of gathering data relating to government's MomConnect project.

Findings: Among the consulted stakeholders, there was general consensus that MomConnect should be implemented beyond mere piloting, to 'as best as possible' capacity within the available resources and time. Experience has shown that the scalability and sustainability of mHealth services as part of an innovative digital health ecosystem could be hamstrung by factors such as stakeholder mismanagement; lack of political support, appropriate choice of technology, funding, and integration of mHealth to existing health programmes in tandem with the Sustainable Development Goals. The findings also revealed that critical considerations for

a re-engineered mHealth strategy included funding for eHealth and mHealth; impact assessment; data management of data; effective leadership and governance from the National Department of Health; integrating lessons learnt from other mHealth initiatives to avoid resource wastage and duplication of efforts; proactive evaluation of both mHealth and eHealth strategies; change management and developing human resources for eHealth. Moreover, contemporary issues of mHealth services could be addressed by applying digital development principles to strengthen best practices and address existing implementation gaps. The centralisation of mHealth at the National Department of Health was regarded as one of the critical steps to ensure coordinated governance.

Conclusions: Based on its findings, the study has only laid a foundation for the implementation of mHealth services within the Digital Health Innovation Ecosystem. The study articulated the need for stakeholder collaboration, such as continuous engagement between academics, technologists and mHealth fieldwork professional. Such compelling collaboration is accentuated more by the South African realities of the best practices in the fieldwork, which may not necessarily be documented in peer reviewed or systematic research documents from which South African professionals, research experts and practitioners could learn. Further research is needed for retrospective analysis of mHealth initiatives and forecasting of the sustainability of current and future mHealth initiatives in South Africa.

On the basis of the reviewed literature (for theoretical and secondary data) and the indispensable ethnographically oriented empirical (primary) data, a 10 (ten) point mobile health implementation framework was produced by this study as an attempt to utilise the findings as an enhancement of practice. The produced strategy implementation areas are:

(1) Implementation of stakeholder management on eHealth from the national department of health, (2) Description and compliance process of user-centred design process within the digital health innovation ecosystem, (3)The development of eHealth governance and leadership from the national and provincial department of Health, (4) Guiding Infrastructure Developments and Monitoring compliance with SA Normative Standards, (5)The provision of proactive and maximum privacy and security measures for mHealth, (6) Development of eHealth policy that includes mHealth at national Level, (7) Implementation of Research and development processes that foster collaboration and evidence based implementation of mHealth initiatives, (8) The development of mHealth indicators as parts of the NIDS, (9) Endorsement of eHealth as an independent health program lead by health professionals and (10) Development and implementation of standard operating process for evaluating mHealth total cost of ownership.

Keywords: mHealth; stakeholder collaboration; digital health innovation ecosystem; sustainable development goals; stakeholder-centred design

ACKNOWLEDGEMENTS

DEDICATION

In loving memory of:

Idah Sibuyi
Frank Sibuyi
Alleta Sibuyi-Ndhlovu

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GLOSSARY

MHealth

Patient-Facing eHealth

Digital Health Innovation Ecosystem

Stakeholder-Centred Design

Re-engineering in Health Services

MomConnect as a Demonstration Case

ACRONYMS/ ABBREVIATIONS USED

ANC	Ante-Natal Care
CA	Conversation Analysis
CDCP	Centre for Disease Control and Prevention
CoJ	City of Johannesburg
CSIR	Council for Scientific and Industrial Research
CPUT	Cape Peninsula University of Technology
DA	Discourse Analysis
DENOSA	Demographic Nursing Organisation of South Africa
DH	Digital Health
DHIE	Digital Health Innovation Ecosystem
DHIS	Digital Health Innovation System
GDHI	Global Digital Health Index
GDPR	General Data Protection Regulation
GP	Gauteng Province
HCHC	Hillbrow Community Health Centre
HI	Healthcare Innovation
HIS	Health Information Systems
HISP-SA	Health Information Systems Programme, South Africa
HIT	Health Information Technology
HPCSA	Health Professions Council of South Africa
HRH	Human Resources for Health
HSDGs	Health Sustainable Development Goals
HSR	Health Service Research
HSRC	Human Sciences Research Council
HWSETA	Health & Welfare Sector Education & Training Authority
ICT	Information and Communication Technologies
I-TECH SA	International Training and Education Centre for Health, South Africa
ITU	International Telecommunication Union
LMICs	Low-to-Middle-Income-Countries
MAMA	Mobile Alliance for Maternal Action
MACeH	Ministerial Advisory Committee on eHealth
MCH	Maternal and Child Health
MCWH	Maternal, Child and Women's Health
mHealth	Mobile Health
MomC	MomConnect
MomCIM	MomConnect Implementation Minutes
MomCTTM	MomConnect Task Team Members
MRC	Medical Research Council
NASSS	Non-adoption, Abandonment, Scale-up, Spread and Sustainability.
N.D.	Not Dated
NDoH	National Department of Health
NGOs	Non-Governmental Organisations
NIDS	Network Intrusion Detection System
NIMART	Nurse-Initiated Management of Antiretroviral Treatment
NHI	National Health Insurance
NHISA	National Health Information System of South Africa
PHC	Primary Health Care
PNC	Post-Natal Care
POPI	Protection of Personal Information Act

RCT	Randomised Controlled Trial
SANC	South African Nursing Council
SAPC	South African Pharmacy Council
SCD	Stakeholder-Centred Design
SDGs	Sustainable Development Goals
SRQ	Secondary Research Question
SST	Strong Structuration Theory
URF	University Research Fund
USAID	United States Agency for International Development

BIOGRAPHY

Idon Nkhenso Sibuyi, known with the hyphenated name of Idon-Nkhenso Sibuyi, is a public health practitioner with special interest in Digital Health. He holds a Master of Public Health (MPH) degree with specialisation in Medical Informatics from the University of South Africa. He has ten (10) years of experience in public health including Hospitals, Primary Health Care Facilities, National Department of Health, Non-Governmental Organisations (and related development organisations) such as HISP-SA, Health Enabled and I-TECH SA. He has interdisciplinary experience and knowledge in the design, development, adoption, implementation and application of ICT-based innovations in health care services delivery, management and planning. Apart from his initial work as a clinician (optometrist), he has also worked in various programmes, where he occupied roles such as health standards compliance, health information systems (HIS) strengthening, digital health implementation in maternal, child and women's health (MCWH), and human resources for health (HRH). At the finalisation and submission of this thesis he was an Independent Consultant working from his own home in Krugersdorp.

During the course of his doctoral study, his output was the following journal article submitted to the Journal of Medical Internet Research (JMIR):

A Mobile Health Stakeholder-Centred Strategy within the Digital Health Innovation Ecosystem in South Africa: MomConnect as a Demonstration Case

FORMAL EDUCATION

Idon Nkhenso Sibuyi attended the following schools and universities:

- Manyeleti Primary School;
- Orhovelani High School;
- University of Limpopo;
- University of South Africa; and
- Cape Peninsula University of Technology.

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CHAPTER ONE: Rationale and Scope of the Study

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1.1 Introduction and Background to the Study

Many eHealth initiatives in developing countries have not progressed beyond the 'pilotitis' stages (Fanta and Pretorius, 2018). Such eHealth projects have not reached full-scale implementation as integral components of the eHealth national technological innovations systems, including mHealth, to address the challenges of the global Sustainable Development Goals (SDGs) (Tilahun, 2017). The state of perennial 'piloting' of eHealth projects has largely accounted for their non-completion. It is in this regard that the intention of this study also focuses on initiating the rationalisation of mHealth from a perspective of enhancing health services to reach wider targets. In this regard, mHealth is viewed as a tool to enhance disease management as part of health services, especially in the realms of adherence and wellness. mHealth is regarded as an area in which health services improvement could have more impact than the discovery of new treatment. Therefore, in addition to development of clinical interventions themselves, further research-based investigation concerning the efficacy of mHealth to reach wider health care consumers could not be over-emphasised (Tilahun, 2017).

Due to the logistical and planning processes involved, it may be cumbersome for a government to provide the health care infrastructure to rural populations, for instance; but mobile health technology may bridge this gap if implemented appropriately, particularly in a way that it can be scaled-up and sustained (Beck, Gill, and De Lay, 2016; Shukla and Sharma, 2016). mHealth is regarded as the new frontier of innovations in health care, facilitated by improvements in information and communication technologies (ICT) and the Internet's asynchronous inter-connectivity (Silva, Rodrigues, De la Torre Díez, López-Coronado and Saleem, 2015). Mobile health (mHealth) technology – also known as eHealth - is a multidisciplinary field cutting across health care, medical and technological sciences, connecting medical informatics, business and public health through the Internet-based technologies (Ali et al., 2016). Around the world, mHealth is growing constantly and continuously as part of eHealth and component of all aspects of health (prevention, diagnosis, treatment, research) (Davis, DiClemente, and Prietula, 2016).

As a tool for supporting health promotion and preventative health, amongst others, mHealth interventions are mainly implemented in public health and primary health care settings (Nyemba-Mudenda & Chigona, 2013). This ability makes it relevant to enhance health services in order to reach broader targets for Sustainable Development Goals. One of the profound advantages of mHealth services as an intervention is its personalisation of devices to needs and circumstances of their users and/ or owners. On the other hand, health itself is personal and extends beyond health care. As such, the implementation of mHealth should be appropriate in responding to one's personal health and wellness (Whittaker, 2012). Presently, health facilities such as hospitals and clinics, and health systems in the general sense are ICT-reliant insofar as improving quality, safety, and productivity of health care services is concerned

(Baskerville and Myers, 2015). mHealth has ushered-in important changes through its facilitation of access and the willingness to use portable devices for health care needs (Fleming, Taber, McElligot, McGillicuddy and Treiber, 2017). The looming question about the cost-effectiveness of mHealth is paramount to its future success and wide-spread use (Fleming et al., 2017).

mHealth is imbued with aspirational and even ambitious promises (Bull and Ezeanochie, 2016). It is against this background that interest in mHealth research is constantly expanding. However, there are still gaps that need to be explored in order to provide rigour in this field (Fiordelli, Diviani, and Schulz, 2013). The need to analyse mHealth implementation strategies is also emerging, considering that current mHealth research was deficient to inform policy and practice. Such deficiency could pose a major obstacle to effective decision making and implementation of mHealth grassroots intervention. Furusa and Coleman (2018) concur with the latter view, citing that a significant number of mHealth interventions characteristically lacked comprehensive design, evaluation and implementation methods and plans to integrate such interventions as crucial components of the wider national health systems. Lack of various stakeholders' involvement has also added to the mHealth implementation gap (Furusa and Coleman, 2018).

Additionally, there is limited evidence to suggest the systematic implementation of mHealth services on the basis of sound processes, stakeholder mapping, as well as implementation from a service point of view as opposed to system and conceptual frameworks (Leon, Schneider, and Daviaud, 2012). However, there is lack of knowledge effects regarding the challenges that developers and end users face before, during and after engaging in an mHealth programme. In such cases, the resort to theoretical frameworks is viewed as ideal in addressing these design and implementation gaps (Chen, 2016).

This study is focused more on patient-facing services than back-end or health-worker tools. Such an orientation coheres with the perspectives by both Sauvola (2014) and Fanta and Pretorius (2018), who contend that strong public publication and active citizenship involvement has now characterised the development and implementation of health care services and programmes, in conjunction with other technological, social, economic, and organisational factors.

1.2   Rationale/ Justification/ Motivation for the Study

The study was inspired by both the researcher's academic training, professional background and work experience; all of which highlighted the real-life problem of health care initiatives that are implemented sparsely and in a disjointed context-specific manner with little, or non-existent national impetus to the broader consumers of health care services. The researcher is a public health practitioner with particular interest in Digital Health (DH), which is enhanced by his

postgraduate qualification and specialisation in Medical Informatics. In addition, the researcher has ten years' experience of working in the public sector health, including hospitals, PHC facilities, National Department of Health, non-governmental organisations (NGOs) and related development organisations such as HISP-SA (Health Information Systems Programme, South Africa), Health Enabled and I-TECH SA (International Training and Education Centre for Health, South Africa). He has interdisciplinary experience and knowledge in the design, development, adoption, implementation and application of ICT-based innovations in health care services delivery, management and planning. Apart from his initial work as a clinician (optometrist), the researcher has worked in various roles in programmes such as health standards compliance, health information systems (HIS) strengthening, digital health implementation in maternal, child and women's health (MCWH) and human resources for health (HRH).

Given the researcher's academic and professional backgrounds, the study was also inspired by a real life mHealth problem in South Africa, given that the country has only scaled up one patient-facing mHealth initiative (MomConnect) nationally, and whose sustainability could be regarded as uncertain. In a number of instances, South African mHealth initiatives only reached the pilot phase; even so, to solve specific health problems implemented in silos, disintegrated and depend on donor funding (Fanta and Pretorius, 2018). To a large extent, then, this study was influenced by the researcher's desire to rationalise mHealth from a perspective of enhancing health services to reach wider targets. 'Pilotitis' is a term aptly coined by Digital Health stakeholders, and remains a major health issue on the African continent. The term refers to the proliferation of several pilot projects, most of which have not been scaled up for wide-spread community use due to the prevalence of copious health-related challenges (Ngoc, Bigirimana, Muneene, Bataringay, Barango, Eskandar, Igiribambe, Sina-Odunsi, Condo and Olu, 2018). 'Project Kopano' in South Africa and 'Hello Mama' in Nigeria are examples of projects that stagnated due to pilotitis, and did not develop beyond their pilot phases. Consequent to 'pilotitis' and its negative organisational impacts, the objective of addressing Goal 3 (good health and well-being) of the global Sustainable Development Goals (SDGs) is jeopardised since health technological developments are not accessible to the majority of people for whom health care service provision is an absolute requirement (Tilahun, 2017).

The South African context of mHealth interventions is mostly characterised by pilot projects with limited reach, lack of large-scale projects that make it difficult to apply best practice, and unclear strategies to upscale such interventions (Nyemba-Mudenda and Chigona, 2013). In addition, there is insufficient evidence to allow scale up, which necessitates the building-up of evidence as an important contribution to mHealth research (Beck et al., 2016 cited in Shukla and Sharma, 2016). Despite the unique opportunity mHealth brings into the health services, scalability and sustainability of mHealth services is still a challenge that necessitates further

investigation into the service design and plans to scale from an implementation perspective (Furusa and Coleman, 2018). Furthermore, most theories in mHealth are not implementation theories, but behavioural in focus (Bull and Ezeanochie, 2016). Therefore, this study, by virtue of its aim and objectives, has opted for digital health service implementation as its key area of focus.

Most importantly, this study is inspired by the research opportunity to embark on an ethnographically informed stakeholder-centred perspective, as opposed to a user-centred perspective. Therefore, the study has considered all stakeholders involved in implementation of mHealth, not just end-users. Yang and Varshney (2016) argue that stakeholder perspectives have not been seriously considered in health information systems and technology. Also, developmental theory has been under-utilised in mHealth research and analytics in developing countries such as South Africa. Notwithstanding, Bull and Ezeanochie (2016) have noted that the country's underserved areas are good ground to explore this research area. The latter authors cite that only 10% of those studies with a randomised controlled trial (RCT) published between 2005 and 2014, made an explicit reference to inclusion of theory. Such a low mHealth theory-based research calls for more theory engagement in mHealth research. In this health services research study, a service design theory- and stakeholder-driven thinking has been applied in order to add to scientific rigour in the ambit of mHealth research.

1.3 Definitions and Operationalisation of Key Terms/ Concepts

The key terms or concepts in this section have been selected in accordance with their thematic and conceptual relevance to the research topic and its problem formulation, the research aim and objectives, and also the research methodological processes entailed in the study (Baniasadi, Kalhori, Ayyoubzadeh, Zakerabasali and Pourmohamadkhan, 2018). Additionally, the definitions and their meaning are both context-specific and disciplinarily inclined, while their sequencing does not in any way indicate any contextual or disciplinary of one term over the other.

1.3.1 Digital Health (DH)

The conceptualisation and provision of health care by healthcare providers through the dominant instrumentalisation of ICT to empower patients to improve, monitor and manage their health and wellbeing of patients and their families (Iyawa, Herselmana and Botha, 2016).

1.3.2 Digital Health Innovation Ecosystem (DHIE)

The systematisation of digital health networks and communities relying on ICT to connect and relate with each other/ one another for the purpose of improving health services and empowering patients to manage their wellbeing and that of their families. The networks in the ICT-dominated ecosystem or environment is constituted by health care stakeholders,

institutions and devices. Such an environment is characterised principally by successful implementation of interactive digital best-demonstrated practices and solutions (Iyawa et al., 2016). In this context, health innovation then relates to the and implementation of successful best-demonstrated practices intended to improve the quality, efficiency, outcomes, safety, and costs of treating, diagnosing, educating, reaching out, preventing and researching in health care (Iyawa et al., 2016).

1.3.3 Digital / e-Health Services

The provision of best possible health related solutions through the integration of healthcare and technology in order to broaden access of patient and provider information from a centrally manged location (Iyawa et al., 2016). Snowdon (2020:1) mentions that: "Digital health connects and empowers people and populations to manage health and wellness, augmented by accessible and supportive provider teams working within flexible, integrated, interoperable and digitally-enabled care environments that strategically leverage digital tools, technologies and services to transform care delivery".

1.3.4 eHealth Innovation

The emerging field in which Internet technologies and networked global thinking, attitudes and mindsets intersect medical informatics, public health, and business to improve health care services to greater numbers of consumers at the local, regional, and global levels (Eysenbach, 2001).

1.3.5 Patient-Facing Health

The ICT-centred multidisciplinary field focusing on the enhancement or delivery of health care information and health services to patients as the critical point of reference (Grover and Lyytinen, 2015; Wakefield, Turvey, Nazi, Holman, Hogan, Shimada and Kennedy, 2017).

1.3.6 mHealth

Medical and public health practices and disease management programmes that are supported by a range of interactive information and communication technologies such as mobile phones, patient monitoring devices, and personal digital assistants (Bull and Ezeanochie, 2016; World Health Organisation, 2011).

1.3.7 mHealth Consumers

These are people or individuals using mobile health services, as well as their families and carers. They are people who have used a health service in the past, or who could potentially use the service in the future. Preference is given to the term 'consumers' rather than 'patients', to emphasise the fact that 'consumer' tends to choose and get involved in decision making, usually in collaboration with other stakeholders; whereas a 'patient' traditionally tends to be a

care recipient without necessarily taking part in decision making. Furthermore, the term 'consumers' includes carers who often have an important role in health care decision making and care giving (Wakefield et al., 2017).

The scientific and multidisciplinary field of investigation that studies the effects of social factors, financing systems, organisational structures and processes, health technologies, and personal behaviours on the quality and cost of health care and well-being of individuals, families, organisations, institutions, communities, and populations (Lohr and Steinwachs, 2002). In the context of this study, HSR is still valuable for better understanding of the values, culture, stakeholder and end-user readiness of mHealth services from inception to monitoring and feedback (Matthew-Maich, Harris, Ploeg, Markle-Reid, Valaitis, Ibrahim, Gafni and Isaacs, 2016).

1.3.8   Practice Research

A scientific mode of inquiry in terms of which the researcher is actively involved in an investigation of a phenomenon that is directly linked to an aspect of his/her profession or occupation (Nyström, Karitun, Keller and Andersson-Gare, 2018). In such instances, the roles of practitioner and researcher could be indistinguishable unless reflexivity is optimally applied throughout the investigation, especially during empirical data collection since the researcher may be a current or former colleague of the research participants (Nyström et al., 2018). In this study, the duality of roles and perspectives applies, given the researcher's academic, professional and work experience and background.

1.3.9   Re-engineering

Fundamental reconceptualisation and radical reconfiguration of business processes for achieving dramatic improvements in critical performance measures such as cost, service efficiency and speed (Hammer and Champy, 2003).

1.3.10 Scale-up

The institutionalisation of interventions and programmes whose success and efficacy has already been established in new contexts for the purpose of producing more positive regular impacts in larger and more heterogeneous populations (Schneider and McDonalds, 2007).

1.3.11 Stakeholder-Centred Engagement

A design process intended for the use of a (health) product at any moment and at any of its location points by all people during the product's lifetime to the advantage of those whose needs are not appropriately addressed. Every effort should be made to identify and understand these stakeholders and address their needs to keep the chain intact. (McCord, 2015). The process of development and design of a health service requires an in-depth understanding and

knowledge of the field, as well as holistic consideration from different perspectives (Schneider and McDonalds, 2007).

1.4   Health, Health Services and Health Sustainable Development Goals

The WHO (2013) describes health as the complete wellbeing of the individual and total absence of any physical, mental, and social deficiencies and constraints. Based on this definition, mHealth is not limited to health care services such as hospital care or caring for the sick, but health as a whole; which includes wellbeing and the enhancement of health services in order to meet the Sustainable Development Goals. In countries with the burden of morbidity and mortality, mHealth is implemented as an innovative method to enhance health services for the benefit of larger health consumer targets in the context of Goal 3 of the Sustainable Development Goals (Sondaal, Browne, Amoakoh-Coleman, Borgstein, Miltenburg and Verwijs, 2016).

According to the WHO (2017), health services include all activities and processes that address the diagnosis and treatment of disease, as well as the promotion, maintenance and restoration of personal and non-personal health. As indicated above in digital health and mHealth, mobile devices are personal and health service include both personal and non-personal services. This renders mHealth an appropriate tool for integrating health services and wellness in the daily personal lives of service consumers. At times, these different perspectives are embedded in organisational silos and can only be obtained through knowledge networks that span across different professions and institutions. For this reason, the criticality of stakeholder mapping and co-design in this health service study is indispensable (Sondaal et al., 2016).

The Sustainable Development Goals succeeded the Millennium Development Goals (MDGs). Goal 3 of the MDGs focuses on good health and wellbeing, and has five themes that link to mHealth as an enhancement tool. The themes are:

- Promotion of health and wellbeing;
- Universal access to health care services;
- Minimise preventable deaths through educating and information;
- Strengthen prevention and treatment of disease; and
- Universal health coverage (National Health Insurance/ NHI in South Africa).

Accordingly, mHealth service implementation in this study is aimed at enhancing health care service in general than at a specific health programme. This is to ensure that the knowledge generated by this study is not limited or focused on maternal health, which is directly linked to the MomConnect case example being studied, but can be relevant to all services. In governmental organisations such as the National Department of Health, service delivery is what distinguishes the progressive from the stagnant. Therefore, focusing on service

implementation remains pivotal ((Sondaal et al., 2016). For purposes of this study, Figure 1.1 below reflects the NDoH's strategic orientation and considerations of a progressive mHealth service delivery plan/ model.
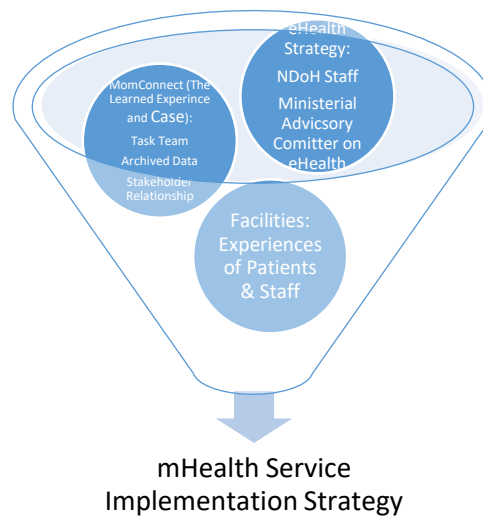
Figure 1-1: mHealth service implementation strategy
(Source: NDoH, 2014:1)

In terms of Figure 1.1 an effective mHealth service implementation strategy premises on the involvement of multiple stakeholders and participants with various skills and knowledge (e.g. political, practice or clinically related).

1.5   mHealth as a Tool

Countries that are still steeped in old and traditional health care models face difficult times ahead (Silva et al., 2015). mHealth service is one of the suggested solutions globally to provide and enhance high quality health services, especially in reaching remote consumers and patients (Dean, Makin, Kydd, Biriotti and Forsyth, 2012; WHO, 2011). However, mHealth as a tool does require rigorous evaluation for properly implementation and addressing socio-cultural, informational, economic and individual vulnerabilities (Chib, Wilkin and Hoefman, 2013). Mobile applications used for health services possess great potential to target different communities and media that would be rather difficult to reach at the same time. The matters addressed by mHealth may reach heterogenous communities such as health professionals, patients, community health workers, citizens of a specific location and the outcomes may be diverse. Mobile technology combines multiple groups such as users, patients, providers of medical services, software developers, governments and even, non-governmental organisations. For that reason, the researcher realised the criticality of conducting a stakeholder-oriented study that integrates mHealth into the government health system (Chatzipavlou, Christoforidou and Vlachopoulou, 2016).

Africa is lagging behind other WHO regions in the implementation of mHealth programmes, and most mHealth projects have been small-scale pilots (WHO, 2011). In this regard, mHealth has the potential to enhance and transform the traditional African delivery of health services, thus improving the clinical and operational processes of rendering health care services (Gurupur and Wan, 2017). Barriers to the implementation of e-Health services in Africa include governance, organisational and management issues, which are further categorised into, sustainability of ICT projects, silos in operations, leadership and stakeholder management issues (Mawela, Ochara, and Twinomurinzi, 2017). Furthermore, the cyclical nature of government, where executive and management are not guaranteed their positions after five-year terms, poses a need for implementation of strategies that mitigate against this risk, even in e-health services (Mawela et al., 2017).

MomConnect is South Africa's first large-scale mHealth service programme, and has been utilised as a case example in this study. As the demonstration case in this study, MomConnect has resulted in several innovative developments. Although South Africa already had a supportive digital health policy framework at MomConnect's inception in August 2014, many policies were not yet implemented, resulting in MomConnect serving as the first real-world test case (Barron, Peter, LeFevre, Sebidi, Bekker, Allen, Parsons, Benjamin and Pillay, 2018). It is in this particular context that MomConnect could be regarded as the catalyst of a growing effort to transform South Africa's public health system through the use of digital health technologies (Barron et al., 2018).

The encouraging results of maternal mHealth interventions in South Africa are a strong motivation for evaluation of the mHealth services in order to achieve scalability (Coleman et al., 2017). In contexts that are characterised by severe resource constraints, the scaling-up of successful piloting of sustainable eHealth projects and technologies is still a challenge (Fanta and Pretorius, 2018).

1.6   MomConnect

According to Barron et al. (2018:3), "MomConnect is the only mobile health programme globally to have reached >60% coverage of all pregnant women nationally, with 1.7 million subscribers registered since its launch in 2014. This achievement has been hard fought". While there is still the potential for improvement, MomConnect represents a significant starting point for the addition of new users, features and links to other health services and databases as technology advances and smartphone access increases (Barron et al., 2018).

MomConnect was launched in August 2014 as the National Department of Health's initiative to improve maternal, children's and women's health services by registering all pregnant women to receive preventative health messages via mobile phones nationally (Barron et al., 2018). In such a context, MomConnect is then viewed as a standard national programme of care for

maternal and child health (MCH) services in health care facilities across South Africa. Nurses at public facilities encourage pregnant women and new mothers to register for MomConnect. Once registered, women receive two SMSes per week based on their stage of pregnancy and through the child's first year of life. MomConnect message content is timed to the expected month of delivery and covers topics such as vaccination and check-up reminders, exclusive breastfeeding recommendations, psychosocial parenting tips, and baby development.

The first South African project to send full-scale text messages to pregnant women was the Mobile Alliance for Maternal Action (MAMA) project that was funded by Johnson & Johnson and the United States Agency for International Development (USAID). The project was implemented by the Praekelt Foundation, Wits University's Reproductive Health Institute and Cell-Life. The MAMA was piloted at Wits RHI sites, although it was not confined to specific health facilities in other areas. Instead, it was a mobile phone service that allowed anyone, anywhere in the country to subscribe. As well as SMS, the MAMA information could be accessed through the 'askMAMA'.mobi site, a website for mobile phones, and MXit (a mobile phone text messaging system popular at the time). MAMA SA was advertised through SMS, 'please-call-me' advertisements and various maternal health organisations. There was no verification of whether the subscriber was a pregnant woman or not (a man could subscribe). In total, 600,000 people subscribed for the duration of the project from 2011-2014. In 2014, the MAMA SA project was closed down, and it became the MomConnect initiative of the National Department of Health.

The original MomConnect content was created by Baby Centre (UK), and then adapted for the South African context by a team of local experts, as well as customised for the length of an SMS (160 characters), and reviewed by a panel of experts including maternal health clinicians. MomConnect has a task team that meets monthly with most active stakeholders. MomConnect was selected as a case example in this study, since it is the first nationally scaled-up mHealth service. An in-depth study of its implementation from a service design perspective may assist in obtaining evidence-based and best practice mHealth implementation strategy. From a technical perspective, mHealth implementation also includes ethical components such as trustworthiness, privacy and confidentiality. The ethical aspect is explored further through different stakeholders in this study.

Strong government support and partnerships between key stakeholders has accounted for the rapid scaling-up of the MomConnect initiative since its inception (Kabongo et al., 2019). While referring to the MomConnect initiative as a demonstration case example, this study also provides descriptions of the health system conditions that influence MomConnect's implementation to improve the uptake of both ante-natal and post-natal care services. The study also provides some recommendations to improve MomConnect's roll-out and

implementation as an example of the application of mHealth technology elsewhere in the country (South Africa).

As South-Africa's first national-scale mHealth service, the implementation of MomConnect has the potential to fill the knowledge gap in mHealth implementation dynamics (which may include the service design) (Coleman et al., 2017). There is currently limited published research in Sub-Saharan Africa (SSA) on large-scale mHealth implementation on which to establish empirical investigation pertaining to exploration of well-designed efficacy and effectiveness of mHealth service (Coleman et al., 2017). The latter view is also shared by Wolff-Piggott et al., (2018), all of whom agree that the proliferation of mHealth initiatives in many developing countries has not necessarily translated to rollouts at national level, as well as practical implications of these projects on the routines of the facilities at which they have been rolled out (Chib et al., 2013; Wolff-Piggott et al., 2018). Figure 1.2 is a representation of the facility-level MomConnect journey from the help desk to the stages up to one year following the birth of the child (National Department of Health/ NDoH, 2014).
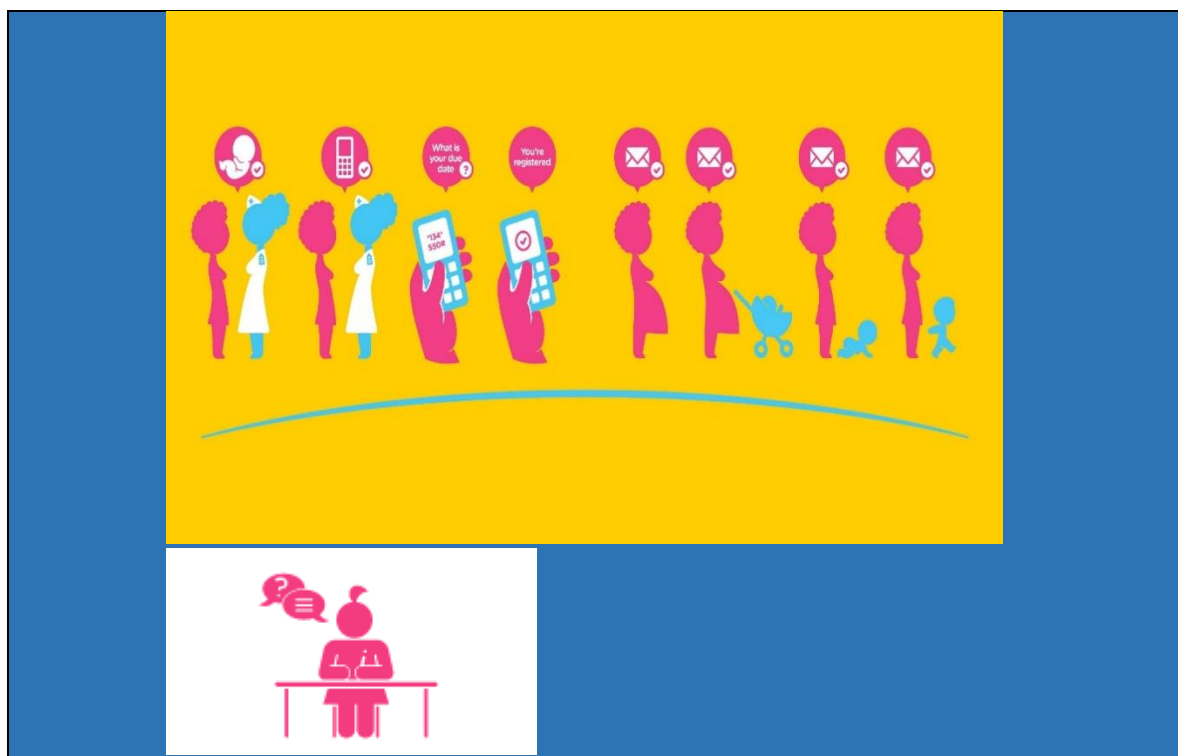
Figure 1-2: The MomConnect journey (including interaction with the helpdesk)
(Source: National Department of Health, MomConnect Flyer, 2014)

The rationale of figure 1.2 above is based on the need to obtain in-depth understanding of the functioning of MomConnect from the elementary stages until its apex stages after the birth of the child. Such detailed understanding is relevant, considering the need to establish the implications of MomConnect on the daily routines and management processes at clinic level (Wolff-Piggott et al., 2018).

1.7   The Research Concept

In the context of this study, the research concept sequentially entails the research problem statement, as well as the objectives and methodology of the study.

1.7.1   Problem Statement

The research concept was identified from a real-life mHealth problem in South Africa. A preliminary review of recent literature has provided credible reasons to focus research on service implementation of mHealth from a stakeholder-centred perspective, given that MomConnect represents the only full-scale mHealth initiative in South Africa. In many instances, especially in developing countries, mHealth initiatives do not proceed beyond piloting stages where they are designed to solve specific health problems, are implemented in silos, disintegrated, and dependent on donor funding (Wolff-Piggott et al., 2018).

Service delivery to benefit patients and meeting the SDGs has mostly been possible by means of substantial MomConnect donor investments and government commitment to upscale the programme nationally at its very from inception (Skinner, Delobelle, Pappin, Pieterse and Esterhuizen, 2018). Such over-reliance on donor funding frequently creates a funding gap when early catalytic grant funding has been spent, but programmes have been unable to secure the resources required to support implementation at national scale (Barron et al., 2018).

1.7.1.1   What is the problem?

In this study, the most essential aspect of the research concept is located within the problem being investigated, and answers the question: *What is the problem?* As indicated earlier in Section 1.2 (pp. 2-4) of this study, the scalability and sustainability aspects of mHealth innovations constituted the rationale of the study being conducted. In the same vein, these fundamental tenets of the rationale invariably answer the question: *What is the problem?* The scale-up of mHealth services and innovations is characterised by uncertainty, complexity and challenges to develop, implement, and rationalise (Hwabamungu, Brown and Williams, 2018; Salgado, Wendland, Rodriguez, Meghan, Bohren, Oladapo, Ojelade, Olalere, Luwangula, Mugerwa and Fawole, 2017).

Scalability is complex, since it occurs across diverse systems, contexts and resources that differ between implementation sites (Baskerville & Myers, 2015; Power et al., 2019). Meanwhile, Wolff-Piggott et al. (2018) contend that heterogeneous stakeholders from different levels and during different time periods participate in networking during innovation and maintenance as there are continuously changing relationships depending on the roles, rules and modalities. Design and development methods are enacted differently by different participants in the development process, and situated in a particular contexts and situations involving different expertise across different disciplines and professions (Salgado et al., 2017).

Wolff-Piggott et al. (2018) state that the underlying conflicts between public health imperatives also contribute to the challenges as described.

1.7.1.2 How is it a problem?

The question: *How is it a problem?* basically underpins the core issues of the investigation, similarly expressed as: *Why is scalability and sustainability of mHealth a problem?* Amongst other factors, most mHealth innovations in low-to-middle-income countries (LMICs) do not transcend the pilot stages, while contextual factors and stakeholder involvement are not sufficiently considered during all the phases of the development process. These impediments could be substantiated as follows:

- Design and development methods are applied differently by different participants in the development process, and are situated in a particular context and situation and involve different expertise across different disciplines and professions (Salgado et al., 2017);
- There are underlying tensions between public health imperatives (Wolff-Piggott et al., 2018);
- Many targeted health innovations for improvement of health system reforms fail at implementation stage (Damschroder, 2020); and
- There are still many mHealth innovations in pilot stage in Sub Saharan Africa (Pankomera and van Greunen, 2018).

Similar to other services, mHealth services are not designed, produced and stored beforehand for consumption, but always co-created when rendered. Accordingly, such services cannot be implemented in the same manner as products in order to address the scale-up, sustainability and uncertainty. There are changes that happen in the later phases of implementation of mHealth services, especially because stakeholders who were in the earlier phases may not be in the later phases of the service. McCord (2015) advocates for a mind shift from 'user-centred' to 'stakeholder-centred' design, since implementation is not necessarily about the user, but the entire chain of stakeholders. Given that MomConnect was launched in August 2014, it is time to focus on the later phases of this implementation.

1.7.1.3 Why is it a problem?

Little is known about national roll-outs of mHealth projects in practice (Wolff-Piggott et al., 2018) and there is an increasing MomConnect disconnect. For instance, facility managers lament that they do not receive sufficient information, which confirms Gelano et al.'s (2018) claim that there was a lack of information on multi-stakeholder involvement during implementation of health innovations contribute to the lack of evidence on successful mHealth innovations. The managers also indicate the lack of evidence on the effects of macro-level policies and regulation on the production of scientific knowledge. Furthermore, not enough

attention is given to the target of mHealth innovation and there are still too many studies that show inconclusive results concerning health services improvement in LMICs (Ilozumba, Abenirinde and Dieleman, 2018). Moreover, there is limited focus on the later phases or 'back end' of mHealth development in both practice and research studies. Unfortunately, little research has been done on mHealth multi-stakeholder involvement during implementation of mHealth innovations (Overkamp and Holmlid, 2017).

The design, implementation and evaluation phases of mHealth development are not completely independent of one another, they overlap (Matthew-Maich et al., 2016). There is a knowledge gap in service implementation research, and four thematically convergent strategies or approaches have been identified and developed to guide exploration of this knowledge gap: implementation as part of the development process, implementation as strategy, implementation as design after design, and implementation as change of practices (Overkamp and Holmlid, 2017). This requires stakeholders as part of service design and implementation (Overkamp and Holmlid, 2017). However, there are further questions to be answered in this regard: *Who owns implementation? What should be incorporated in the strategy to mitigate for adequate and desired scale up and sustainability?*

In both practice and academia, a knowledge gap has also been created by the less limited focus on the later phases or 'back end' of mHealth development (Overkamp and Holmlid, 2017). Key stakeholders such as service designers leave the innovations with more knowledge acquired in the initial stages and the process of development. This may leave the mHealth services at risk due to the detached insight from the service designers and change in stakeholder priorities left in the service provision. But, how can this be prevented from happening and to ensure proper service implementation? Service implementation is described as the process of moving well-designed services from conceptualisation to the repeatability and regularity of services delivered (Overkamp et al, 2016). (Overkamp and Holmlid, 2017) argue that another solution would be to involve other stakeholders in the incipient stages to preserve the insight that might be lost with other stakeholders leaving. The difficulty becomes: How can this be achieved since nothing is known about user involvement in later phases (Overkamp and Holmlid, 2017).

In the literature consulted, two thematic mHealth design constructs are emerging, which are: user focused design, and interdisciplinary /collaborated team approaches. The latter includes technological experts, professionals in health care, end-users and diverse stakeholders, further noting the need for multi-stakeholder/ multi-sectoral involvement in the design of mHealth services to a point of developing interprofessional collaboration (Matthew-Maich et al, 2016). As a result of the collaborated impetus, improvements in patient satisfaction has been noted after clinic visits following implementation of mHealth services (Doocy, Paik, Lyles, Tam, Fahed, Winkler, Kontunen, Mkanna and Burnham, 2017). However, stakeholder-based

concerns emerged where clinicians' perspectives on this intervention were mixed. Consequently, further research was recommended on organisational and clinician factors associated with implementation of mHealth services (Doocy et al., 2017).

From the literature review, other mHealth service failures include programme management challenges, leadership transition and poor process design (Meyers et al., 2017). Notwithstanding, a close engagement or relationship of technological partners is a positive lesson – this makes stakeholder mapping pivotal in this study. Governments, businesses and other organisations have invested in ICT solutions in order to meet expectations of quality services they offer (Mawela et al., 2017).

However, these collaboration and partnership across public, private and non-governmental sectors still lack ICT implementation capacity, as evidenced even in e-government implementation (Mawela et al., 2017). The common e-government and e-health ICT implementation capacity challenges are noticeable in three areas: firstly, total failure reflected in either non-implementation or partial implementation and immediate abandonment of the initiative/ project; secondly, partial failure demonstrated by non-achievement of the most critical objectives of the initiative; thirdly, significant, desirable or successful achievement of stakeholders' main goals. The extent of stakeholders' attainment of their goals is a major determinant of successful projects on account of their stakeholder-centred perspective; therefore, it is even more compelling for the study to explore the service implementation research question (Mawela et al., 2017).

Mawela et al. (2017) report that a recent study showed ICT was not regarded as an important service department such as electricity and water, and also not viewed as an important support department or function such as finance or audit. Although this study focused on a municipality, it is evident that service implementation through ICT innovations warrant further exploration to ensure that different stakeholders clearly understand the support they could obtain through ICT services just like other support functions (Mawela et al., 2017). In such a situation, further research is required to investigate how current public sector organisational values could be changed to new values that support both e-government and mHealth.

1.8   The Purpose/ Aim and Objectives of the Study

The purpose or aim of the study refers to the more abstract and general intention or goal of the study in relation to the research problem and methods employed to resolve the identified problem or phenomenon (Brink, van der Walt and van Rensburg, 2013; Tilahun, 2017). Accordingly, the main purpose of this study was:

To design an mHealth Stakeholder-Centred Strategy based on best demonstrated practices (considerations and methods) and learnt experiences from the perspectives of the Digital

Health Innovation Ecosystem stakeholders in South Africa grounded in the related body of knowledge.

1.8.1 The Objectives of the Study

An objective of a study is effectively a representation of the articulated research question/s in terms of dissembling the study objectives by means of specified, measurable, achievable, realistic and time-specific processes/ procedures and activities ((Bradbury-Jones et al., 2014; Brink et al., 2013). Regarding this study, the objectives are:

- To explore and describe the perspectives of the Digital Health Innovation Ecosystem stakeholders as the basis for designing an implementable mHealth Stakeholder-Centred Strategy in accordance with best demonstrated practices and principles;
- To explore, describe and analyse strengths and weaknesses of previous and existing health care technologies (including MomConnect) as a framework for any lessons to be learnt for a successful and efficacious mHealth Stakeholder-Centred Strategy based on the relationships, collaborations and processes in the public health services;
- To propose a stakeholder-centred framework for an appropriately scalable and sustainable mHealth service Stakeholder-Centred Strategy involving the integration of development and implementation processes for public health care services.

1.9 Research Questions

Based on the main study purpose, three main subsidiary research questions were formulated, each with its own secondary research questions, represented as 'SQR'. The first main research question relates to mHealth strategy design considerations, and the second relates to mHealth strategy design methods; while the third main research question premises on lessons from the digital health innovation system.

1.9.1 Main Research Question 1: mHealth Strategy Design Considerations

Research Question 1
What are the design considerations of an mHealth service implementation strategy in terms of which mobile technologies are infused in health services (scalable), from a stakeholder-centred perspective?

SRQ 1.1: How do stakeholders involved in the same mHealth initiative rationalise their actions and experiences in the process of implementing a health service?

SRQ 1.2: What contextual factors could potentially influence scalability and sustainability of mHealth services as part of a digital health innovation ecosystem?

SRQ 1.3: What critical factors need to be considered for a re-engineering strategy that aims to implement and rationalize suitable mHealth services?

SRQ 1.4: What contemporary issues of an mHealth service influence its re-use?

1.9.2 Main Research Question 2: mHealth Strategy Design Methods (Practice Research)

Research Question 2

How should a suitable mHealth service strategy be designed and implemented to rationalise the involvement of relevant stakeholders and integrate development and implementation processes of an mHealth facilitated service?

SRQ 2.1: How do a stakeholder involved in the same mHealth initiative rationalize their actions and experiences in the process of re-engineering and implementing of a health service?

SRQ 2.2: Which appropriate methods could be applied to involve relevant stakeholders in the design of an mHealth service as a concept for implementation and rationalisation?

SRQ 2.3: Which key scalability factors should be considered in the implementation of an mHealth service during its development?

SRQ 2.4: Which key sustainability factors should be considered in the implementation of an mHealth facilitated service during its development?

1.9.3 Main Research Question 3: Lessons from the Digital Health Innovation Ecosystem (DHIE) (GP abstract knowledge)

Research Question 3

What can be learnt from the realities of a local mHealth-enabled health service based on the relationships, collaborations and processes of a specific situation?

SRQ 3.1: How can the best demonstrated practices be described in the context of digital development principles?

SRQ 3.2: What can be learnt from the mHealth environment within the Digital Health Innovation Ecosystem in South Africa?

SRQ 3.3: What measurements can be learnt about the demonstration case through development, adoption, scalability and sustainability?

SRQ 3.4: Which structures and agents can be conceptualised in the implementation of mHealth services?

It is noteworthy that all of the above-cited main research questions and their attendant secondary research questions are cohesively bound by various tenets of mHealth strategy design, which is the foremost aim of this study.

1.10 The Research Design and Methodology

The research design and methodology fundamentally relate to the philosophically informed processes, principles or strategies and data collection instrumentation employed to guide,

underpin and manage the study in both its theoretical (non-empirical) and empirical aspects and orientations (Figueiredo and Cunha, 2007). In this regard, both the design and methodology adopted in this study were fundamentally linked to the design and development of an mHealth Implementation Strategy as alluded to in both the research questions and objectives (Brink et al., 2013). Accordingly, the study's research design and methodological orientation entails the role of some theories (mostly prominent in Chapter Two); the explication of MomConnect as both the demonstration case and the foremost unit of analysis (most prominent in Chapter Four); and the practitioner-researcher perspective (also prominent in Chapter Two, but integrated into various aspects of the study as well).

1.10.1 Research Philosophy

The research philosophy refers to the conceptual principles and parameters that inform the scientific nature and methodological inclinations adopted in a study (Matua and Van Der Wal, 2015). Also, the research philosophy adopted in a study necessarily reflects how the researcher views reality and the world, including the most practical considerations to conduct data collection - given the complexity of MomConnect as a national project and the diversity of data sources involved (Matua and Van Der Wal, 2015; Peter et al., 2018).

Inspired by practice research, this study is underpinned by interpretivist-ethnographic epistemology. Empirical and non-empirical knowledge was developed to uncover strategy considerations that will guide scalable and sustainable mHealth services building up from stakeholders' knowledge, experiences and perceptions concerning MomConnect. The researcher aims to explore the social structures and stakeholder relationships in order to understand the process of implementing an innovative and re-engineered large-scale mHealth service facing patients (Donley and Graueholz, 2012). As an interpretivist-ethnographer, the researcher has prioritised the multi-level and multi-faceted methods and processes of collecting data from multiple sources and stakeholders in order to provide a fuller picture encompassing all aspects of the implementation process (Fetterman, 2010).

In this study, the research philosophy was enhanced by reference to various theories in an effort to provide a conceptual understanding and implications of terms associated with mHealth; for instance, the definitions in Section 1.3 as well as the summary of applicable theories in Table 2.1 (p. 34). In this regard, the theory of constraints (ToC) served as guiding concept for implementation of re-engineered stakeholder-centred mobile health programmes (Chen, 2016). Meanwhile, the stakeholder theory served as a guiding concept for implementation stakeholder-centred mobile health with the involvement of a heterogeneous stakeholder/ participant for the enhancement of the qualitative collection of data (Bond, Mulvenna, Finlay and Martin, 2015). On the other hand, the strong structuration theory (SST) served as the conceptual framework of the data analysis trajectory pursued in this study

(Greenhalgh, Wherton, Papoutsi, Lynch, Hughes, A'Court, Hinder, Procter and Shaw, 2018). In addition, the information systems theory served as a conceptual guide for discussions pertaining to the design and implementation of stakeholder-centred mHealth strategies (Gregor, 2002).

As the central unit or phenomenon whose design and core implementation aspects (i.e. scalability and sustainability factors) are being analysed in this study, the MomConnect initiative constitutes the core demonstration case in whose context multiple data collection methods and a heterogeneous stakeholder constituency were involved to examine the sustainability and scalability factors of a public digital health system (Kahn, Wareham, Young, Willis and Pilkington, (2008)

In tandem with the research topic, the philosophical orientation of the study encompasses a practitioner-researcher perspective in terms of which the researcher is simultaneously an active participant and/ or observer in the situation being analysed (Göran, 2011). In addition, the practitioner-researcher approach has been influenced by the fact that the researcher is also a public health practitioner with more than 10 years 'experience in the field. Moreover, the researcher served as a member of the MomConnect Task Team from November 2015 to June 2018 when he was employed by one of the implementing partner organisations and seconded to the National Department of Health to implement the digital/ electronic aspect of mother-to-child-transmission (eMTCT) of HIV component of the MomConnect initiative. Incidentally, this is the period during which the various critical activities and processes of the current study were undertaken and completed.

1.10.2 Research Approach

Linked to the research design, the research approach is largely described according to the research philosophical paradigm from which it emanates. Linked to its interpretivist-ethnographic background and character, the study has employed the qualitative research approach using qualitative data supported by its explorative, descriptive and evaluative elements (Wetter, 2011). Donley and Graueholz (2012) inform that qualitative studies are most appropriately suited for ethnography-interpretivism, since the intention is to explore, describe and interpret the world of the participants or stakeholders in respect of their knowledge, reality, experiences, and perceptions concerning the phenomenon being studied or research problem being investigated.

Since the researcher interacts directly with these stakeholders in their naturalistic or ecological environment, the researcher then becomes part of the research because he has participated in the process. In such cases, the researcher exercised maximum self-monitoring to avoid imposition of his own worldview on the different groups of stakeholders involved in this study (Fetterman, 2010). In this study, the qualitative approach was advantageous for its facilitation

of inductive logic or reasoning, according to which the idiosyncratic elements of the stakeholder perspectives could be referred to as an applicable framework for the broader environment outside of the original stakeholders (Hayes, Heit and Swendsen, 2010). In the context of this study, the inductive perspective was necessary, given that selected research environment was only a case study for the generalisation of a national health care service such as MomConnect.

For all its intents and purposes, the current study is essentially a health service research aimed at inductively exploring and evaluating the design thinking process, due to the nature and complexity of the digitalisation and integration of mHealth in a health service environment (Bauer et al., 2018). As an emerging discipline, service design research and thinking is now being widened to connect to health services research (Wetter, 2011). The process of service design applies, amongst others, to explorative and evaluative design approaches, which have been incorporated in this study is as well (Wetter, 2011). Figure 1.3 below is an illustration of the service design research model in the context of the information technological environment. The illustration is of particular relevance, given that the mHealth projects and services which the research will evaluate, are either in-use or have been-used.
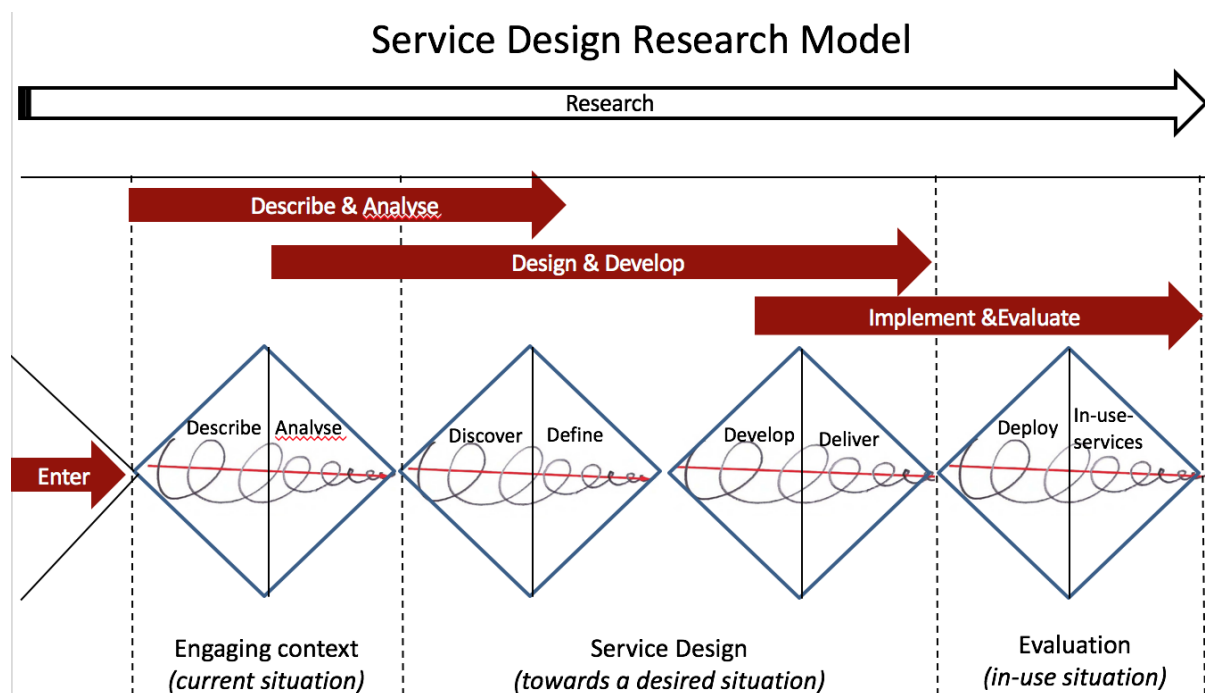
Figure 1-3: Service design research model
(Adapted from Wetter, 2011:34)

The service design research model provided guidance on the descriptive analysis and evaluation processes and procedures in order to conceptualise the scale-up framework that may be utilised to guide large-scale implementation of mHealth services from the very beginning. (Kuziemsky, Craig, Varpio, Hall, Casimiro, Leipe, Weaver et al., 2009) laments that, compared to quantitative research, the under-utilisation of qualitative and interpretive research methods and processes in health information systems limits the capacity of information service

designs. Continued research is needed to explore methodological approaches, especially qualitative analysis such as grounded theory or content analysis, to answer technology and health research questions (Kuziemsky et al., 2009). In this regard, the study adopted the service design research, since it allows the researcher to ask questions such as: why, by whom, and for whom? (Arvola and Holmlid, 2016). Such questions further explore, investigate and enhance more understanding on motivations behind any particular service design model.

1.11 Data Sources

Data sources were consulted for both the non-empirical (theoretical/ secondary) and empirical (primary) information deemed relevant and instrumental in yielding the expected research outcomes in relation to the research problem (Saunders, Lewis and Thornhill, 2016). Theoretical data sources involved the review of academically-inclined literature on the subject of mobile health re-engineering in general, and implementation specifically within digital health innovation ecosystems. Pertinent policy and strategy documents were also reviewed, such as the current NDoH's mHealth Re-engineering Strategy (MomConnect), the Non-adoption, Abandonment by individuals, failure of local Scale-up, distant Spread and long-term Sustainability/ NASSS Framework, as well current and archived minutes of the MomConnect Task Team.

In addition to the secondary data, the following key stakeholders constituted the main sources of the study's primary/ empirical data, and were consulted as a result of their involvement and 'first-hand' involvement in the different aspects and stages of the implementation of MomConnect, the government's mHealth Re-engineering Strategy within the Digital Health Innovation Ecosystem in South Africa.

- The MomConnect Task Team (MomCTTM) members;
- The Ministerial Advisory Committee on eHealth (MACeH); and
- Selected primary health care facility personnel (clinical staff);
- Non-clinical staff at the selected health care facilities; and
- Service users/ outpatients who received primary health care services at the selected health care facilities.

It is worth noting that the above-mentioned primary data sources of this study, also constituted the essential stakeholder categories and study population from whom the sample size (actual number of stakeholder participants) was selected for eventual participation in the study and its ethnographic orientation (Edmonds and Kennedy, 2017).

1.12 The Sampling Context

Sampling is described as the selection of a representative sub-group of individuals or units on account of the homogeneity or similarity of characteristics, qualities or attributes relative to the larger group (study population) or units from which it (sampled group) was selected (Kumar, 2012; Suresh, Thomas and Suresh, 2011). It is against this particular descriptive background that stakeholder mapping became very useful to the study by enabling the researcher's identification of all the critical stakeholders involved, and who had vested or special interests, influence and expectations in the various aspects and outcomes of the MomConnect project as government's flagship eHealth re-engineering strategy. Accordingly, the sample of the study comprised selected representatives of different constituencies and stakeholders in terms of: National Department of Health officials; the MomConnect Task Team; the Ministerial Advisory Committee on eHealth; primary health care facility personnel (clinical and non-clinical staff; and health care service users or patients at the health care facilities.

In this study, the stakeholder-focused sampling context (detailed further in Chapter Three) encompasses the study setting, study population and sample size, sampling method or strategy, as well as the sampling criteria.

1.12.1 The Study Setting

The study was held primarily at two geographically disparate locations in Gauteng Province (GP), Pretoria and Johannesburg. Pretoria, the administrative capital and executive centre of the South Africa government, was the most appropriate physical location (research site) for engagements with the MomConnect Task Team through individual semi-structured interviews and participant observation sessions of six of their monthly meetings. Most importantly, the National Department of Health - the primary driver in the implementation of MomConnect initiative, and also appointed the MomConnect Task Team – is located in Pretoria, which was an opportunity for this phase of empirical engagements to be held, including the archived documents in the MomConnect repository.

Further south of the capital city, Johannesburg (the largest city and economic hub of South Africa) was the primary setting for the focus group discussions with clinical and non-clinical staff, and health care service users. The researcher selected health care facilities located in the Johannesburg inner-city's Sub-District F. These sites include the Shandukani Maternal and Child Health Centre (Midwife Obstetric Unit) based at the Hillbrow Community Health Centre (HCHC), and the following 3 (three) primary health care referring facilities: Yeoville Clinic; Jeppestown Clinic, and 80 Albert Street Clinic. Figure 1.4 below indicates the location of Hillbrow within the City of Johannesburg in Gauteng Province.
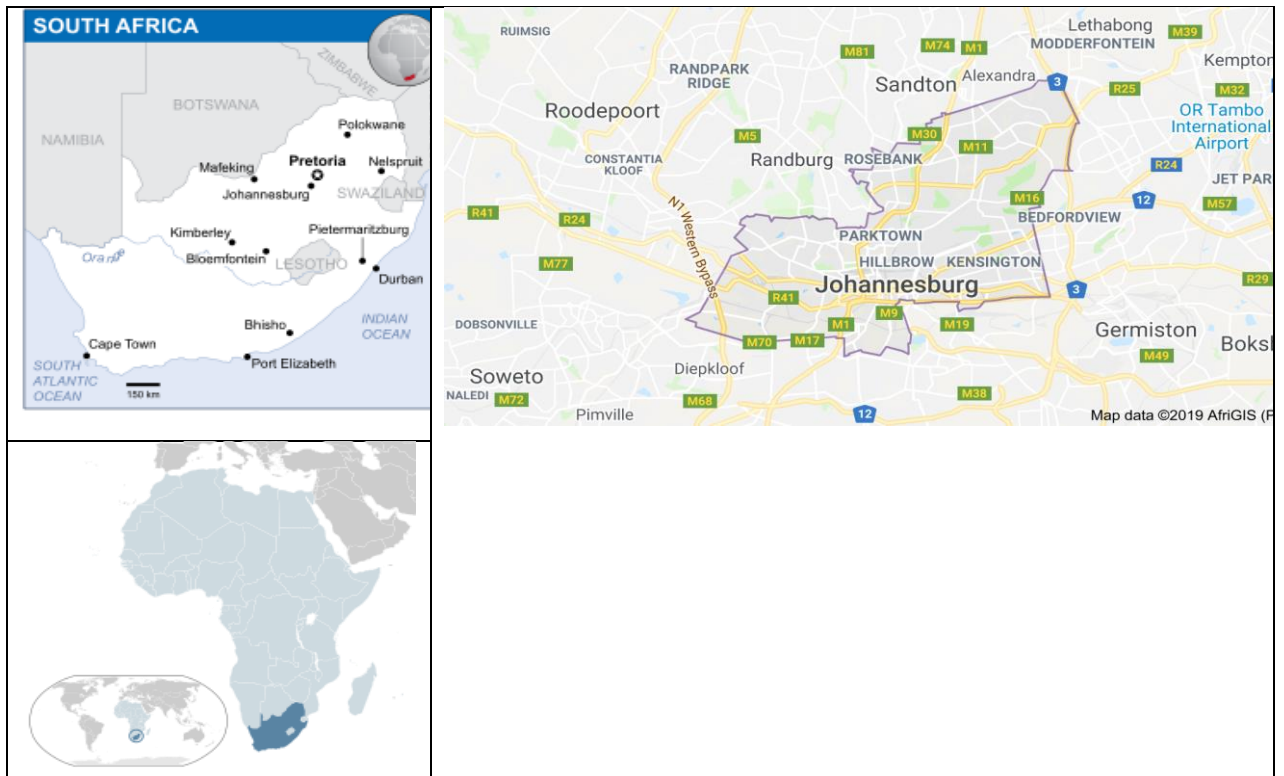
Figure 1-4: Map showing the location of Hillbrow within the City of Johannesburg in Gauteng Province

(Source: Wikipedia, 2019; Google Maps, 2019)

All of the health care facilities above are representative of all facilities in South Africa in that they provide PHC services and led by nurses/ midwives as health care professionals.

1.12.2 Study Population and Sample Size

The study population consisted of a heterogenous constituency of the MomConnect Task Team (MomCTTM) members; the Ministerial Advisory Committee on eHealth (MACeH); and selected primary health care facility personnel, who were the main sources of data. By means of stakeholder mapping, a representative framework was established for all the constituencies in terms of the (Pretoria-based) MomConnect Task Team's composition, and (Johannesburg-based) staff and health care service users. Hwabamungua et al. (2018) assert that in public health organisations, their heterogeneous composition was critical to successful strategy implementation at local, regional and national levels. It was from this larger study population that a representative sample was selected.

The MomConnect Task Team (MomCTTM) involved representatives of different private and public sector organisations, academic institutions and independent consultants. These representatives were involved at different stages of the MomConnect implementation and held monthly meetings since the inception of the MomConnect project. This mapping of the various groups and stakeholders is critical, since it enhances more understanding of the relationships and inter-relatedness of individuals, groups and the specific mHealth service itself (Kaufmann,

2017). In this particular case, all stakeholders are already known, but the extent of their interpersonal relationships is not known (at personal, familial or professional level). It is against this context that the mapping process is focused on the exploration and understanding their relationships rather than finding out who the stakeholders are (see Appendix L) (Sabet, Heard nad Brown, 2017).

The study's sample size consisted of the actual number of individuals who were selected for participation in the empirical aspects of the study (Hayes et al., 2010). From the above-mentioned heterogeneous stakeholder categories who simultaneously constituted the study population, the eventual sample size (actual number of stakeholder participants) is captured in Table 1.1, which also displays the respective research sites.

Table 1-1: Sample size and research sites representation

Participants/ Stakeholders	Composition	Number	Venue/ Research Site
MomConnect Task Team	NDoH officials; Implementing partners: Academia, Funders, NGOs, Consultants, Research Institutes.	15	National Department of Health, Pretoria
Ministerial Advisory Committee	It consists of one senior government official representative from each of the nine provinces, academia, research organisations(e.g. CSIR), private sector as per government gazette.	9 (nine)	Pretoria
Clinical Staff	Predominantly nurse working at clinics providing ANC services	5 (Five)	Johannesburg
Non-clinical Staff	Staff based at the facility who are not registered clinicians but do interact with the patients that come for ANC services: e.g. health promoters, lay counsellors, community health workers and data capturers within the facility.	6 (Six)	Johannesburg.
Patients/ Users	Pregnant women and mothers visiting health care facilities for maternal, child and women's health at the clinics. Women who were at the facilities on the specific day when researchers were at the clinic were all sampled and formed part of FGDs.	45	Johannesburg.
Total		**80**	

Based on the information in Table 1.1 above, the various stakeholder groups and their articulated composition at the respective research sites finally constituted a sample size of 80 research participants.

1.12.3 Sampling Method/ Strategy and Sampling Criteria

The sampling method or strategy pertains to the technique employed in the selection of relevant stakeholders for participation in the empirical data collection, such that their involvement advances the resolution of the problem being investigated and the objectives of

the study (Creswell and Creswell, 2018). In this study, two sampling techniques were employed to address two inter-related aspects of the sampling context, namely: the stakeholders/ participants themselves, and the research sites (Pretoria and Johannesburg).

Non-probability judgement or purposive sampling was utilised for the selection of participants who eventually constituted the sample size of 80 on account of their availability, accessibility and qualities (e.g. knowledge and experience) (Bradshaw, Atkinson and Doody, 2017). This sampling strategy was based on the researcher's own professional judgment that these sampled participants or stakeholders complied with the requirements or criteria that he determined prior to the execution of the empirical data collection phase (Brink, 2013; Creswell and Creswell, 2018). In this regard, the Ministerial Advisory Committee on eHealth representatives were selected mainly on policy-related reasons, given their knowledgeability and close interactions with the Ministry of Health.

Furthermore, the MomCTT members were sampled on the basis that they represent different stakeholder constituencies involved in the implementation of the MomConnect project from national, provincial, district and sub-district levels, attended the MomConnect Task Team meetings regularly, and were very knowledgeable on the project's functioning, mandate and expected deliverables when appointed by government.

Professional clinical staff were purposively selected on account of their practice-related knowledge and professional experience pertaining to the functioning of their health care facilities in Johannesburg. On the other hand, the purposively sampled health care users were mothers who came for maternal child and women's care (MCWH) services, pregnant women who came for antenatal care (ANC), and mothers who came for postnatal care (PNC), (see Appendix K for the researcher's guidelines and questions in his engagement with the health care users at the facilities).

Meanwhile, the Johannesburg inner-city primary health care facilities were chosen according to the non-probability convenience sampling strategy. Convenience sampling makes allowance for the researcher to select participants or facilities on account that they are readily accessible or available (Coleman et al., 2017). The three Johannesburg-based clinics were selected because they were located in high-density populations, which ensured large-scale participation in the study. Furthermore, each of the three study clinics in Johannesburg's Region F offer similar primary health care services which predominantly focus on HIV/ AIDS and maternal health (ANC and PNC /vaccination (PNC/ EPI) services. ANC services are offered four days in a week (Monday to Thursday) at each site, and pregnant women are expected to attend at least 4 (four) ANC visits prior to their estimated date of delivery. During the 2014 calendar year, these three clinics (Yeoville Clinic; Jeppestown Clinic, and 80 Albert

Street Clinic) registered an average of 90, 100 and 120 first ANC monthly visits respectively (Wolff-Piggott et al., 2018).

The regularity or frequency of the helpdesk visits at the three healthcare sites, particularly by these socioeconomically disparate groups of women, resonates with the observation by Xiong, Kamunyori and Sebidi (2018:1) that: "Most users access the MomConnect helpdesk for maternal information rather than for discussing health services received. Despite it being an unadvertised resource, use of the helpdesk is high, with an average of 252 messages received per day during the period analysed. Messages received were strongly correlated with the utilisation of ANC services in provinces". The latter observation coheres with the assertion by Engelhard, Copley, Watson, Pillay, Barron and LeFevre (2018), that MomConnect helpdesk in various healthcare centres serve "as a social accountability mechanism" that directly connects people/pregnant women using ANC and PNC services with the National Department of Health.

1.13 The Potential Contribution of the Study

There are two inter-related levels at which the significance of this study is established, namely, the epistemological and research methodological contexts. In the epistemological sense, the study makes a contribution to the generation of knowledge from a stakeholder perspective, which also coheres with the foundational tenet of the research topic; namely, a stakeholder driven perspective directed at implementation rather than theorising or being academic about an existing phenomenon or prevalent state of affairs (Tabish and Nabil, 2013).

In the research methodological context, the study is uniquely positioned by its integration of the researcher-as-participant in the same study as his participants, and in an environment of which he is not a peripheral observer or onlooker only. Between the researcher and the unique knowledge generation approach, stands MomConnect as the core variable or unit of analysis. In this regard, the eclectic weaving of methods and approaches have rendered to the study, the unique contribution of practical problem solving, or the pragmatism and action with which cases of policy development and implementation discord (as well as theory and practice gaps) could be addressed (Groop, Reijonsaari and Lillrank, 2010).

The study's contribution is also to be realised in the benchmarking of mHealth services. It has been noted that the longevity and successful roll-out of programmes such as the MomConnect initiative was hamstrung by factors such as resource capacity, planning design and stakeholder involvement and coordination by the National Department of Health. With the benefit of lessons learnt from these challenges, this study (and its proposed mHealth Stakeholder-Centred Strategy) contributes to health services policy design, implementation and management beyond the life span of donor funding, which may also assist benchmarking by other health services, not necessarily maternal health services only.

Given the South African health care system and its active stakeholders, this implementation strategy will fill this gap. Currently, there is insufficient evidence, that national and provincial departments of health in South Africa, and Ministries of Health in other African countries can use to make decisions on wide-scale sustainable implementation of digital and personal-connected health services such as mHealth to enhance other health services such as maternal, child health, and women's health. Without this critical evidence, description of lessons learnt, exploration of failures and successes, the implementation of successful and sustainable large-scale mHealth programmes remains uncertain (Marcolino, Oliveira, D'Agostino, Ribeiro, Alkmim and Novillo-Ortiz, 2018).

1.14 Delineation of the Research

This study focuses particularly on health as a service (from a service design perspective), and mHealth from a patient-facing service perspective, especially to empower patients to take care of themselves and able to engage with the health services from outside of the health facility. Health services are only explored from a perspective of strengthening and expanding them through mHealth in order to reach targets in Goal 3 of the Sustainable Development Goals by 2030. Therefore, this study is located entirely on health care service implementation, and does not include any clinical outcomes, behaviour change or impact evaluation of MomConnect.

1.15 Ethical Considerations

Ethical considerations reflect on, amongst others, research-researcher relations, treatment of participants, and the researcher's compliance with both regulatory and administrative requirements of the institutions and/ or organisations that are directly involved with the research (Fanta and Pretorius, 2018; Suresh et al., 2011).

1.15.1 Ethical Clearance and Permission

A written proof of ethical clearance was granted by the Cape Peninsula University of Technology (CPUT) for official commencement of the study (see Appendix A). Similar permission was sought from, and granted by the National Department of Health (see Appendices B to E). Each stakeholder was contacted and invited to participate in the study with both the CPUT and NDOH approval documents attached as proof of the study's endorsement. The information sheets and informed consent forms were also attached, providing a full and detailed disclosure of the study and its objectives (see Appendix G and Appendix H).

1.15.2 Participants' Informed Consent

This study involved only participants over the age of 18 years. Participants' informed consent is an indication of their agreement to participate in the study voluntarily after a full written disclosure has been made by the researcher (Kendall and Halliday, 2014).In compliance with

this ethical requirement, the participants were provided with an information sheet indicating the study purpose, how the findings will be utilised, and the expected level and manner of their involvement. Both the informed consent and information sheet were read and explained to the stakeholders before they could participate, so that they can make an informed decision. The information sheet included, but was not limited to the following aspects:

- There was no risk to the participant or the facility for participating in this study;
- No financial reward is due to the participants or district for participating in this study;
- No reimbursement was made to participants or district during and/or after the study; and
- Participants could withdraw at any stage of the study should they wish to do so.

Having read the information, participants were expected to sign the informed consent form together with the researcher as an indication of voluntarily agreeing to participate in this study, and understanding the expected manner of participation.

1.15.3 Protection of Participants' Identities

The protection of participants' identities was a form of ensuring their privacy, confidentiality and anonymity (Kendall and Halliday, 2014; Polit and Beck, 2012). In this regard, no personal information of the participants or names of stakeholder organisations is shared in this study. No patient files were reviewed, nor their confidential clinical information discussed whatsoever. All information was treated and recorded anonymously. Only participants' experiences in implementation of the mHealth service was discussed. Personal identifiers were removed from research-related information. Implementation documents such as minutes of MomConnect Task Team meeting, progress reports and subscription data were reviewed and reported anonymously in such a way that stakeholder relations are not harmed.

Paper-based records will be kept in a secure location and only accessible to researcher. Computer-based records will only be available to researcher and supervisors involved in the study through the use of access privileges and passwords. The documents to be reviewed were located at the MomConnect repository – sensitive budget figures were not disclosed, and funders' terms and conditions were also observed. The findings were shared with the MomCTT (in which all stakeholders that are part of implantation are represented) and the National Department of Health at the end of the study.

1.16 Conclusion

This chapter has given the scope of the study. It has also given the research gap in literature and in practice, including how the researcher executed the study. The next chapter address the foundations of the study and literature review.

CHAPTER 2: THEORETICAL AND EMPIRICAL FOUNDATIONS AND LOCATION WITHIN LITERATURE

CHAPTER ONE: Rationale and Scope of the Study

CHAPTER TWO: Theoretical and Empirical Foundations and Location within Literature

- Introduction
- Section A: Theoretical Foundation of the study
- Section B: Concepts guiding study's Empirical focus
- Section C: Location of the Study within Literature
- Coclusion

CHAPTER THREE: Description of the Research Methodology

CHAPTER FOUR: Local Practice as The Case: MomConnect Innitiative

CHAPTER FIVE: Situational Inquiry and Theorising (Phase 2)

CHAPTER SIX: Stakeholder Analysis (Phase 2)

CHAPTER SEVEN: Practice Based Analysis: Phase 3 (NASSS Framework)

CHAPTER EIGHT: Practice Based Analysis: Phase 4 (Principles of Digital Development)

CHAPTER NINE: Practice Based Analysis: Phase 5 (Global Digital Health Index)

CHAPTER TEN: Synthesis as Convergence of Findings from Phases 1 to 5: Using Strong Structuration Theory as Lens

CHAPTER ELEVEN: Practice Enhancement: An Evolving Stakeholder Centred Strategy for Mobile Health re-Engineering

CHAPTER TWELVE: Discussion of The Findings As a Mechanism to Highlight Insights From The Study

CHAPTER THIRTEEN:

2.1   Introduction

This chapter principally presents an overview of theories that guided the study in terms of both its empirical/ practical perspective and literature underpinnings. The chapter is structured into three sections, all of which respectively reflect the contiguous association between specific theories, their seminal tenets, and their relevance or applicability to this particular study and its idiosyncratic practitioner-researcher methodological character (Hultgren and Goldkuhl, 2013). By virtue of the structure and focus of the entire study, the three sections in this chapter further advance a degree of seamlessness between the aspects of implementation and stakeholder-centredness entailed in the research topic. Accordingly, and in terms of the study's practitioner-researcher approach, it is not so much the theoreticity that is of much significance. Rather, of particular significance is the utilitarian value derived from the capacity of the theories themselves to allocates a degree of pragmatism at both the methodological and outcomes/findings levels of the research process to enable the narrowing of the gap between theory and practice (Hilton and Hilton, 2017). Figure 2.1 below illustrates the realms of theory and practice in knowledge generation.
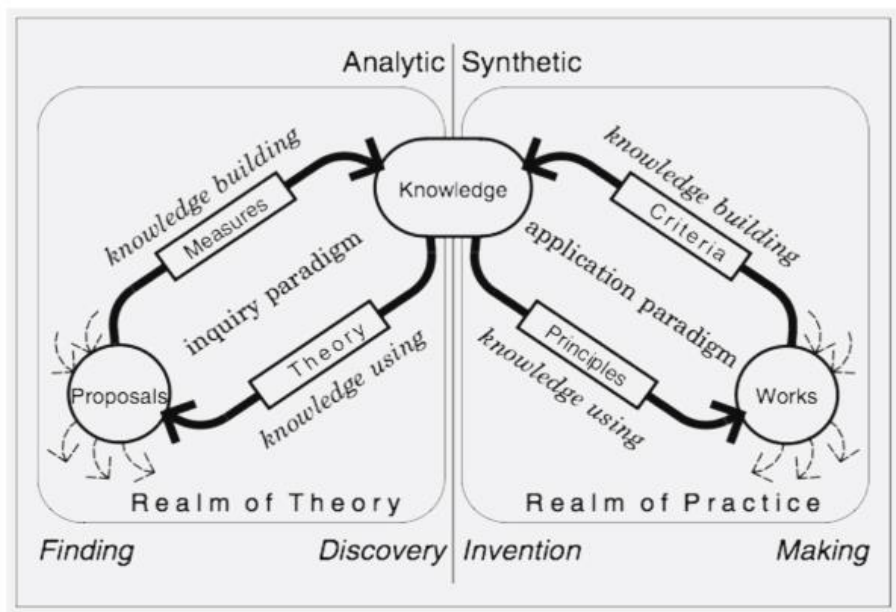
Figure 2-1: Practical vis-à-vis theoretical premises of knowledge generation
(Source: Owen, 1998, cited in Jonas, 2014)

The rationale of Figure 2.1 above is to illustrate the philosophical or conceptual parameters of both abstract (theoretical) and practical knowledge production. The latter is the principal orientation of the study, whose pragmatism rests on both the *implementation* and *stakeholder-centredness* aspects of the research topic by means of which the multiple research methods and stakeholder categories informed the key tenets of the practitioner-researcher perspective adopted by the study (Hultgren and Goldkuhl, 2013). Additionally, Table 2.1 (p. 34) signifies

the rationale and justification for the selection of the particular theories being referred to in this chapter (Owen, 2014).

Damschroder (2020) intimates that theories, despite their abstract and philosophical nature, are not peripheral to the subject matter or phenomenon the researcher is investigating; but rather, theories provide scientific understanding to humankind's everyday experiences and problems. Therefore, the study' theoretical underpinnings were considered as relevant for understanding the conceptual aspects of the nomenclature associated with mHealth in its organisational and strategic environments (Mueller and Urbach, 2013; Pinto, Spector and Rahman, 2019) The latter authors also illuminate that theories, in addition to providing conceptual understanding, also demonstrate the relationship between these concepts, as well as the contextual or scientific boundaries between these concepts. For purposes of this study, the latter perspective is both critical and useful, given the complexity of the subject matter in its integration of health service care delivery and technology. For further purposes of this study, Mueller and Urbach (2013) and Pinto et al. (2019) affirm that the utility of theories is manifested as follows:

- theory as an input to strategy design;
- theory as a means to evaluate design of a strategy (hypothesis of design effects);
- theory as a building block for empirical evaluation (e.g. design experiments);
- theory as a meaningful device to interpret empirical intervention results; and
- theory as an output of evaluation in the sense of a refined or even changed conceptual understanding.

2.1.1 Theoretical Orientation of the Study and Justification

This study's primary aimed is to produce a sustainable mHealth Service Implementation Strategy framework that is not stagnated by organisational 'pilotitis' and improve efficiency in health care service provision. The National Department of Health's learned experience in mHealth is represented by the nationally scaled MomConnect initiative, which has been implemented by a task team (whose relationships are mapped later in this study). The study's proposed framework of guidelines will contribute to the strategy based on learned experiences and perceptions of all stakeholders (Tabish and Nabil, 2013). As such, the multifaceted integration of health aspects and technological requirements necessitate that theoretically driven perspectives be learnt or referred to, for better understanding as well as effective and sustainable design practices (Gurupur and Wan, 2017). Table 2.1 (p. 34) is a depiction of the inter-theory approach guiding the study and its justification.

Table 2-1: Theories and their justification

Theory/ Concept	Justification
The Theory of Constraints (ToC)	Acts as guiding concept in reconfiguration of mobile health to stakeholder-centredness
The Stakeholder Theory	As a consulting concept in reconfiguration of mobile health to be stakeholder-centred
Strong Structuration Theory (SST)	As an empirical approach for data synthesis

For logical presentation and obviating conceptual opacity, the present chapter is structured into three main sections, each focusing on particular aspects of the health-technology nexus.

2.2 SECTION A: THEORETICAL FOUNDATION OF THE STUDY

In this section, four main theoretical perspectives are presented, namely: the theory of constraints; the stakeholder theory; as well as the strong structuration theory.

2.2.1 The Theory of Constraints (ToC)

The theory of constraints is a guiding concept in mobile health re-engineering and implementation performance (Chen, 2016). Developed by Eliyahu Moshe Goldratt in the 1970's to optimise production systems through Optimized Production Technology (OPT), subsequently known as the Theory of Constraints (ToC), it provides philosophically informed premises for resolving/leveraging any limiting factors or 'bottlenecks' that pose risks to the achievement of goals and objectives within an organisation or a system (Ikeziri, de Souza, Gupta and Fiorini, 2018; Sadat, Carter and Golden, 2013). The alleviation of such limiting factors is enabled by the TOC's main philosophical assumptions, namely: convergence, consistency, and respect (Tabish and Nabil, 2013). These assumptions collectively posit that inherent simplicity is a viable management approach to limiting conflict factors or obstacles within complex systems or organisations on a consistent basis with due respect to the people involved (Tabish and Nabil, 2013).

In the context of this study, the MomConnect initiative of the National Department of Health is frequently referred to as a demonstration case to identify both its success and inhibiting factors with specific regard to its sustainability and scalability since its inception in August 2014 to broaden health access to all. Notwithstanding his reference to the ToC, the researcher also notes concerns raised by authors such as Sadat et al. 2013), who note – among other possible inherent weaknesses of the ToC - that it lacks evidence-based modification and performance measures to compare publicly-funded health systems with public for-profit companies from which the ToC is cognate (Sadat et al., 2013). The latter perspective (of the ToC's inherent weaknesses) is also shared by Chen (2016) and (Groop et al., 2010), who contend that assessing the efficacy of technologies that strive to improve productivity may not necessarily apply to assessment approaches that were commonly in use in the healthcare sector.

Contrarily, despite the inherent weakness (on non-adaptability) Ikeziri et al. (2018:2) emphasise that the ToC is still a valid "… global management philosophy focused on leveraging performance and offering decisive competitive advantages to organisations". The latter authors contend that the efficacy of the ToC as a performance management concept is applicable to a range of fields, such as " …production, supply chain, projects, accounting, distribution, and retail" (Ikeziri et al., 2018:2). To this effect (a counter argument to the non-adaptability contention referred to earlier), the ToC's is credit with its generalisable explanation of phenomena in many disciplines; simplicity (parsimony) of the logic behind the relationships among its concepts; capacity of its innovative approaches for further development of hypotheses; its internal consistency; propositions that are subject to confirmation outside of themselves; and the higher abstraction levels of its theoretical proposition statements (Ikeziri et al., 2018).

Principally, the theory of constraints builds on the premise that every advanced system (e.g. processes in production), can be further reduced into several activities. According to Tabish and Nabil (2013), such reduction ought to focus on responding to these three questions: What needs to be changed?, Into what should it be changed?, and What actions are required to cause the change?. The core features of the ToC are the five focusing steps in terms of which the system is analysed, and identified constraints are addressed and confronted. Figure 2.2 below illustrates a general description of the five focusing steps used in the ToC.
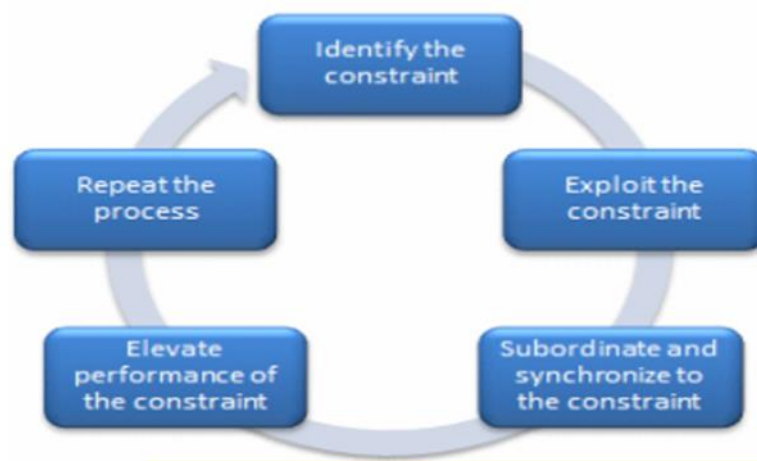
Figure 2-2: Five focusing steps in system analysis
(Source: Tabish and Nabil, 2013: 2678)

Figure 2.2 above shows the five focusing steps in analysing the design features of a system. These steps are:
1. Identifying the system's constraint(s);
2. Deciding on how to exploit the system's constraint(s);
3. Subordinating all else to the above decision(s);
4. Elevating the system's constraint(s); and

5. Checking for a breakdown or constrain in any of the above steps. Revisiting step 1 expeditiously in the vent of constraint identifies, and not allowing inactivity to cause a system's constraint.

The researcher opted for a qualitative research design, rather than a quantitative design. The decision was due to the fact that qualitative research may offer an in-depth contextual understanding of the implications of applying the ToC in a healthcare context. Table 2.2 below indicates such implications.

Table 2-2: Implications of applying the ToC in a healthcare context
(Source: Chen, 2016:21)

Constraint location	Constraint type	Constraint identification	Approach to constraint alleviation
Patient cancellation of surgery invitation	Policy, external	Patients are able to cancel the their surgery appointments just one day before surgery	Establish "short notice" surgery appointments where patients are offered surgery with short notice.
Coordination between physicians, anesthesia and coordinators	Physical, internal	The communication between inter-departmental functions are limited or non-existent, results in confusions and misunderstandings when scheduling patients	Establish daily meetings with the inter-departmental functions to alleviate communication and decrease misunderstandings
Incomplete surgery notification	Physical, internal	Surgery notifications for patients are missing vital information about patients for surgery	Launch workshop and establish guidelines for how to conduct a proper notification and launch a check list of required information when surgery notifying patients
Operation competence among physicians – no coverage	Physical, internal	The coordinators have limited knowledge of surgery competence among physicians	Survey the physicians in the department of their capabilities in terms of operation competence

Table 2.2 above significantly highlights that the implications of applying the ToC in health care contexts will impact on the various approaches to the alleviation of constraints. As such, efficiency is enhanced consequent to such alleviation.

2.2.2 The Stakeholder Theory

For the purpose of this study, the stakeholder theory applies as a consulting concept in the re-engineering of mobile health. The stakeholder theory premises on the extent of involvement of relevant parties (e.g. individuals, organisations, groups, institutions) in the development,

decision-making and implementation processes of a project or strategy (Bond et al, 2015). Similarly, the design of an electronic information system for personal health (e.g. MomConnect) requires the involvement of all stakeholders and the inclusion of their specific contribution is a potential solution (Bond et al., 2015). It is the fundamental focus of this study to bring together stakeholders from all representative constituency groups to obtain their perspectives on a sustainable digital health care system, and then develop an appropriate framework to illustrate what a relevant technical stakeholder-driven solution would look like. The development and implementation of mHealth solutions is to a large part, due to the involvement of users as stakeholders (Marcolino et al., 2018).

(Gupta, Thorpe, Bhattacharyya, and Zwarenstein 2016) mentions that innovations progress through stages of maturity and the uptake of innovation depends on the innovation aligning with the interests of three critical stakeholder groups: innovators, end users and the decision makers. Innovation is also influenced by three broader contexts: social and physical environment, the health system, and the regulatory, political and economic environment. To facilitate stakeholder collaboration in SD-projects, the following assumptions for successful implementation of service innovation should be made:

> - Clear agreements regarding stakeholder responsibilities;
> - Prevalence of a flexible process, then a fixed and rigid process;
> - Service providers are not outsourcing opportunists;
> - Requisite organisational change for successful innovative SD-ideas (Yang and Varshney, 2016).

Beck et al. (2016) highlight that strong collaboration at local, regional, and national levels are prerequisites for successful development and implementation. Furthermore, such collaboration is a pre-condition for the successful implementation of a range of national and global programmes (Marcolino et al., 2018).

2.2.3   The Strong Structuration Theory

In this study, the strong structuration theory was viewed as providing impetus to the empirical domain of the study insofar as emphasising the indispensability of organisational and group communication in a holistic manner (Bernardi, 2018; Greenhalgh et al., 2018; Jeffries, Phipps, Howard, Avery, Rodgers, and Ashcroft, 2017). Figure 2.3 below illustrates the theory's main principles.
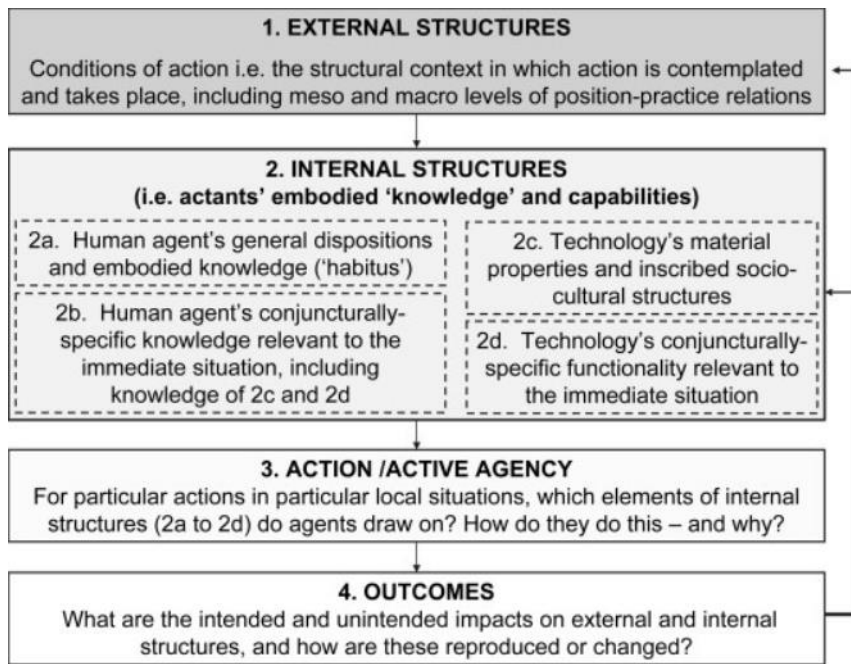
Figure 2-3: Strong structuration theory incorporating a technology dimension.
(Adapted from Greenhalgh et al., 2018:66)

In terms of Figure 2.3, the structuration theory's super structural domain is sequentially constituted by internal and external structures; as well actions and outcomes. In terms of this study, the theory's relevance is based on the fact that the researcher's proposed re-engineered mHealth framework is stakeholder oriented. Accordingly, external and internal conditions in the participants' environments to determine the nature (material properties) of the technological innovations to be developed and applied. Therefore, communication patterns between, and among the stakeholder was important to determine, as this would eventually determine the desirability or otherwise of the outcome (product being developed (Greenhalgh et al., 2018). In addition to Figure 2-3 and its emphasis on the technological dimensions of the strong structuration theory (SST), Figure 2-4 reflects the bureaucratic and democratic accountability perspectives.
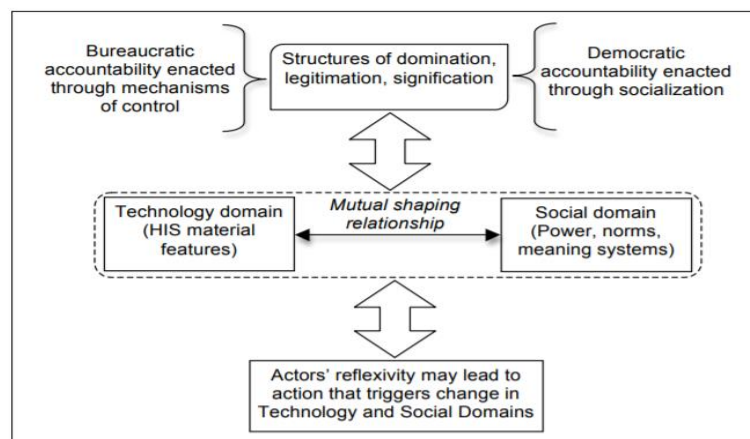
Figure 1. A structuration theory model of IS-mediated accountability

Figure 2-4: Strong structuration theory incorporating the bureaucratic and democratic dimensions. (Source: Bernardi, 2018:11)

It is clear from Figure 2-4 that the SST further entails technology in its bureaucratic and democratic dimensions. In this regard, the SST is posited as a multifaceted continuum of inter-related perspectives, principles and processes that advance information systems in health management.

2.3 SECTION B: KEY CONCEPTS GUIDING STUDY'S EMPIRICAL FOCUS

Following the various theoretical perspectives and orientations highlighted in Section A, this section (Section B) highlights specific key concepts that informed and guided the empirical focus of the study. These concepts derived from the literature are: eHealth contextual rationalisation; best demonstrated practices; the digital health innovation ecosystem, principles of digital development; the NASSS framework; and the global development health index that are summarised and discussed in more detail below (p. 39). The NASSS framework refers to Non-adoption, Abandonment, Scale-up, Spread and Sustainability) mechanism used as a best practice learning tool (Greenhalgh, 2018; Trilling and Jonkman, 2018). In this study, the NASSS framework is utilised to determine the extent to which MomConnect implementation and sustainability is measured, based on the empirically generated themes from engagements with the participants.

Table 2-3: Concepts and their empirical justification

Concept/ Frameworks, Practices, Principles and Indeces	Justification
eHealth Contextual Rationalisation	As a reasoning process during re-engineering in general (Pankomera and van Greunen, 2018; Tilahun, 2017).
Momconnect Best Demonstrated Practices	As an application of knowledge and experience in re-engineering implementation contexts (Iyawa et al., 2016; Pinto et al., 2019).
Digital Health Innovation Ecosystem (Chapter 12)	As a community in which mHealth services exists (Iyawa et al., 2016).
Principles of Digital Development (Chapter 8)	As an interpretation guideline of best practice and existing gaps (Aranda-Jan et al., 2014; Bauer et al., 2018; Salgado et al., 2017).
NASSS (Non-adoption, Abandonment, Scale-up, Spread and Sustainability) Framework (Chapter 7)	As a measurement tool (Greenhalgh et al., 2018; Trilling and Jonkman, 2018).
Global Development Health Index (Chapter 9)	As an assessment tool for the demonstration case to feedback regarding the mHealth environment (AbouZahr, Boerma and Hogan, 2017; Hogan, Stevens and Hosseinpoor, 2018)

2.3.1 eHealth Contextual Rationalisation

eHealth contextual rationalisation is presented as a reasoning process in re-engineering contexts. In the context of this study, eHealth contextual rationalisation applied in the sphere of the reasons and reasoning provided by the participants for the enhancement of mHealth

during the various interview sessions (Ngoc, 2018). For instance, in a business organisation, rationalising an organisation's processes would entail the reasons and reasoning allocated by the concerned internal stakeholders for a particular cost-efficient method to increase the levels of production without the necessity to make large investments (Groop et al., 2010; Izekiri et al., 2019). MomConnect came into existence against the backdrop of a number of similar mobile health pilot programmes aligned and rationalised by the National Department of Health into a single overarching initiative (Peter et al., 2018).

Emanating from the literature, there is consensus on the need for mHealth service implementation to be rationalised. This strategy (MomConnect) will need to cover issues that have not been addressed previously such as institutionalisation of digital health, and provide a clear description of the differentiation of such a digital strategy from other strategies, given that it is stakeholder-centred; 'service implementation oriented; and based on nationally scaled mHealth (Duarte and Pinho, 2019). Therefore, any durable mHealth strategy for the future ought to encapsulate all of the latter aspects.

2.3.2 Best Demonstrated Practices (BDP)

In this study, the notion of best demonstrated practises is relevant as an application of knowledge and experience in re-engineered strategy implementation. (Iyawa et al., 2018) defines healthcare innovation as those practices aimed at improving treatment, diagnosis, education, outreach, prevention and research, and with the long-term goal of improving quality, safety, outcomes, efficiency and costs. This study aims to make use of the best practices learnt from the MomConnect Stakeholders in order to re-engineer mobile health as a contribution to health care innovation. The latter authors further characterise the digital health ecosystem with the best practises. In this study, the concept of best demonstrated practices was adopted in the researcher's conceptualisation and adoption of ten stakeholder-centred mobile health re-engineering strategy implementation framework areas (alluded to in the study's Abstract and Sections 12.3 and 12.4 in respect of the extent to which the study aim and objectives were achieved. Best practice is a method or technique that has been generally accepted as superior to any alternatives, because it produces results that are superior to those achieved by other means, or because it has become a standard way of doing things (Iyawa et al., 2018). Figure 2.4 below illustrates the process of integrating best demonstrated practices for continuous improvement and innovation in health care.
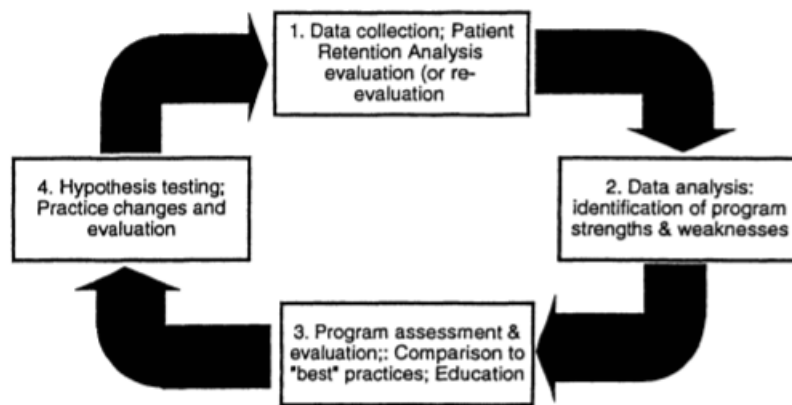
Figure 2-5: Integration of BDP components into a continuous improvement process (Source: Holden and Villano, 1994:240)

Figure 2.4 above is an illustration of four important BDP components that are useful for the improvement of a health care process. In component 1 (data collection), the retention, analysis and evalution of patients is crucial. In component 2 (data analysis), the identification of the strengths and weaknesses of a program or strategy is crucial. In component 3 (programme assesment and evaluation), health care best demonstrated practices are compared with those of other professions. In component 4 of BDP (hypothesis testing), evaluation of changes occuring in health care practice are critical.

Holden and Villano (1994) mention that best demonstrated practice has been utilised by professionals to analyse performance, which is characterised by two aspects: measurement of individual centre performance; and determination of 'best' practices from excellence centres. This process was useful in understanding the practices that enhance success and failures. The application of BDP processes has modified other practices to effect outcomes and identified strengths, challenges and weaknesses. In this study, the BDP principle was helpful for understanding best practices for the proposed MomConnect initiative. Best demonstrated practices were used to unpack the practices of the MomConnect case, explained in more detail in Chapter Eight and Chapter Nine.

2.3.3   Digital Health Innovation Ecosystem (DHIE)

DHIE is presented in this study as the community within which mHealth services exist.(Mitchell and Kan (2019) mention that significant challenges remain in implementation, despite a growing consensus that digital health is a positive change in the delivery of health care in low- and middle-income countries. Inputs from research experts and practitioners in South Africa, Africa and Europe working in mHealth portray the conceptual digital health innovation ecosystem as potentially viable. Feedback indicated that the conceptual digital health innovation ecosystem for South Africa is a good reflection of the realities of developing contexts where all role players that affect digital health are indicated (Herselman, Botha, Toivanen, Myllyoja, Fogwill, and Alberts, 2016). The Digital Health Innovation Ecosystem consists of

three interactive, complementary modules: context, the innovation lifecycle and users or stakeholders (Herselman et al., 2016).

Herselman et al. (2016) further urge that it is time for South Africa to use its own best demonstrated practices, because effective technology transfer will not occur only by means of outsourced off-the-shelf-technology solutions. Consideration of local conditions are a conducive mechanism to affect a viable digital health innovation ecosystem. Due consideration of local conditions and demands are indispensable for the design and implementation of relevant, user-friendly, cost effective and stakeholder-centric eHealth and mHealth policies and technologies (Kruse, Betancourt, Ortiz, Valdes-Luna, Bamrah, Segovia, 2019).

2.3.4   Principles of Digital Development

Principles of digital development were also helpful as an interpretation guideline of best practice and existing gaps. Bauer et al. (2018) regard the principles of digital development as viable, and have potential to guide improvement efforts in health care services and/or quality in mHealth. These authors further proposed five more principles: public health design impact; user value add; product and process testing; acknowledging discontinuities; and expectation of changing circumstances.

The principles of digital development were developed due to conflicts among international development organisations regarding access to digital technology. As such, a proactive system is required to include better technological outcomes (Bauer et al., 2018). Organisations involved in access to digital technology include: The Bill and Melinda Gates Foundation, the Swedish International Development Agency (SIDA), the UN's Children's Fund (UNICEF), UN Development Program (UNDP), the World Bank, and the U.S. Agency for International Development (USAID), and the World Health Organisation (WHO) and these principles were as a result of lessons learnt through ICT for Development, which also included ICT for Health. According to Principles for Digital Development (2018), there are nine active guidelines designed to facilitate the integration of best practices in technological programmes, which are to be updated and refined over time (WHO, 2010). These guidelines include guidance for every phase of the project life cycle, and are part of an ongoing effort among development practitioners to share knowledge and support continuous learning (Aranda-Jan and Loukanova, 2014).

In using the principles of digital development, organisations are expected to officially agree as an indorsement gesture, to use the principles in their work. These principles are relevant to this study because it is based on mobile technology. The principles can be used in different ways. In this study, they are used to interpret findings and the outcome may contribute to the

establishment of a digital community (Digital Principles Forum, 2018). A chronologically determined summary of digital development principles in the previous two decades indicates:

Early 2000's: Donor and multilateral representatives start discussing common implementation challenges of digital development projects;

2009: The UNICEF launches their innovation principles;

2010: 40 mHealth donors and practitioners meet to discuss practice in digital development, resulting in Greentree Principles;

2012: The UK government develops its own Digital Service Design Principles;

2014: Principles for Digital Development Working Group is formed for purposes of gathering community insights, recommendations and challenges. Members of the group included donors, implementers and development practitioners, meeting about nine times that year for in-depth discussions on each of the Principles and to make recommendations on the application of the Principles;

2015: Launch of the endorsement campaigns led by USAID, and 54 international organisations endorse the first year.

2016: The report, 'From Principles to Practice' is published; and

2017: Development of implementer resources and update to digitalprinciples.org; Launch of the Principles for Digital Development Forum.

The history of the principles of digital development suggest that the momentum towards integration and accessibility has been an international effort. This state of affairs also implies that uniform principles are essential and not optional, given the current state of cyber-crimes, as well as intellectual property rights, domain rights and privileges, and patent conflicts (Leon et al., 2012). Therefore, adherence to the afore-cited principles has to be observed in order to maintain an innovated digital health ecosystem consistent with acceptable global practices (Bauer et al., 2018).

2.3.5 Global Development Health Index (GDHI)

The Global Digital Health Index (GDHI) is an interactive web-based resource that aims to track, monitor, and assess the enabling environment for digital health throughout the world (Digital Health Index, 2019). The GDHI provides an indication of the state of digital health around the world, and participating countries are scored according to the state of their respective digital environments and practices (Hogan et al., 2018). According to the inaugural State of Digital Health report, which is aimed at providing the first ever snapshot of digital health ecosystems throughout the world and further lays the foundation for better informed and coordinated investments in digital health, reported that in 2019, only 22 countries across six global regions have participated in the GDHI (Global Digital Health Index, 2019).

The GDHI is incorporate in this study as an assessment tool for the demonstration case for feedback regarding the mHealth environment. According to AbouZahr, Boerma and Hogan (2017) greater transparency and involvement of country partners in the development of global estimates will help improve ownership, strengthen country capacities for data production and use, and reduce reliance on externally produced estimates. There is insufficient data to represent the country. However, for the purpose of this study, exploring data themes may give an estimation in the context of this study, which is not aimed at collecting any global index data whatsoever. Nonetheless, the researcher found it useful to test the content of the data from the themes by using the Global Digital Health Index, given that future work should support countries or regions to adapt the index by selecting different tracer indicators according to data availability and priority health areas, while more work is needed to develop methods for tracking progress on the coverage of health-care services over time **(**Hogan et al., 2018).

2.4   SECTION C: LOCATION OF THE STUDY WITHIN LITERATURE

Whereas the previous section focused on concepts in their empirical context, this section (Section C) focuses mainly on the literature (non-empirical) context of relevant concepts and justification for the particular concepts mentioned. This study used a focused literature review to guide the empirical inquiry based on the concepts identified as experienced in practice. These concepts were grounded in the following fields: Healthcare, services, ICT and developmental studies. The focus of the study is mHealth as part of maternal healthcare services within the domain of healthcare.

Table 2-4: Organisation of identified key concepts within literature.

General practice concepts in the literature	Field orientation focus	Justification
ICT for Health Development	Healthcare, ICT and developmental	This study interrogates ICT for Development in health.
Digital Health	Healthcare and ICT	mHealth is part of digital health.
Re-engineering of Health Services in Primary Health Care	Healthcare and Services	This study focused on PHC facilities, where most health programs supported by mobile health technologies are based. The concept of PHC Re-engineering being the motivation.
Sustainable Development Goals (SDGs)	Developmental	mHealth is regarded as one of the tools critical to facilitate health service in order to meet sustainable goals.
Health Strategy	Healthcare	In order to re-engineer mHealth, a strategy is key as a guideline for implementation.
National Strategy development	Healthcare	MomConnect is a national initiative and should be incorporated in the national health strategy
E-services as Social Integration	Services	This study presents mHealth as a service.
mHealth as a Patient-Facing eHealth Service	Healthcare, services and ICT	In this study, the focus is mHealth that is patient facing, to assist in health and wellness services.

General practice concepts in the literature	Field orientation focus	Justification
mHealth Service Ethics: Security and Confidentiality	ICT	Cyber security cannot be separated from mHealth, considering the extent in which healthcare information may be sensitive, and even carry stigma.
Service Design Process	Services	The process of mHealth re-engineering is design in its nature.
Service Implementation	Services	Elements of implementing other services may assist the process on implementing mHealth.

Table 2.4 depicts the conceptual logic and adoption of concepts considered to be pivotal in the application or implementation of digital solutions in spreading health access to all, especially to socio-economically depressed sectors of society – such as the pregnant women who constitute an important part of the stakeholder constituency in the current study. From the perspective of this study, justification of the study's location in literature premises on the interpretivist orientation in terms of which the practitioner-researcher approach is pursued for the advancement of "… alternative voices [as] a novel way to develop applicable forms of understanding within the field" (Kahn et al., 2008:169).

2.4.1 Sustainable Health Development

In the context of this study, Sustainable Health Development (SHD) is closer to SDGs, rather than to ICT only. Information and communication technology (ICTs) has radically transformed healthcare delivery across many developing countries. The introduction of ICT in healthcare, particularly the application of mobile technology-based health care services (mHealth), has made healthcare delivery more accessible and affordable in recent times. However, the design strategies and capabilities of such devices have also been questioned (Whittaker, 2012).

Information and communication technologies for development, also known as ICT4D, refers to the application of 'information and communication technologies' toward social, economic, and political development, with a particular emphasis on bringing interventions that improve the lives of the less privileged, and marginalised people and their communities. The application is available and active in some areas of health, education and e-government (Tim, 2009). Mobile health, which this study is focusing on, is a good example of ICT4D, particularly that ICT for Health is one of the most frequently searched topics on the internet (Kendrick, 2017). The changing nature of information distribution due to the evolution of the web has important implications for health care, given the wide use of the web n providing medical information, giving patients the appropriate content based on signs and symptoms as well as to further enhance health education (Kendrick, 2017). High quality, personalised and accurate information is vital to patients, especially on relevant health topics (Kendrick, 2017).

The International Communication Union (ITU), acknowledges that none of the Sustainable Development Goals 2030, make direct reference to ICT. However, there is a role for ICT in achieving these goals (ITU, 2018). The 2030 Agenda for Sustainable Development also recognises that the spread of information and communication technology and global interconnectedness has great potential to accelerate human progress, to bridge the digital divide and to develop knowledge societies (United Nations, Sustainable Development, 2018). Figure 2.5 below shows that eHealth is at the top of ICT social applications.
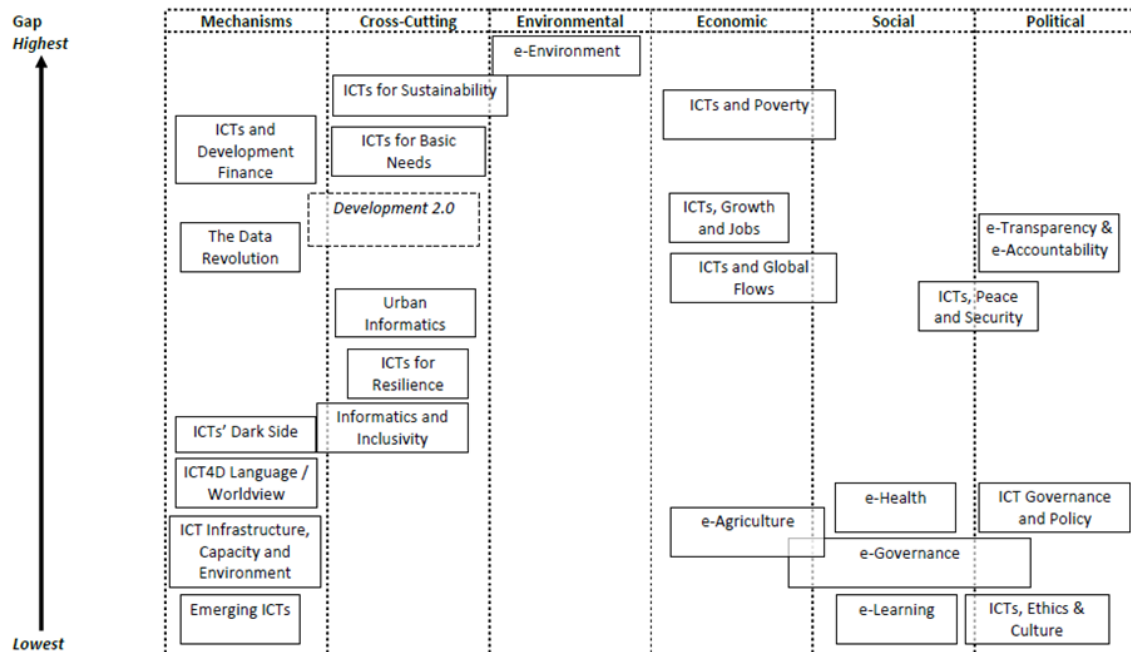
Figure 2-6: Map of post-2015 ICT for D priorities
(Source: Heeks, 2002:38)

From the Figure 2.5 above, it is clear that ICTs for Sustainability and eHealth are priority research areas as part of ICT for development. Mobile phone text messaging approximately doubles the odds of medication adherence (van Eijk et al., 2016). Mobile telephone text messaging may be a more feasible platform to deliver electronic reminders in practice. The technology is old and therefore can be delivered to any existing mobile telephone (Creswell & Creswell, 2018).

2.4.2   eHealth

eHealth forms part of the continuous change and evolvement of health care delivery, and is regarded as the core of responsive technology-aided health services, particularly the information and communication technologies (WHO, 2011). There is a growing expectation that the health sector should integrate technologies (including ICT), in rendering its services due to the technological advances, economic investment, social and cultural changes (WHO) and the International Telecommunication Union (WHO, 2014).

mHealth may also be used to inform the practitioner about a patient's status. For example, real-time monitoring of patient symptoms such as ecological momentary assessment or, where treatment is undertaken at a distance, as part of the ongoing evaluation of response telemonitoring called *telemedicine*. Mobile devices can be used for further information about health data both at individual patient level as well as at an aggregated level, such as big data in cases such as disaster management. New developments are becoming available that use this type of data to direct policy makers (Olff, 2015).

2.4.3 Digital Health

Digitalisation of health care processes is regarded as the norm currently, and is also one of the key phenomena in global health, making it undoubtedly one of the focus areas for different stakeholders that have interest in services that provide health and well-being services (Herselman et al., 2016). According to Iyawa et al. (2016) digital health innovation ecosystem is rarely discussed and has not been clearly defined in academic literature. Furthermore, there is limited theoretical research that focuses on the components that constitute digital health innovation ecosystems.

Herselman et al. (2016) mention that digital health is very much about moving away from the artisanal and analogue mode of organising and providing health care, where economies of scale, access to and availability of care are constrained by the physical proximity and availability of skilled health personnel and sophisticated equipment. It is a ubiquitous phenomenon, impacting potentially all aspects of health care and opens up new avenues of cross-sectoral collaboration, especially between social security and health care sectors (Herselman et al., 2016).

Notwithstanding the adequacy of academic, policy and business literature to elevate the need, potential and importance of digital health, there are still two important gaps. Firstly, there has been relatively insufficient consideration to the transformation of health care systems to also integrate required new innovations into digital health systems (Baskerville and Myers, 2015). Secondly, digital health innovation ecosystems have mainly emerged within the context of rich developing countries (Herselman et al., 2016). In addition, the lack of technological savvy among some physicians may attenuate the importance of ICT in health care services delivery to patients (Vydra et al., 2015). The latter author also decries also that various clinical, practice and clinical factors impede on the capacity of health care ICT providers to expand the role of technology in the provision of health care services (Vydra et al., 2015).

2.4.4 Re-engineering and implementation of Health Services in Primary Health Care

The concept of re-engineering in health services is not unique to the South African health system. In 2010, the then Minister of Health of South African government team visited Brazil

and returned with a vision of re-engineering primary health care in the country (Public Health Association of South Africa/PHASA, 2011). Figure 2.6 below shows a typical re-engineered PHC model.
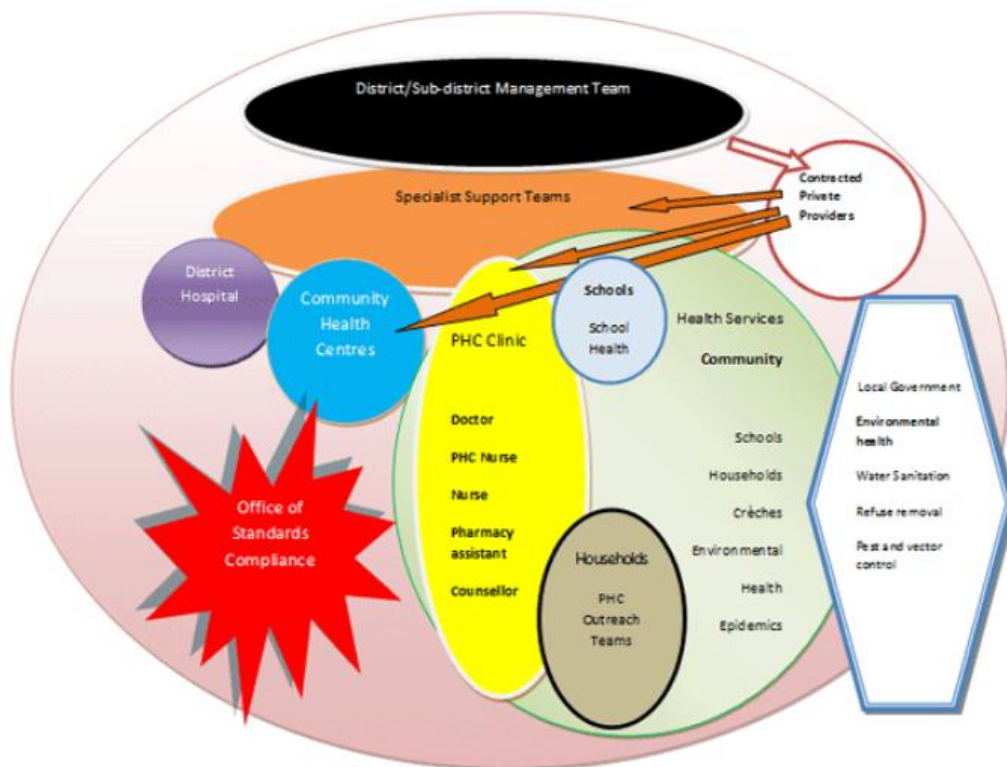
Figure 2-7: PHC model showing three streams of PHC implementation.
(Source: PHASA, 2011)

In terms of Figure 2.6 the implementation PHC model is composed of three streams, namely: facilities/ community health care centres; the PHC clinic with the doctor, pharmacist and nurse); as well as specialist support teams. The viability of the three streams of PHC re-engineering is dependent on collaborated stakeholder involvement in order to increase the access of health services to the general public and to improve the quality of health services in general (Soul City Institute, 2019). Furthermore, the implementation efficacy of a re-engineered health care model requires a vigorous monitoring and evaluation regime for the achievement of the desired health outcomes (PHASA, 2012). In the case of this study, collaborated stakeholder involvement was found to be ineffective, if not completely absent; such as continuous engagement between academics, technologists and mHealth fieldwork professionals. Such compelling need for collaboration is accentuated more by the South African realities of the best practices in the fieldwork, which may not necessarily be documented in peer reviewed or systematic research documents from which South African professionals, research experts and practitioners could learn (Leon et al., 2012). Further research is needed for retrospective analysis of mHealth initiatives and forecasting of the sustainability of current and future mHealth initiatives in South Africa.

2.4.5 Advantages of mHealth

The advantages of mHealth are mostly within the realms of its capacity, equity, its tailored approach, and low cost.

2.4.5.1 Capacity

Mental health care institutions often do not have the capacity to provide everyone with the care they need because it is either time-consuming and costly, or people live far away. m-Health tools may support therapy and increase efficacy and efficiency, while reducing waiting lists. This may be especially helpful for tools that prompt individuals to take their medications in time, do their exercises, and monitor their health status.

2.4.5.2 Equity

In resource-scarce areas, m-Health may increase access to mental health care and contribute to fairness in the distribution of mental health care resources. For individuals with symptoms (e.g., anxiety) which are triggered by external reminders in the individual's environment, mobile apps could offer immediate support by providing tools and exercises that help manage symptoms. Patients may use the apps outside the 1-hour weekly therapy session to support treatment. mHealth tools provide anonymity and non-stigmatising support to people searching for mental health advice or treatment (Olff, 2015).

2.4.5.3 Tailored approach

mHealth can be tailored to the individual, addressing personal needs and ''remembering'' these. Users are in control over *what, when,* and *where* to use the app (self-paced), have access independent of a health care provider, and a variety in modalities exist (text-based, interactive, multiple media) to match individual learning styles. mHealth can be linked to wearables, other apps, or features. Native apps which are built for a specific platform (e.g., iOS or Android) may be more advanced in having access to specific hardware features (e.g., camera, microphone, GPS, calendar) as opposed to a web-based app which is hosted on the web. Advantage of the latter is that these can be accessed from any a browser on any device with internet access and access to other features is increasing.

2.4.5.4 Lower cost

Widening access to psychological interventions with mHealth as a relatively light intervention is potentially cost-effective, compared to traditional interventions (Olff, 2015). In places like Africa, mHealth is regarded as an innovative approach to delivering health services, even to individuals who are less inclined to engage with traditional health services. Its low-cost, ease of use and wide-spread availability are often referred to as the main drivers for implementation (Aranda-Jan et al., 2014; Marcolino et al. 2018). The most widely used mHealth intervention is

SMS, and this study is prioritising MomConnect, which is a SMS based innovation as a case example (Marcolino et al., 2018).

It was also noted that mHealth was the most widely used technology in the SADC region (24.3% of all digital health), followed by social media (21.2%), telemedicine/telehealth (20.2%), e-learning (17.2%), electronic health record (EHR) (6.7%) and big data (2.2%) (Ngoc et al., 2018). The challenges impeding the successful scale-up of digital health were also highlighted as including, but not limited to: non-interoperability among various DH systems; proliferation and duplication of digital health solutions and projects; weak capacity for monitoring and evaluation; high cost of scaling-up; poor coordination and limited impact on the health system and the non-use of health system-based approaches for deployment of digital health projects. (Ngoc et al., 2018).

2.4.6   Challenges in mHealth and Research Recommendations

Olff, (2015) mentions that mHealth research related challenges relate mainly to the following factors:

- Will the app be used?
- Extent of confidentiality and security;
- Extent of efficacy and innovative designs;
- Extent of cost-effectiveness;
- The nature of diverse reactions, if any;
- Impact of business models and multi-disciplinarily; and
- Extent of collaboration (Olff, 2015).

In the light of the above challenges, Aarts, Vennik, Nelen, van der Eijk, Bloem, Faber and Kremer (2015) cautions that the promising prospects of digitalised health services could be hampered by inadequacies of implementation strategies.

2.4.7   Sustainable Development Goals (SDGs)

In their provision of sustainable access of health to all citizens, it is the SDG 3 that is directed at ensuring healthy lives and promotion of well-being at all ages. It is the aim of SDG3 to reduce the global maternal mortality ratio to less than 70 per 100 000 live births by 2030 and end preventable deaths of new-borns and under-five children. The SDG3 further aims to:

- End the epidemics of AIDS, tuberculosis, malaria, and neglected tropical diseases and combat hepatitis, water-borne diseases, and other communicable diseases by 2030;
- Reduce by one-third premature mortality from non-communicable diseases (NCDs) through prevention and treatment, and promote mental health and well-being by 2030;

- Strengthen prevention and treatment of substance abuse, including narcotic drug abuse including harmful use of alcohol by 2030;
- Halve global deaths and injuries from road traffic accidents by 2020;
- Ensure universal access to sexual and reproductive health care services including for family planning information and education and the integration of reproductive health into national strategies and programmes; and
- Achieve universal health coverage (UHC), including financial risk protection, access to quality essential health care services, and access to safe, effective, quality, and affordable essential medicines and vaccines for all (United Nations, 2016).

All of the above-stated SDG3 imperatives make a Case for the application of digital health care services through digitalisation (Williams, 2008). Considering the move from Millennium Development Goals to Sustainable Development Goals, mHealth is likely to play an increasing role as a strategy to enhance health services (Hwa-Lee et al., 2016). mHealth technologies are increasingly being used to enhance health care services by increasing access and utilisation by users (Hwa-Lee et al., 2016). In the era of globalisation, the MDGs could be achieved with a degree of efficiency by enhancing citizens' access to health care information, which MHealth and digital health have the capacity to provide (Royston et al., 2015).

Furthermore, Hwa-Lee et al. (2016) report that the vaguely described mHealth research projects contribute to the difficulty of scaling-up, thus, limiting the translation of research into practice through implementation by policy makers and other interested stakeholders. In this regard, this study's phenomenological approach aims to provide stakeholder-driven evidence that may guide future strategies of implementation in accordance with assertions by (Hwa-Lee et al., 2016).

Large-scale computing provisions, such as mHealth services amongst others, have the potential to improve accessibility and quality of public or community health and well-being which is very pivotal for the SDGs (Miah, 2017). The latter author further recommends further research in developing new knowledge to address the complex practical demand of large-scale mHealth services in public health, especially that universal health coverage (UHC) is an integral aspect of the Sustainable Development Goals (Miah, 2017). Despite that MomConnect digital interventions clearly contribute to different determinant layers of UHC, there are still significant opportunities for future enhancement, which would further benefit from additional integration with existing systems in the evolving South African national digital health ecology (Mehl, Tamrat, Bhardwaj, Blaschke and Labrique, 2018).

2.4.8 The Need for an mHealth Strategy

The need for an mHealth strategy has emerged in literature, suggesting it is technically possible to deliver mHealth interventions to large populations at low cost, because downloading and automation to send SMSs which can be a once-off processes (Free et al., 2013). However, implementation has been complicated than this. In this regard, the decrease in costs and increasing network coverage and reliability provides an opportunity to implement mHealth services in low- and middle- income countries (Aranda-Jan et al., 2014). The process of documenting and assessing experiences of stakeholders involved in mHealth service implementation may add to a more insightful understanding of contemporary issues faced before, during and after implementation (Aranda-Jan et al., 2014). However, policy reform at all (national, provincial, local) levels is needed to drastically make a change and improve the use of mHealth in developing countries (Kruse et al., 2019).

Regardless of the consensus in literature on the positive outcomes of mHealth in health services provision, reproducibility and scalability remains uncertain (Aranda-Jan et al., 2014). There are learnt experience that efforts to improve the use of ICT for health requires strategic and integrated at national level in order to maximise the advantage of existing stakeholders' capacity through collaboration of different (WHO, 2014).

The ITU encourages countries to develop national eHealth strategies, into which an mHealth implementation strategy fits into this action (WHO, 2014). Developing strategies for ICT for Health remains pivotal for countries at different levels of implementing eHealth programmes. This includes countries like South Africa, who are seeking to learn, document best practices and build on promising results of pilot initiatives and sustaining nationally scaled up initiatives and updating existing strategies to reflect and be responsive to the continuously changing circumstances as a coordinated action (Aranda-Jan et al., 2014).

The integration of mHealth into local healthcare systems remains pivotal. Experience shows that successful projects have been mostly adapted to local contexts, especially where countries have strategic plans that support the larger eHealth or just the mHealth component, also collaborations amongst interdisciplinary stakeholders such as academic institutions, research institutions, NGOs private and public sector amongst others (Aranda-Jan et al., 2014). Management and project design, which incorporates service design, and data collection for real-time supervision and monitoring, are also core components of successful implementation (Aranda-Jan et al., 2014). Moreover, scaling up an mHealth project comes with its complexities and evidence shows that there are gaps in understanding the complexities that health systems may face and standards in which they may be evaluated and monitored (Aranda-Jan et al., 2014). The gaps in mHealth intervention result from the limited scale and scope of mHealth implementation and evaluation, and the current mHealth evidence base

comprises mostly of evidence from the field of computer science, and not health; which is not sufficient to inform and influence stakeholders to invest resources in nationally scaled mHealth initiatives (Skinner et al., 2018).

2.4.8.1 Developing a national strategy

Despite assertions for country-specific mHealth strategies, the role of targeting strategies is unclear in the implementation of interventions, and related outcomes and the relationship with reproductive health decision-making roles in different contexts (Ilozumba et al., 2018). Addressing all of these questions and roles is fundamental for the future design and implementation of maternal and reproductive mHealth and related mHealth interventions in LMICs.

The World Health Organisation's Toolkit for developing a National eHealth Strategy highlights three different parts for developing strategy, namely, national eHealth vision that responds to health and development goals (which in this study is the mHealth and the sustainable development goals 2030), the implementation roadmap (which is the core of this study), implementation monitoring plan that seeks to secure long-term support for sustainability (of which sustainability is also the focus of this study) (WHO, 2014).

Figure 2.7 shows the design of a national strategy model of eHealth, according to which three sequentially linked processes are indispensable. Firstly, a national eHealth vision should have been articulated. Secondly, a national eHealth action plan should be in place. Thirdly, a related national eHealth monitoring and evaluation should be articulated. All of these three parts or stages are accompanied by a series of process management and monitoring and evaluation indicators.

Toolkit for developing a National eHealth Strategy

Part 1 National eHealth vision	Part 2 National eHealth action plan	Part 3 National eHealth monitoring and evaluation
• Manage the process • Engage with stakeholders • Establish the strategic context • Learn from trends and experience • Draft an initial vision • Identify required components • Gather information on the eHealth environment • Assess opportunities and gaps • Refine vision and develop recommendations	• Manage the process • Engage with stakeholders • Develop eHealth action lines • Develop an integrated action plan • Determine high-level resource requirements • Apply funding constraints to refine plan • Define implementation phases	• Define indicators for monitoring and evaluation • Define baseline and target measures • Define supporting governance and processes

Figure 2-8: Toolkit for developing a national eHealth strategy.
(Adapted from: WHO, 2014:2)

2.4.9   e-Service as Social Integration

Congruent with the assertion by Hultgren and Goldkuhl (2013), undertaking this kind of research and multi-grounding it on research in e-services, the study represents a deviation from techno-centric e-service traditions to the embeddedness of health and technology in social interaction Hultgren and Goldkuhl (2013) refers to multi-grounding as a deliberate combination of theoretical, empirical, and internal organisational aspects.

The design of E-services does not mean that the technological aspect is added to existing services but that it is much more complex where the social aspect also needs to be considered (Hultgren and Goldkuhl, 2013). When health care services are moved from the human-to-human domain to technical domain it does not mean that the social interaction ceases to exist, only a technical device is added in between the user and distance social actors (Hultgren and Goldkuhl, 2013). Therefore, e-services imply the use of ICT is designed for consumers, including citizens using e-government services, thereby introducing from an ICT systems perspective to an ICT service view (Hultgren and Goldkuhl, 2013).

2.4.10 mHealth as a Patient-Facing eHealth Service

Alami, Gagnon, Ahmed and Fortin (2019) assert that digital technologies are now widely recognised as an important mechanism to improve access, continuity and quality of healthcare and services. In this regard, cybersecurity is indispensable for developing learning and value-based health organisations and systems. Therefore, further studies still need to be undertaken

to make policy makers and managers aware that mHealth service is not only an expenditure source, but also a source of value creation source for patients, clinicians, organisations and for the health system as a whole.

mHealth is one of the policy options and interventions which supports the approach of incorporating new technologies and reorienting the conventional model of care and its inherent integrated, people-centred health services (WHO: 2016). For instance, the preponderance of mobile phones has led to more mHealth programmes being implemented to improve patient care services. Nonetheless, mobile technologies are used compliant with the user's socio-cultural practices, such that mHealth use is not detached from the other regular uses of the mobile device (Hultgren and Goldkuhl, 2013). In this regard, the implementation of a sustainable mHealth service requires precise understanding of the user's adaptation and use of mHealth tools in their broader social and cultural environments (Hultgren and Goldkuhl, 2013).

Due to continuous technological advancements, including mHealth, implementation of its services should be flexible and contextual making taking into consideration the perceptions and interaction of all stakeholders involved in a service crucial for successful implementation (Hultgren and Goldkuhl, 2013). Patient-facing eHealth services are necessitated by factors such as the justification for involving patients in their own health care, as well as the increasing complex nature of diseases and fragmented provision of care (Aarts et al., 2015). It is then a policy imperative to develop and improve patient focused health care interventions that are easily available at all times without any geographical, organisational and other barriers at a low and affordable cost (Kruse et al., 2019; Silva, 2015). Therefore, mHealth application-driven services reconfigure the traditional patient-doctor physical interaction to the benefit of the patient as health care consumer (Hultgren and Goldkuhl, 2013; Silva, 2015). Figure 2.8 illustrates the reconfigured health care social interaction facilitated by ICT. The diagrammatic illustration is also a representation social interaction between a service provider and different customers (Hultgren and Goldkuhl, 2013).
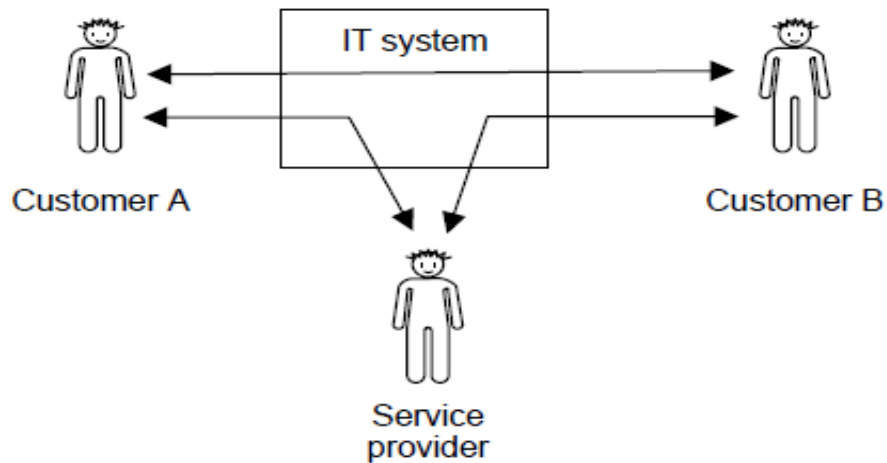
Figure 2-9: E-service as a social interaction facilitated by the IT system.
(Source: Hultgren and Goldkuhl, 2013:333)

When designing or evaluating an mHealth service, it is crucial to take into consideration users' autonomy and independence, since they are more than just beneficiaries of a specific mHealth service; thus, a diversified and cost-effective approach is appropriate as to a generalised mHealth service strategy (Hultgren and Goldkuhl, 2013). It is also important for new service innovation to be accompanied by a shift at all levels of the health system, including technical and organisational systems, patient participation, and practitioner support (Hultgren and Goldkuhl, 2013) . There is a great shift from product-based economy to services based one, especially digital services, and this comes as a result of increases availability and usage of information and communications technologies by both provider and consumer (Williams et al., 2008).

From a clinical point of view, the central theory behind the effectiveness of mHealth rests on a partnership between patients and clinicians. Any mHealth system requires engagement from both parties. Experience with EHRs has illustrated a major concern for clinicians' work- flow. (Fleming et al., 2017). In particular, mHealth devices would benefit from interoperability standards to ease integration with other health software apps, which are increasingly required to organise the large amounts of data collected. It should also be noted that third-party industry participation could mitigate interoperability gaps, although the extent is presently unknown (Fleming et al., 2017).

Marcolino et al. (2018) report that many mHealth studies are methodologically inefficient and of no long-term benefit. There is scant literature reporting on large-scale or nationwide coverage of mHealth services, and the potential for scaling them up is frequently mentioned; thus, reporting on MomConnect remains pivotal (Aranda-Jan et al., 2014). In this study, different data collection methods were used, including retrospective document review that looks at the MomConnect's progress since its initiation.

Jun, Morrison, and Clarkson (2014) identifies four key drivers in project initiation: government policies, service demand, complaints from other service providers, and budget constraints. However, government policies played a major role in most projects, because aligning project goals to government policies was critical in order to obtain approval and financial support (Jun et al., 2014). This top-down policy driven approach undervalues stakeholder involvement. Partnerships between health service managers and service design researchers may lead to shared opinions in policy briefing, which may bridge this gap (Jun et al., 2014). In service improvement projects, there is an explicit 'new idea generation' process, in which stakeholders co-create new service concepts by introducing and applying various design methods such as process mapping and lean principles to support analysis and idea generation (Jun et al., 2014). Figure 2.9 below illustrates steps in a service improvement project.
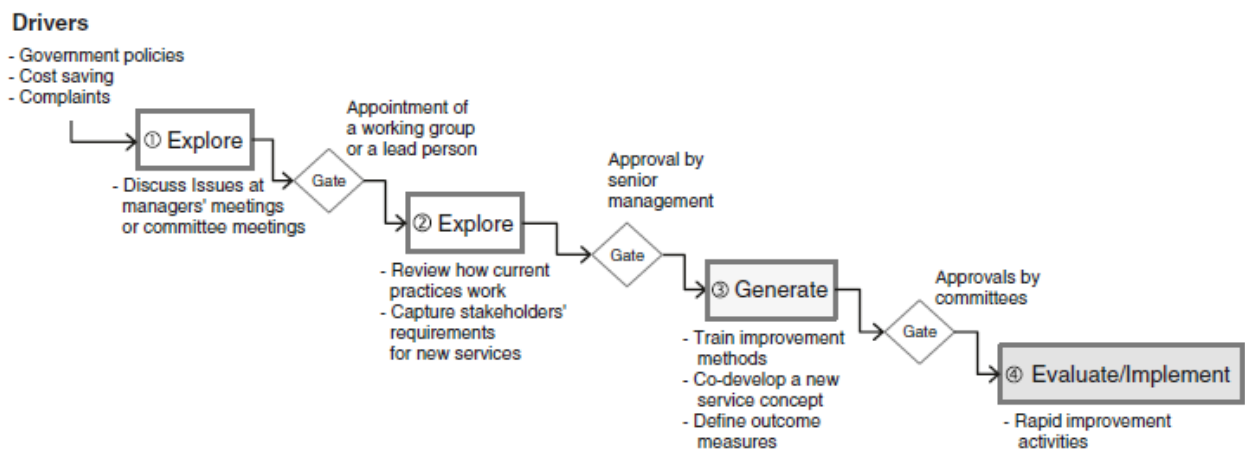
Figure 2-10: Service improvement project
(Source: Jun et al., 2014:5)

In terms of Figure 2.9 above, a service design project consists of key elements in the form of: drivers, exploration, generation and evaluation/ implementation (Jun et al., 2014).

2.4.11 mHealth Service Ethics: Security and Confidentiality

This study also addresses ethical issues concerning the mHealth implementation process, which are not adequately reported on in many studies on mHealth (Marcolino et al., 2018). For example, some confidentiality issues not addressed include the fact that users frequently change phone numbers, reducing certainty of the message being delivered to the correct recipient (Marcolino et al., 2018). Poor connectivity is one of the barriers during implementation (Marcolino et al., 2018). The ethical issue of security and confidentiality of the patient's information could be exposed to vulnerabilities. In the context of mHealth services, the mobile devices are an important communication tools between patients, clinicians, and healthcare professionals for purposes of diseases management, self-monitoring, and drug control as well as other clinical and educational applications (Silva et al., 2015).

In such an environment, there is the problem of sparse reference to legal factors, standards and regulations and regarding the use and application of mHealth in health services before, during and/or after implementation (Williams et al., 2008) This concern is important since expectations or preference remain variable in terms of privacy, security and confidentiality; which emphasises that human beings cannot participate in a digital service without the aid of ICT, and this calls for setting of standards in order to guide the interaction (Aranda-Jan et al., 2014).

2.4.12 The Service Design Process

Service design is essentially about the translation of ideas into reality, from abstract to concrete and tangible thoughts in the initiation of solutions (Figueiredo, 2007). The design process ensures that quality and usable services that meet the needs of their users (Bull and Ezeanochie, 2016). Designers ensure that they test and improve their ideas throughout the design process and also apply prototyping to both services and products (Coleman et al., 2017), making the process of getting experiences from those who were involved in the design of services pivotal in order to learn implementation of services.

A service takes time to develop, and comprises touchpoints, namely: people, information, and products, amongst others (Grover and Lyytinen, 2015). A service design process creates the touch points and determines how these touch points interact with each other (Skinner et al., 2018). In addition, a service design process enables the design of a new service and re-design of an existing service to improve its performance and usability (Skinner et al., 2018). Figure 2.10 below depicts a service design process.
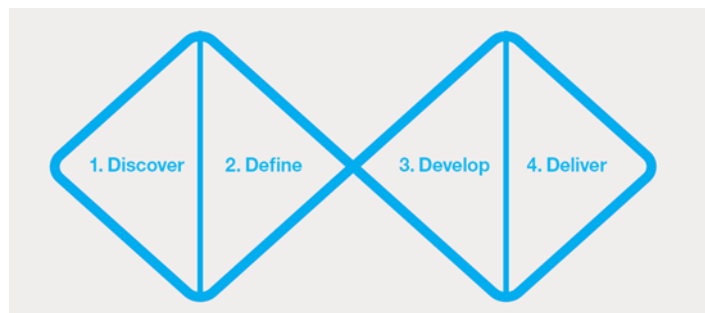
Figure 2-11: The discover, define, develop and deliver design process.
(Source: Figueiredo, 2007:15)

Figure 2.10 above, shows four important aspects of service design process: discover; define; develop; and deliver. The 'discovery' aspect entails the development of incipient ideas and identifying need, while the 'define' aspect entails the designers' making sense of all possibilities that may emerge. The 'develop' aspect relates to a trial-and-error period of creating, prototyping, testing and iterating solutions. The final 'deliver' aspect entails the finalisation, evaluation and launch of the service or product (Figueiredo, 2007).

Service design projects such as the NDoH's MomConnect project focus on long-term, appropriate and sustainable, consumer facing solutions to the needs of communities in development contexts. As such, there is a critical need to develop and strengthen relationships amongst stakeholders involved, considering that these stakeholders have very different relationships with each other. Also, these stakeholders from different backgrounds, must understand each other and create a new hybrid technology and its supporting systems. Designers working in developing countries face challenges that are virtually non-existent in developing. However, there is a paucity of design theories or methods to address these challenges. There is a need to share experiences and challenges amongst design stakeholders regarding methods and/or principles that were tried and tested or applied for future design processes, or even lessons learned from other projects (International Conference on Engineering Design, 2013).

2.4.13 Service Implementation

There is an urgent need for the application of core implementation principles (such as targeted planning, implementation strategies and clear activity specification) in service organisation (Damschroder, 2020). There are different viewpoints concerning implementation science. (Bhattacharyya, Reeves, Garfinkel, and Zwarenstein, 2006), for instance, urges for empirical evidence on behaviour choice and interventions in service implementation. The latter author also urges that such empirical evidence should not be interfered with by research funders, ethics committees, systematic reviewers, editors, and policy decision makers. Meanwhile, Aranda-Jan et al. (2014) urge that the review of mHealth implementation should conform to the following useful areas of project implementation:

- Mid- and long-term results and impacts on project sustainability;
- Project integration into the health system in terms of design relevance, involvement of key stakeholders, compatibility to existing government management information systems and policies;
- Technology/ and existing infrastructure in terms of network coverage, acceptance, cost, usage, electricity and other infrastructure;
- Project management processes in relation to required project implementation resources;
- Scale-up and replication requirements for projects at a regional or national level; and
- Legal issues, regulations and standards that influence mHealth projects.

2.4.13.1 Service implementation in the public sector

There is evidence-based consensus showing that interest is high and there's positive progress in the identification, development and testing of implementation strategies (Proctor et al., 2013). In health care, implementation strategies could be defined as methods or techniques used to enhance the adoption, implementation, and sustainability of a health programme in

health, and may include 'top down/bottom up,' 'push/pull,' and 'carrot/stick' tactics, and typically involve 'package' approaches. Implementation strategies may incorporate interventions from other disciplines, such as management sciences when it comes to organisational interventions, social sciences in community or interpersonal interventions (Proctor et al., 2013).

mHealth is an example of a health care service provided to the public by government. Notwithstanding other challenges, the implementation of services is one of the major service design challenges, occasioned by the attendant complexity of combining physical, technological and human components (Kruse et al., 2019). Consequently, there is a growing body of economic evaluation research on mHealth's major gaps in further implementation and scale up as originally intended. However, few evaluations of digital health solutions have explored whether mHealth programmes have been as efficacious as originally intended; instead of processes that measure outcomes and impact level indicators without establishing linkages to programme exposure. In this regard, it would also be methodically established and understood *who* receives *what* quantity of services, and *where* do critical breaks in the continuity of service delivery occur (Kruse et al., 2019).

Iribarren, Cato, Falzon, and Stone (2017) argue that the dependence on outsourcing and piloting exacerbates the direct cost of service implementation to the public. Costs and savings are mostly calculated for implementation of large-scale and pilot health projects, showing of the extant dependence on pilots (Iribarren et al., 2017).

2.4.13.2 Understanding the 'grey areas' of failure and success in mHealth implementation

Heeks (2002) describes information systems failures in developing countries as either total or partial. Total failure occurs when an initiative was not implemented, or a new system was implemented but immediately abandoned. Partial failure occurs when major goals are unattained, or there are significant undesirable outcomes. An emerging and more relevant subset of partial failure is the 'sustainability failure' – by which a successful initiative in the beginning is then abandoned or fails to continue or to scale-up after a given period (Heeks, 2002). Success implementation is one in which most stakeholders achieve their intended major goals and do not experience any significant or undesirable outcomes (Heeks, 2002). Table 2.4 shows a matrix of organisational practice against which failure or success could be determined.

Table 2-5: Matrix of organisational design practices

(Source: Heeks, 2002:2)

	Designing for Citizens	Designing with Citizens	Designing by Citizens
Designing for Organizations	Design experts design for organizational staff and for citizens	Design experts design with citizens for organizational staff	Citizens design for organizational staff
Designing with Organizations	Design experts design with organizational staff for citizens	Design experts design with organizational staff and with citizens	Citizens design with organizational staff
Designing by Organizations	Organizational staff designs for citizens	Organizational staff co-designs with citizens	Organizational staff and citizens co-create and 'co-produce' (i.e., operate the new)

Organisational design practices are influenced by the organisation's perceptions of its own design capability design expertise (Heeks, 2002). In addition, organisational design practices are part of the design legacy found in organisations. Table 2.5 below illustrates the involvement of stakeholders in the development and design of an IT service project at Omega, a technology company.

Table 2-6: Stakeholders and their involvement areas in service development

(Source: Rose et al., 2006:1)

Involvement \\ Events	Decision making	Image creating	Specifying service	Implementing service
Service development team	O	O	O	O
Service designer	O	O		
End user		O	O	O
Service worker		O	O	O

In terms of Table 2.5, various stakeholders were involved at various stages of the service development. However, it only in the decision-making process that some stakeholders were not involved; that is, end-users and service workers. Table 2.6 further reflects on various components of service implementation strategies at Omega (Rose and Kræmmergaard, 2006).

Table 2-7: Implementation strategies

(Source: Rose et al., 2006:1)

Dominant technological discourses at Omega

Discourse component	Technology Discourse 1—classical IT project	Technology Discourse 2—technology-driven organisational change initiative
Understanding of ERP implementation	The implementation is a classic, time-delimited project, which should be planned in advance and run like other projects	The implementation is an evolutionary change process affecting organisational life, and should respond to changing objectives, conditions and unfolding circumstances
The role of the system	The ERP system is an administrative tool to support existing processes and procedures—IT supports business processes	The ERP system is a strategic resource which facilitates changes in processes and procedures—IT drives process improvement
Task for the implementation group	Steering the project according to the planned scope and deadlines	Combining business objectives with the ERP system to give the company a strategic advantage
The implementation led by	Top management and the implementation group	Corporate-wide employees
Driving force for the implementation	IT department led	IT department/executive led with user-involvement
Resource allocation	Resource allocation should be done in advance	Resource needs are dependent upon unforeseeable evolving conditions
Management praxis	Command and control—top down	Facilitation and inspiration—change agent
Guiding logic	The implementation should be controlled according to rational analysis	The implementation is complex and difficult to analyse, and should be managed on evolving best guesses
Success criteria	On time and on budget, efficiency gains	Organisational learning and keeping the ERP system "alive"
Scope and responsibilities	Middle managers responsible for technical projects, users need training	Senior management responsible for coupling IT and business planning, wide active involvement from others
Underlying change model	Linear phases	Iterative cycles

Strategy implementation and service design have generated various responses and perspectives from various authors. Proctor, Powell, McMillen (2013) urges that implementation strategies should be named, defined, and operationalised according to their targets, outcomes, and theoretical relevance, among others. There should also be manuals to guide the operations of a strategy. Furthermore, implementation strategies should be able to address human capital challenges and users' expectations (Proctor et al., 2013). Meanwhile, Cresswell (2013) contend that strategy implementation challenges (especially in health information technology) are compounded by the paucity of clear policy directives locally. Therefore, local implementation processes should be sufficiently mapped prior to implementation. In this regard, implementation strategies ought to be tailored to local organisational circumstances (Cresswell, 2018).

On the other hand, (Letts, 2013) supports the idea of stakeholder participation as it generates collective ownership of the service or product. However, service designers could be more preoccupied with the needs of the users than with the needs of the business or stakeholders. Also, the monopoly of service designers and providers could affect the public sector needs and focus more on the private sector. Gupta (2016) also presents the view that service implementation in health care presents some disequilibrium between science and health systems. The latter author argues further that the complexity of the system requires multi-

purpose design improvements at every stage, while innovative and empirically supported designs may not all serve this purpose. Therefore, an effective and scaled-up service design requires collaborative approaches of all stakeholders in clinical, practice and design industries (Gupta et al., 2016). Table 2.7 exemplifies the prerequisites of measuring an implementation strategy.

Table 2-8: Prerequisites to measuring implementation strategies.

(Source: Proctor et al., 2013:139)

Prerequisite	Requirements	Resource(s) and Example(s)
1) Name it	Name the strategy, preferably using language that is consistent with existing literature	Cochrane EPOC [25] Mazza et al. [24] Powell et al. [20]
2) Define it	Define the implementation strategy and any discrete components operationally	Abraham & Michie [38] Powell et al. [20] Michie et al. [26]
3) Specify it		
a) The actor	Identify who enacts the strategy (e.g. administrators, payers, providers, patients/consumers, advocates, etc.)	Kauth et al. [39] describe characteristics, qualifications and roles of an external facilitator
b) The action	Use active verb statements to specify the specific actions, steps, or processes that need to be enacted	Rapp et al. [40] operational definition of 'leadership'
c) Action target	Specify targets according to conceptual models of implementation. Identify unit of analysis for measuring implementation outcomes	Tabak et al. [41] Damschroder et al. [42] Flortorp et al. [43] Cane et al. [44] Michie et al. [45] Landsverk et al. [46] Proctor et al. [47]
d) Temporality	Specify when the strategy is used	Magrabosco [21] Chinman et al. [31] Kibourne et al. [33]
e) Dose	Specify dosage of implementation strategy	Atkins et al. [48] recorded frequency of support by opinion leaders
f) Implementation outcome affected	Identify and measure the implementation outcome(s) likely to be affected by each strategy	Proctor et al. [47] Proctor & Brownson [49] Proctor et al. [50]
g) Justification	Provide empirical, theoretical, or pragmatic justification for the choice of implementation strategies	**Theoretical** Eccles et al. [51] Grol et al. [52] **Empirical** Cochrane et al. [52] Grimshaw et al. [5] **Pragmatic** Oxman et al. (54) Wensing et al. (55) suggest brainstorming as a low-cost, low intensity method of linking strategies to identified barriers

Factors associated with effective implementation strategies are further presented in Table 2.8 below. The table indicates the technical, social, organisational and wider socio-political imperatives and considerations as instrumental in shaping the effective implementation of

service or product design strategies (Cresswell, 2013). In this regard, the table further indicates the collaborative requirement for all stakeholders to be involved.

Table 2-9: Factors associated with effective implementation

(Source: Cresswell, 2013:2)

Service Design Factors/Strategies	Implementation Imperatives
Technical	Usability; system performance; integration and interoperability; stability and reliability; adaptability and flexibility; cost; accessibility and adaptability of hardware
Social	Attitudes and concerns; resistance and workarounds; expectations; benefits/values and motivations; engagement and user input in design, training and support champions; integration with existing work practices
Organisational	Getting the organisation ready to change; planning; leadership and management; realistic expectations; user ownership; teamwork and communication; learning and evaluation
Wider socio-political	Other healthcare organisations; industry; policy; professional groups; independent bodies; the wider economic environment; international developments

Gupta (2016) identified several stages of innovation development, including: identification of the problem; pilot design, testing and evaluation; implementation planning, evaluation and testing; as well as planning, evaluating, monitoring and institutionalising the scaling-up operations. The institutionalisation stage was not addressed in any of the frameworks reviewed by the researcher, which accentuated the need and significance of this study.

Testing for extensibility is unique, and was achieved in this study by the scoping review, notwithstanding that it was not defined anywhere in the literature. Extensibility in the NTT defines the stage where innovation teams conduct several studies in various settings with variable samples to ensure that the innovation produces positive outcomes in different environments (Gupta, 2016).

2.5 Conclusion

This chapter has provided both the theoretical and empirical foundations of the study, substantiated with various literature perspectives. The next chapter focuses entirely on the research design and methodology of the study.

CHAPTER 3: DESCRIPTION OF THE RESEARCH METHODOLOGY

CHAPTER ONE: Rationale and Scope of the Study

CHAPTER TWO: Theoretical and Empirical Foundations and Location within Literature

CHAPTER THREE: Description of the Research Methodology

- Introduction
- Overview of mHealth Research Methodologies
- Phenomenological/ Interprevist Para
- Qualitative Research Approach
- Data Analysis
- Trustworthiness
- Conclusion

CHAPTER FOUR: Local Practice as The Case: MomConnect Innitiative

CHAPTER FIVE: Situational Inquiry and Theorising (Phase 2)

CHAPTER SIX: Stakeholder Analysis (Phase 2)

CHAPTER SEVEN: Practice Based Analysis: Phase 3 (NASSS Framework)

CHAPTER EIGHT: Practice Based Analysis: Phase 4 (Principles of Digital Development)

CHAPTER NINE: Practice Based Analysis: Phase 5 (Global Digital Health Index)

CHAPTER TEN: Synthesis as Convergence of Findings from Phases 1 to 5: Using Strong Structuration Theory as Lens

CHAPTER ELEVEN: Practice Enhancement: An Evolving Stakeholder Centred Strategy for Mobile Health re-Engineering

CHAPTER TWELVE: Discussion of The Findings As a Mechanism to Highlight Insights From The Study

CHAPTER THIRTEEN:

3.1 Introduction

This chapter basically presents and describes the critical research design and methodological components of the study, which include the data collection and analysis approaches that were adopted in the quest to allocate meaningfulness and relevance to the study (Bentley, Gulbrandsen and Kyvik, 2015). Therefore, in its holistic context, the chapter's presentation of the methodological aspects is aimed at detailing information that would ensure understanding of steps followed in conducting this study. The chapter then concludes with a description of the measures undertaken to allocate trustworthiness and scientific rigour as demonstration of the validity and reliability of the data and research methods applied in the establishment of the findings. Bradshaw et al. (2017) contend that it is indispensable that a research study should describe and explain its theoretical grounding, clarify its philosophical orientations (see sub-section 1.10 in Chapter One), articulate its research methodologies and methods, as well as strategies for its rigour. Table 3.1 below basically outlines the trajectory of this chapter in accordance with the assertions above.

Table 3-1: Research processes that guided the methodology

(Source: Researcher's own construction from various sources)

Concepts	Justification
Overview on mHealth Research Methodologies	It is critical to look at how methodologies were conducted around mHealth.
Service Design Research	This has to be described as a chosen methodology.
Applied Research	This study identifies as applied research as opposed to pure research.
Health Services Research	This study is aimed at contributing to health services research.
Phenomenology/ Interpretivist	The philosophy driving this study.
Data Collection Tools	The description of the tools ensures the reader understand what was used to obtain the data.
Data Collection: Triangulation	Different sources of data were used to minimise any doubt of bias, should there be any.
Data Analysis: Thematic, Content, Conversational and Discourse.	The way in which data was analysed is described to understand how themes emerged. The further explanation of themes in the light of practicality and applicability to the research problem was done through content analysis.
Qualitative Synthesis	Convergence of findings through an analysis lens in order to inform policy and practice.
Credibility, dependability, confirmability, and transferability	For a qualitative study, these concepts remain critical.

3.2 Overview of mHealth Research Methodologies

Consonant with the research topic, research problem, research questions and objectives, the overview of mHealth research methodologies focuses on service design research, applied

research, health services research, and the phenomenological/interpretivist research design. Such focus is necessitated by the vastness of experiences, lessons learnt, best practices and implementation steps that are pivotal to answer the research question (Aranda-Jan et al., 2014).

3.2.1   Service Design Research

This study is based on the delivery phase, which aims at ensuring effective end-user systems as a determinant of client feedback regarding quality of services (Williams et al., 2008). The delivery phase is beneficial for also providing insight tools, feedback lessons and shared knowledge from the process to relevant partners. This study ensures that the team involved in MomConnect is sharing lessons learnt, new knowledge, tools (strategies), and ways of working (in terms of collaboration between stakeholders).

The delivery phase uses design scenarios of small teams of experts with a range of skills and knowledge to make these teams as productive as possible. The success of mHealth services offered through different projects that were reviewed is based on the accessibility, acceptance and low-cost of the technology, effective adaptation to local contexts, strong stakeholder collaboration, and government involvement (Aranda-Jan et al., 2014).

There is growing interest in design science, despite gaps in its teaching and research (Williams et al., 2008). The application of design thinking in health care has the potential to enhance innovation, efficiency and effectiveness of health services by the nature of its focus on the multiple stakeholders needs rather than a one-sided approach. Although design thinking is characterised by collaborative multidisciplinary teams, it is used and applied in different health care environments and conditions (Altman et al., 2018).

Based on the study's main purpose of redesigning the MomConnect's implementation strategy through stakeholder-centred perspectives, service design research was found to be relevant due to its enhancement of complex problem-solving solutions, despite its shortcomings on large-scale projects such as MomConnect (Aranda-Jan et al., 2014). Most importantly, service designs allow for the voices of service users to be heard in the design of services, (Altman et al., 2018; Liddicoat, 2019) which coheres with the phenomenological-ethnographic approach adopted in this study.

Furthermore, a combination of service design research and health care is conducive for improvement in implementation of innovative services (Griffioen, Melles, Stiggelbout and Snelders, 2017). Services design is advantageous for its approach to addressing existing problematic situations by synthesising information from multiple sources, which can combine with the linearity of health services and its emphasis on "analysis and testing of pre-formed, theory-driven hypotheses" (Griffioen et al., 2017). In addition, while service design focuses on

the improvement of patient experiences by actively involving the participation of all those who may influence the quality of that experience; health services research mainly involves patients and physicians to obtain information by surveys or interviews (Griffioen et al., 2017). Figure 3.1 below shows the combined approach and effect of services design and health services research.
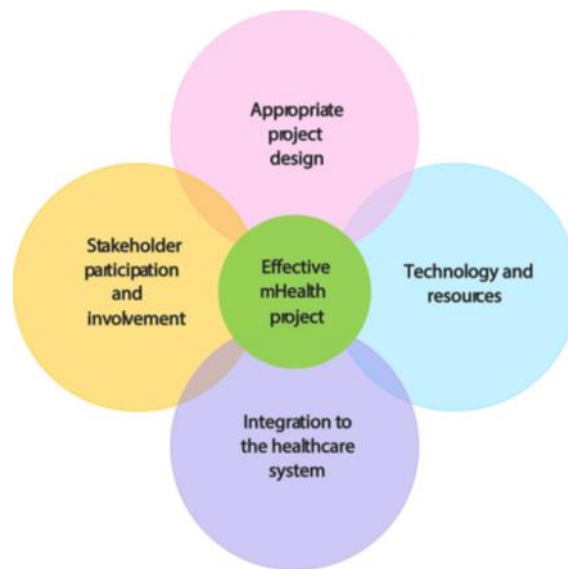
Figure 3-1: Combined effect services design and health services research
(**Source: Aranda-Jan et al., 2014:1)**

3.2.2 Applied Research

Applied research involves the transformation of theoretical principles into empirical and practical reality (Tappen, 2016). For purposes of this study, applied research was considered relevant insofar as its focus on making a practical contribution to resolving the researcher's concerns with MomConnect's scalability and sustainability issues and material implications on its beneficiaries. The researcher's focus and inspiration remains to address challenge facing the mHealth industry, with direct relevance to the public health sector in South Africa, and to develop strategy with best practice techniques. Moreover, health care inequalities are rampant, which is inimical to Goal 3 of the Millennium Development Goals that is intended to expand health care to all. Figure 3.2 illustrates the main differences between applied and basic research.

Key Differences Between Basic and Applied Research

The points given below explain the differences between basic and applied research:

1. Basic Research can be explained as research that tries to expand the already existing scientific knowledge base. On the contrary, applied research is used to mean the scientific study that is helpful in solving real-life problems.

2. While basic research is purely theoretical, applied research has a practical approach.

3. The applicability of basic research is greater than the applied research, in the sense that the former is universally applicable whereas the latter can be applied only to the specific problem, for which it was carried out.

4. The primary concern of the basic research is to develop scientific knowledge and predictions. On the other hand, applied research stresses on the development of technology and technique with the help of basic science.

5. The fundamental goal of the basic research is to add some knowledge to the already existing one. Conversely, applied research is directed towards finding a solution to the problem under consideration.

Figure 3-2: Key differences between basic and applied research
(Source: https://keydifferences.com/difference-between-basic-and-applied-research.html

From Figure 3.2 above, it is clear that applied research is advantageous for its pragmatism and relevant applicability to existing problems in a specific situation, rather than on theory-driven generalisations. Furthermore, applied research uses basic research principles to develop strategies and technologies for direct application to specific problems identified. Most importantly, applied research does not focus merely on knowledge generation, but on applying the knowledge to solve a particular problem.

3.2.3 Health Services Research

Health services research focuses on the coherent generation of quality health care knowledge for the enhancement of the patient's health care experiences by means of comprehensive or scientific methods such as surveys (Griffioen et al., 2017). The latter authors mention also that both service design research and health services research contribute to insights to resolve implementation barriers. Future mHealth research should draw more rigorously on structuring frameworks, so that empirical findings may be generalized more widely. (Wolff-Piggott et al., 2018).

The provision of health services is considered a basic human right (WHO, 2014). In this regard, research on improving such services is helpful for generating knowledge and information systems to enable broader access of these critical services. MomConnect is a technology-based health care service facing many implementation challenges. Thus, its improvements require systematic evidence-based interventions that integrate technology solutions as well (Vaismoradi, 2013). The MomConnect initiative has a clear contribution to make as part of an integrated information system in support of clinical services (Heekes, Tiffin, Dane, Mutemaringa, Smith, Zinyakatira, Barron, Seebregts and Boulle, 2018).

3.2.4 Practitioner-Research Perspective/Paradigm

The practitioner-researcher perspective, in conjunction with the stakeholder-centredness of the study, constitute a critical aspect of the research topic. Necessarily, such criticality directed both the approach and nature of the data collection methods, as well as the various categories of the research participants involved in the study. In this regard, both the practitioner-researcher perspective and stakeholder-centredness collectively demonstrate "the practitioner's [current researcher's] role in the generation of knowledge" (Kahn et al., 2016). Consonant with the latter emphasis, the practitioner-researcher perspective presents to the current study's research methodology, a unique opportunity in terms of which the generation of knowledge did not follow predictable construction patterns (Kahn et al., 2008).

To the extent that the practitioner-researcher perspective entails the active involvement of the researcher (who is also a practitioner in the investigated field), maximum objectivity was maintained throughout the empirical stages of the data collection. Furthermore, the flexibility of the research methods enhanced the pragmatic aspect of the data collected (Barron et al., 2016; Campbell, 2013). Pragmatism forms an essential philosophical or conceptual premise of the practitioner-researcher perspective, since the object of investigation necessarily entails the narrowing of the gap between theoretic knowledge and its application (Goldkuhl and Sjöström, 2015). Accordingly, pragmatism could be construed as advancing the utilitarian value of knowledge actively obtained in the process of its generation. Table 3.2 below depicts

both the advantages of involving practitioners in research and the attendant opportunities for practitioners in respect of various research phases (engagement, methods, dissemination, evaluation and implementation.

Table 3-2: Advantages and opportunities for practitioner-researcher partnerships
(Source: Pinto et al., 2019:8)

Phase of Research	Advantages of Involving Practitioners in Research	Opportunities for Practitioners
Engagement	- Develop leadership; - Help researchers understand local issues; - Build consensus; - Introduce local theories; - Write grant applications; and - Distribute tasks and procedures.	- Share power; - Encourage buy-in; - Facilitate dissemination; - Solve problems; - Exchange knowledge; and - Build capacity.
Methods	- Define methods; - Identify, select and refine measures; - Represent local theories; - Identify existing local interventions; - Translate and adapt interventions; - Screen participants; - Act as research assistants; - Manage and code data; and - Analyse and interpret data.	- Improve relevance of research aims; - Improve comprehensibility of measures; - Help scientific interventions resemble natural local interventions; - Bridge research and practice by adopting and delivering evidence-based practices; - Add to practice wisdom.
Dissemination	- Write and review papers; - Disseminate reports; and - Choose outlets for publication.	- Improve dissemination of findings by diversifying outlets; and - Expand meaning of findings.
Evaluation	- Identify local politics and concerns; - Reflect practice wisdom; and - Represent clients' voices.	- Share power and solve problems; - Exchange knowledge and encourage buy-in; and - Build capacity.
Implementation	- Deliver EBIs; - Manage and maintain EBIs; and - Translate and modify EBIs to adhere to local cultures and norms.	- Maintain fidelity and effectiveness of established programmes; - Prevent unintended effects when programmes are transferred from labs to community and other settings; and - Integrate multiple interventions for better cost-effectiveness.

In terms of Table 3.2 above, it is evident that practical approaches to the generation of usable knowledge transcend the knowledge-for-its-own-sake (theoretic/ abstract/ basic) methodologies. Julkunen (2011) attributes the practicality and pragmatism of the practitioner-researcher method to the mobilisation of actions taken to generate knowledge for the improvement of practice. In the case of this study, practice entails a duality of implications. On the one hand, it entails the occupational context of the researcher in his current practice. On the other, it embodies the non-theoretical (action-oriented) methodological orientation by which the practitioner-researcher approach enabled knowledge generation in the context of application by its actors (active participants) (Julkunen, 2011). It is largely due to the context-of-application factor that the relied wholly on the stakeholders' (participants') perspectives to

produce a 10 (ten) point mobile health implementation framework as the foundational basis to utilise the findings as an enhancement of practice (Gurupur and Wan, 2017; Hultgren and Goldkuhl, 2013; Julkunen, 2011).

3.3   Phenomenological/ Interpretivist Paradigm in the Study

Considerations such as the study's diverse stakeholder constituencies, necessitated that relevant information and knowledge be obtained first-hand from those directly involved or affected by the MomConnect experience (Gemma, 2018). As such, a phenomenological-interpretivist perspective was adopted, which involved the researcher's direct engagement with the selected participants to obtain their emic perspectives on MomConnect.

The interpretivist-ethnographic approach is credited with its allowance of multiple data gathering methods. However, the disadvantage of the approach could be on its perceived high levels of subjectivity from the researchers and his/her research subjects (Gemma, 2018). As such, the quality and validity of the generated information could be doubted for its subjectivity and relevance. Based on the experiential component of the present study, the qualitative approach was adopted, since it accommodated non-singular methods of acquiring information from the diverse range of participants (Dean et al., 2018).
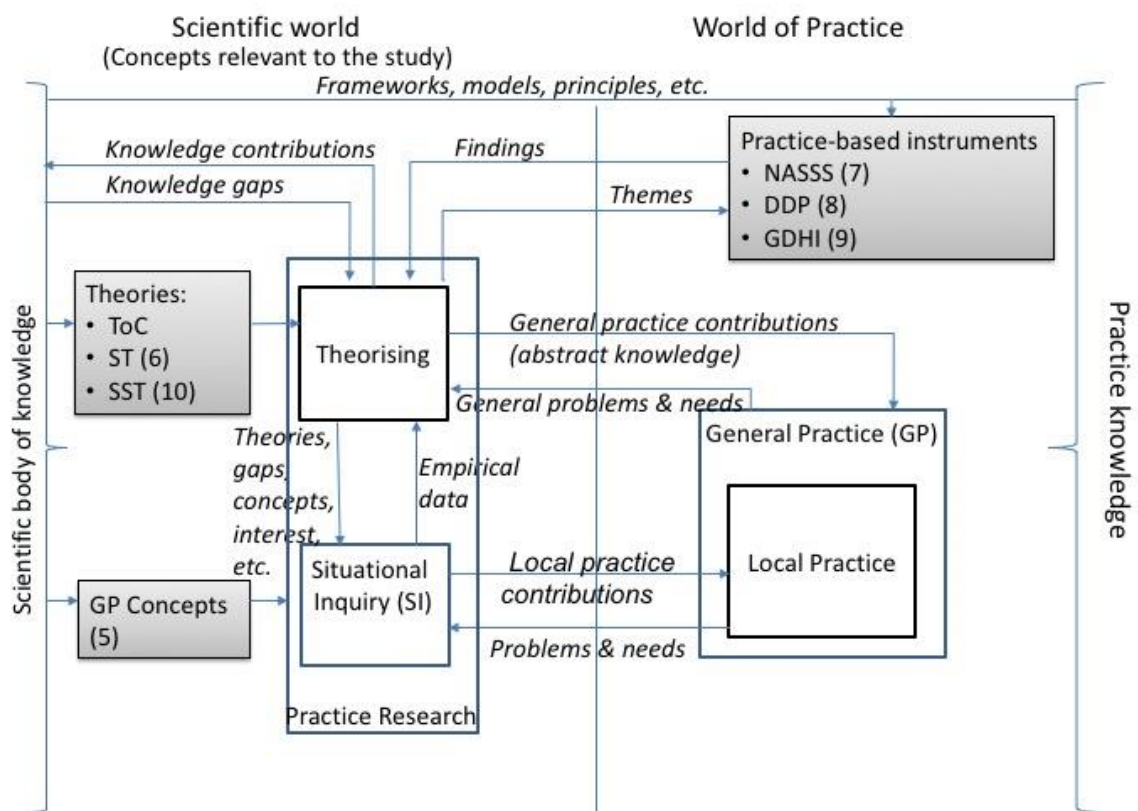
Figure 3-3: Research orientation for this study

The research orientation for the study is depicted in Figure 3.3. It shows how the demonstration case, MomConnect is situated in a local practice. The practice research consists of a situational inquiry where the local practice is investigated. Suitable theories are used to guide the inquiry and analyse of the empirical data (Baskerville and Myers, 2015; Bernardi, 2018). In this study the Theory of Constraints (ToC), Stakeholder Theory (ST) and Strong Structuration Theory (SST) are used to gain insights in the practice of how MomConnect was developed and is currently used. The insights contribute to the body of knowledge as knowledge claims to address the knowledge gaps presented in the problem study (Jeffries et al., 2017). Because the practice is an important consideration and driver for this study, three practice-based instruments were also used, namely: Non-adoption, Abandonment, Scale-up, Spread and Sustainability Framework (NASS), Digital Design Principles (DDP) and the Global Development Health Index (GDHI). The evaluation based on the practice-based framework and theorising provided insights relevant to both the local practice as well as for general practice.

3.3.1 Qualitative Research Approach

In health services qualitative approach is aimed at exploring complex phenomena encountered by clinicians, patients, policy makes and other stakeholders (Vaismoradi, 2013). Based on its phenomenological-ethnographic philosophical grounding, the qualitative research approach adopted by the researcher sought to obtain better understanding of the MomConnect phenomenon from the perspectives of the groups experiencing it directly (Than and Than, 2015).

3.4 Qualitative Data Collection Methods and Procedures

The researcher's direct involvement with the participants in their naturalistic environments involved narrative dialogues, rather than formalistic interactions characteristic of quantitative approaches (Campbell, 2013). In this regard, the methods of data acquisition (in addition to the protracted review of literature) involved audio-recordings, listening and observations in meetings, note taking (field notes), interviews and focus group discussions. Table 3.3 indicates the utilisation of various data collection instruments in the study.

Table 3-3: Data collection methods according to participant category

Participants/ Stakeholders	Composition	Number (N=80)	Site and Data Collection Method
Ministerial Advisory Committee	MomConnect Task Team representative from each of the nine provinces	9 (nine)	One-on-one interviews at NDoH offices
MomConnect Task Team	NDoH officials; Implementing partners: Academia, Funders, NGOs, Consultants, Research Institutes (e.g. CSIR)	15	One-on-one interviews at NDoH offices
Clinical Staff	Professional nurses working at the three inner-city clinics providing ANC services	5 (five)	One-on-one interviews at the inner-city PHCs
Non-clinical Staff	Staff based at the facility who are not registered clinicians but do interact with the patients that come for ANC services: e.g. health promoters, lay counsellors, community health workers and data capturers within the facility.	6 (six)	One-on-one interviews at the inner-city PHCs
Patients/ Users	Pregnant women and mothers visiting health care facilities for maternal, child and women's health at the clinics. Women who were at the facilities on the specific day when researchers were at the clinic were all sampled and formed part of FGDs.	45	Five focus group discussions of nine members each, at the inner-city PHCs
Total		**80**	

From Table 3.3 above, it is clear that only patients/ users were involved in the focus group discussions, and not in the individual interviews. Additionally, the MomConnect Task Team members were the only participant category who were involved in the stakeholder relationship mapping exercise and observation phase. However, observation of all research processes is an ongoing activity (Campbell, 2013).

By virtue of its qualitative orientation or approach, the corresponding qualitative data collection methods and procedures were applied in 5 (five) sequential phases in this study, as indicated below.

3.4.1   Phase 1: Literature and Document Review

As opposed to a pertinent literature review (which is characteristically academic, intellectual, epistemologically- or discipline-focused, scientific and peer reviewed) (Hayes et al., 2010), document review is characteristically focused on the systematic search, identification, synthesis and evaluation of mostly (electronic and non-electronic) secondary data sources and documents that could even entail informal (but relevant) information and details (Baker, 2016). As such, a review of documents could include official government policy documents and records. For purposes of this study, the review of documents by the researcher was facilitated through the MomConnect Repository.

The MomConnect Repository contained publicly available (un/ declassified) documents (without any moratorium) such as: progress reports of implementation, archived and current minutes of task team project meetings, surveys reports, and data and operational research documents/ reports. The MomConnect Repository itself was relevant, since it 'housed' the official institutional memory of the MomConnect Task Team (consisting of representatives of different private and public sector organisations, academic institutions and independent consultants involved at different stages of the MomConnect implementation and held monthly meetings since the inception of the MomConnect project). This phase of data collection was of significant importance to the study, as it facilitated the researcher's evaluation of the MomConnect's decision making processes, providing a comprehensive background on the implementation process of the project, as well as an opportunity to examining the difference between planned programme (MomConnect) implementation and actual implementation (Iribarren et al., 2017).

3.4.2   Phase 2: Stakeholder Relationship Mapping

Having obtained considerable background information and knowledge through the systematic review of relevant literature and documents, stakeholder mapping (similar to research participant selection criteria) constituted the logical phase prior to the actual empirical data collection itself through interviews and focus group discussions (Jun, Morrison and Clarkson, 2014).

Stakeholder relationship mapping basically refers to the identification and categorisation of the main project participants (individuals, organisations or institutions) who directly or indirectly have a vested interest in the ultimate outcome of the particular project based on their levels or stages of involvement in the very same project (Fiordelli et al., 2017). Stakeholder relationship mapping was of critical importance, especially that poor and weak programme management challenges accounted for the failure of scalability and sustainability capacity required for the delivery of huge national projects such as MomConnect (Mawela et al., 2017; Miah, 2017). Therefore, stakeholder mapping was only applied to the participant category located within the decision-making and policy development echelons (such as the members of MomConnect Task Team); rather than applied to the project implementers (e.g. clinical and auxiliary health personnel) or end-users (i.e. patients at the PHC facilities). In this study, the relationship mapping was only applied to the MomConnect Task Team members by means of a written exercise, filling-in an informed consent form and return to the researcher the same day. Subsequent to informed consent, task team members were emailed an exercise used to determine the nature and range of their past and current relationships that may have some impact on the MomConnect project.

As indicated respectively in Section 1.11 and other sub-sections in Section 1.12, the principal stakeholders in this study comprised: selected National Department of Health (NDoH) officials; the MomCTTM); the Ministerial Advisory Committee on eHealth (MACeH); and selected primary health care facility personnel (clinical and non-clinical) and health care users. (Appendix L illustrates a stakeholder relationship mapping tool for the MomConnect Task Team).

3.4.3   Phase 3: Semi-Structured Individual/ One-on-One Interviews

Phase 3 of the data collection was mostly characterised by semi-structured individual/ one-on-one interviews with the key informants at both the NDoH premises in Pretoria and the selected Johannesburg health care facilities. Similar to the focus group discussions (held subsequently at the Johannesburg health care facilities), individual semi-structured interviews were conducted by the researcher and assisted by a professional nurse who was fully conversant and experienced in the functioning of the MomConnect help desk. These one-on-one NDoH interviews were held with both the Ministerial Advisory Committee on eHealth and MomConnect Task Team members (whose composition is mentioned sub-section 1.12.1 above). The full range of the structure and functioning of the Ministerial Advisory Committee on eHealth (MACeH), which was appointed by the Minister of Health, is detailed in Chapter Five (see Appendix I for interview guide questions of the MomConnect Task Team members, and Appendix J for the interview guide questions of the Ministerial Advisory Committee).
The Ministerial Advisory Committee on eHealth is appointed by the ministry of health, and is responsible for matters around eHealth.

Facility staff occupy a central role in any large-scale mHealth rollout. They can be approached as an important resource, or neglected in the implementation planning. MomConnect used experiences at pilot sites to set out examples of work flows in the training material. (Wolff-Piggott et al., 2018). At the health care facilities, the researcher was still assisted by the self-same professional nurse who assisted him with the MACeH and Momconnect data collection at the NDoH premises. The primary stakeholders with whom individual semi-structured interviews were held at the health care facilities were: clinical staff nurses and non-clinical staff (health promoters, lay counsellors and data capturers), as well as PHC users at those selected facilities (see Appendix K for the questions posed to both staff and users at the facilities).

3.4.4   Phase 4: Ethnographic Observation of MomConnect Task Team Meetings

The observation of research participants (informants or stakeholders) is ethnographically significant, based on the opportunity it provides for the researcher to interact directly in conversations/ dialogues with the participants and observe their attitudes, behaviour and interaction towards each other and one another within their ecological parameters (natural environment to which they are very familiar and interpret their reality and conditions) (Kumar,

2012; Yin, 2016). In this regard, participant observation complemented both the primary data collection methods (i.e. individual interviews and focus group discussions).

Participant observation was facilitated by means of the researcher's observation of task team members in their monthly meetings, during which he mainly listened as part of adding value to this study, to the extent that more understanding was important for assessing the stakeholder relationships and collaboration. The latter two aspects are critical factors because they allocated a degree of success or failure of project design, planning and implementation processes and dynamics at the both the bureaucratic and technocratic levels – given the composition of the MomConnect Task Team (Kuziemsky et al., 2009; Leon et al., 2012). For the purpose of this study, and given the heterogeneous representation of interests and constituencies within the MomConnect Task Team, the researcher attended three of their monthly meetings and took field notes of their inter-personal relationships, as well as their decision-making processes and procedures in meetings (see Appendix M for guidelines of the researcher's involvement with MomCTT members in their meetings).

3.4.5   Phase 5: Focus Group Discussion with Health Care Service Users/Patients

Focus group discussions are a form of qualitative data collection mechanism by means of targeted engagement, interaction and conversations between the researcher and specific groups of stakeholders (users, clinical and non-clinical staff) for the purpose of obtaining insightful understanding of their experiences, perceptions and knowledge - in this case – regarding MomConnect (for clinical staff) and quality of facility-based health care service 9for users) (Schnall et al., 2016). Focus group discussions are advantageous in that some participants are more at ease in a group than in one-on-one settings (Creswell and Creswell, 2018).

Focus group discussions were conducted with clinical, non-clinical and users of health care services at the facilities. Participants were recruited with the help and guidance of the facility manager, after which all written ethical protocols and requirements (i.e. information sheets and informed consent forms) were complied with. The health care users were mothers who came for maternal child and women's care (MCWH) services, pregnant women who came for antenatal care (ANC), and mothers who came for postnatal care (PNC) (see Appendix K for the researcher's guidelines and questions in his engagement with the health care users at the facilities).

3.5   Data Management and Analysis

'Data' is considered as a body of unprocessed or raw information that is still to be systematically analysed (Bogdan and Biklen, 2007). After its systematic reconstruction and deconstruction (synthesis and analysis), the raw data is converted and translated into usable and reliable information and knowledge that can be used to draw inferences. In that regard,

data management refers to the initial phase of the conversion process during which data is preserved from any damage or contamination (Seers, 2014).

The audio-recorded data from the interviews and focus group discussions was transcribed into Excel sheets immediately after the relevant engagements with the participants, and digitally kept in USB format for back-up and to prevent any possible loss. No unauthorised persons were granted any form of access to the information, which will be destroyed after five years.

3.5.1 Data Analysis

Data analysis and synthesis basically involves the organisation, classification and categorisation of collected data into intelligible themes and content through in a manner that coheres with both the research problem, research questions and research objectives (Seers, 2014). Meanwhile, Vaismoradi et al. (2013) illuminates that a theme is generally a manifest statement, while a category refers to a latent description of the content or theme.
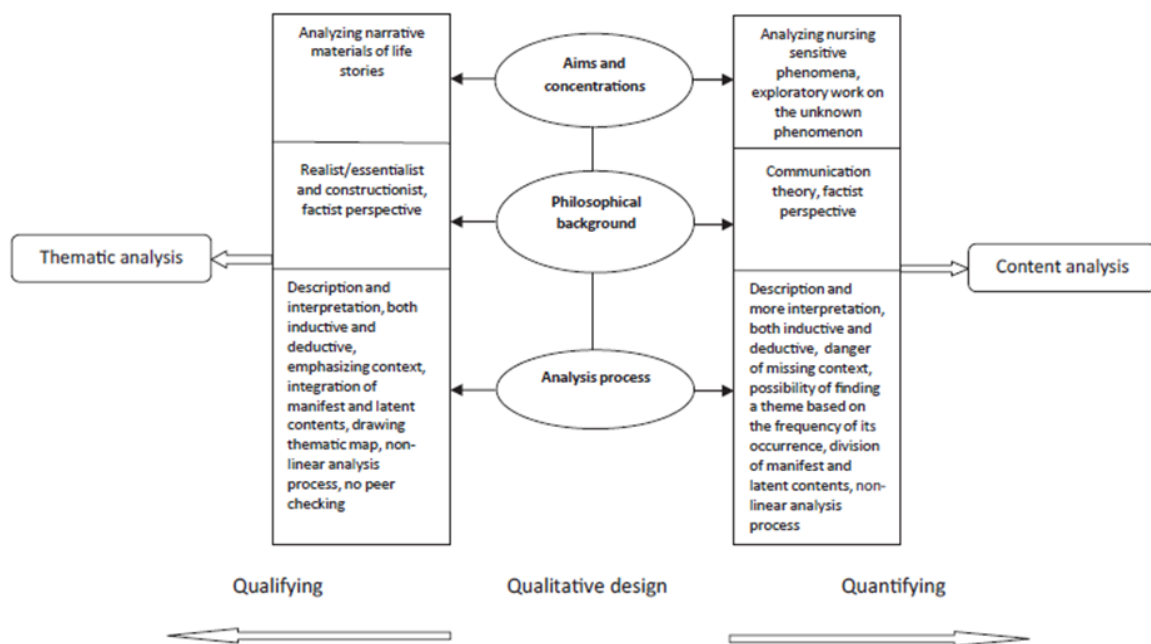
Figure 1. Main characteristics of thematic analysis and qualitative content analysis in the continuum of the qualitative methodology.

Figure 3-4 Main characteristics of thematic and qualitative content analysis
Source: Vaismoradi, 2013:399

In qualitative studies focusing on health and social care, data analysis and synthesis have become widely used health care policy instruments (Soilemezi and Linceviciute, 2018). Additionally, qualitative synthesis may either be applied as an integrated review, through a process of aggregating and/or summarising data using themes or an interpretive review (C. S. Kruse et al., 2017). In this study, content and thematic analysis were used complementarily with conversation and discourse analysis. Figure 3.4 illustrates the configuration of the data analysis processes as applied during the various data collection stages of the study.

3.5.1.1 Content analysis and thematic analysis

In tandem with the sequential empirical data collection stages, the consequent analytic methods applied differently, but directed towards the same objective of identifying common patterns and themes of data and information in varying degree of description and interpretation (Matua and Van Der Wal, 2015). When exploring a field in which there is limited knowledge, content analysis becomes suitable to report common issues mentioned in data qualitatively and possibly quantify it (Vaismoradi, 2013). In this regard, the content of documents such as minutes of MomConnect meetings and other official policy reports and record, was analysed for recurring themes of information that could be translated into meaningful knowledge. Vaismoradi (2013) illuminates that content analysis is mostly characterised by manifest (developing data categories) and latent contents (developing themes).

Thematic analysis focuses on the hierarchical grouping or organisation of both the latent and manifest data categories and categorising (classifying or coding) them according to their similarities/ dissimilarities and relevance/ irrelevance (Matua and Van Der Wal, 2015). Thematic analysis is common across all forms of data analysis, and is concluded with a narrative summary of the findings emanating from the narrated statements of the participants/ stakeholders. The findings were then interpreted in conjunction with their implications on eHealth policy and practice.

3.5.1.2 Conversation analysis and discourse analysis

Conversational analysis emanates from 'talks' between and among individuals as they attempt to 'make sense' of their realty, experiences and living conditions (Macura et al., 2019). By observing and engaging with the stakeholders (during participant observation, interviews and focus groups), the researchers was able to describe and analyse their behaviours, attitudes and frequently emerging issues or topics in relation to policy formulation and organisational design (for the MomConnect team). On the other hand, the conversations and 'talks' among the facilities-based participants (nurses and users/ patients) were an opportunity to describe and analyse the issues that these participants constantly referred to, or 'talked' about. The audio recordings of the fieldwork were also an important aspect of the conversation analysis because the narrated statements still had to be transcribed and translated into meaningful knowledge.

Shaw and Bailey (2009) highlight that discourse analysis focuses on the investigation of the social and cultural character and meaning of language (socio-linguistics) in its broader context (including face-to-face talk, non-verbal interaction, images, symbols and documents). In this study, discourse analysis was useful for understanding the 'socio-linguistics' of the participant. Accordingly, language use of the participants is described, analysed and understood beyond ordinary linguistic or grammatical constructs. Due to the various backgrounds of inner-city

dwellers, their usage of language demanded for the researcher to also understand socio-cultural and other factors. For the MomConnect Task Team members and facility-based professionals, their educational or literacy backgrounds, for instance, could be different from that of the health care users. As such, the extent of conversations and discourse between and among different stakeholders or constituencies was also helpful in complementing the audio recorded statements of the participants. Jointly, the narrated statements and their attendant conversations and discourses provided a sufficient framework for meaning-making.

3.5.1.3 Convergent analysis

Convergent analysis involves the flexible utilisation of different analytic processes in the same study (Soilemezi and Linceviciute, 2018 3). Given the range of stakeholders, methods and approaches, the systematic review, classification and synthesis of differently acquired information required that flexibility be applied during all stages of data analysis in order to converge the different contexts of data into major themes and their attendant categories. Chapter Five of this study reflects a typical approach to the convergence of themes and content derived from the conversations and discourses with the participants.

3.6 Trustworthiness

The study's trustworthiness is an indication and assurance of the efficacy and quality of the research methods and ultimate findings in the study (Wu et al., 2016). In this qualitative study, the measures of trustworthiness involved: credibility, transferability, dependability, confirmability, and reflexivity.

3.6.1 Credibility

Credibility refers to the confidence that the findings of the study are an accurate representation of the views of the participants. In the study, credibility was applied by means of the triangulated methods of collecting data, as well as long-lasting observations and engagements with the participants even beyond the scheduled data collection sessions. This was embarked on, to ensure that the researcher understood 'the world of the participants' as much as possible (Korstjens and Moser, 2018).

3.6.2 Transferability

Transferability relates to the extent to which the study's findings could be applied with other participants in other contexts that resemble the original research settings (Walliman, 2015). The descriptive aspect of this qualitative study enabled the researcher to present and document every aspect (contexts) of the study as comprehensively as possible to ensure that anyone interested in the study is able to understand all of its processes and decisions taken from the very beginning to the end stage of writing the research report.

3.6.3 Dependability

Dependability is the measure of the findings of the study's stability and consistency as determined and corroborated by the participants (Walliman, 2015). All processes and important decisions in the study were comprehensively documented and audited, such that transparency was accorded anyone interested in the study to review all of its processes.

3.6.4 Confirmability

Confirmability relates to the extent to which other researchers and professionals or experts in the field meritoriously agree or confirm the research processes and study findings as objective, and not red-herring or the researcher's own unsystematic imposition (Korstjens and Moser, 2018). Similar to the notion of dependability in this study, confirmability was ensured by transparently subjecting the data and methods of interpretation to scrutiny by independent practitioners and the participants of the study themselves (Korstjens and Moser, 2018).

3.6.5 Reflexivity

Reflexivity, on the other hand, premises on the self-monitoring of the researcher in order to inculcate objectivity and eliminate bias, prejudice and subjectivity throughout the research process. Similar to ethical considerations, reflexivity was a valuable self-monitoring process, considering that judgement sampling was opted for, against the researcher's professional experience and having worked previously as a member of the MomConnect Task Team. The researcher is also a professional health care practitioner (ophthalmologist). The researcher ensured that none of the participants were misrepresented. Chapter Five bears testimony to the fact, which is also reflected in varying degree in Appendices O, P and Q.

3.7 Conclusion

This chapter focused on presenting the research processes that informed the qualitative data gathering processes of the study. These processes are not the data itself, but a framework on whose basis the qualitative findings themselves were arrived at. Chapter Five of this study (considered the 'heart' of the investigation) captures the multifaceted findings themselves. In its essence, whereas Chapter Five presents the empirical domain of the study, this chapter (Chapter Three) fundamentally presents the theoretical background or approaches that guided and complemented the methods by which the findings were established. The following chapter (Chapter Four) highlights the MomConnect initiative as a demonstration case of evaluating the project in its context of an mHealth intervention.

CHAPTER 4: LOCAL PRACTICE AS THE DEMONSTRATION CASE: MOMCONNECT INITIATIVE

CHAPTER ONE: Rationale and Scope of the Study

CHAPTER TWO: Theoretical and Empirical Foundations and Location within Literature

CHAPTER THREE: Description of the Research Methodology

CHAPTER FOUR: Local Practice as The Case: MomConnect Innitiative

- Introduction
- MomConnect Subscription
- MomConnect as Responding to Sub optimal
- The MomConnect Task Team/ MomCTT
- The Ministerial Advisory Committee on eHealth (MACeH)
- The Facilities
- The Users (Pregnant women and mothers
- Conclusion

CHAPTER FIVE: Situational Inquiry and Theorising (Phase 2)

CHAPTER SIX: Stakeholder Analysis (Phase 2)

CHAPTER SEVEN: Practice Based Analysis: Phase 3 (NASSS Framework)

CHAPTER EIGHT: Practice Based Analysis: Phase 4 (Principles of Digital Development)

CHAPTER NINE: Practice Based Analysis: Phase 5 (Global Digital Health Index)

CHAPTER TEN: Synthesis as Convergence of Findings from Phases 1 to 5: Using Strong Structuration Theory as Lens

CHAPTER ELEVEN: Practice Enhancement: An Evolving Stakeholder Centred Strategy for Mobile Health re-Engineering

CHAPTER TWELVE: Discussion of The Findings As a Mechanism to Highlight Insights From The Study

CHAPTER THIRTEEN:

4.1   Introduction

This chapter presents an introduction and description of the case example, which is mainly used for demonstration purposes of MomConnect, an initiative of the National Department of Health (NDoH) in South Africa. This is a national mHealth initiative in which data is gathered to answer the research question and to learn from it. It worth noting that it is not a case study, but a demonstration case. Most importantly, it is neither a study setting as well. This explanation is critically important for the reader's perceptual orientation and understanding in context. Photographic material is provided in this chapter to present a visual, rather than imaginary understanding of various MomConnect scenarios. It should be noted that no prior permission needed to be granted for the publication of the individuals appearing in the photos, including that of the former Minister of Health, Dr A Motsoaledi.. Not only are they in the public domain, but they are also freely available from various electronic domains of the National Department of Health. As a matter of fact, as the Minister of Health under whose watch the MomConnect initiative was incepted, Dr Motsoaledi championed the success of this initiative by conducting roadshows in all nine provinces and monitoring the utilisation of its helpdesk registration trends during his routine provincial visits (Peter et al., 2018). In addition, each MomConnect milestone achievement was commemorated during public events.

Since it focuses on the demonstrative aspects of MomConnect, the chapter also highlights some of the MomConnect initiative's associated components, such as NurseConnect, the MomConnect Task Team, and the Ministerial Advisory Committee on eHealth; the functionality of the initiative on the mobile device; as well as the requisite resources.

Betjeman, Soghoian, and Foran (2013) mention that the evidence of mHealth's interventions in Sub-Saharan Africa is not strong enough to warrant large-scale implementation of the existing interventions of mHealth. Furthermore, Tomlinson et al. (2013) state that no large-scale, well-designed efficacy and effectiveness trials of mHealth have been carried out as yet. Therefore, a socio-technical approach asserts that an understanding of existing ways of working is important. This implies that the actual conditions under which work is carried out, rather than an abstract model, should be the point of departure (Wolff-Piggott et al., 2018).

Nilsen and Bernhardsson (2019) mention that organisations and department are valuable in addressing the implementation challenges and describing the context of projecting an understanding of *when, how, what, whom, which*, in a health innovation or service by a team. The most common context dimensions were organisational support, financial resources, social relations and leadership support, organisational culture and climate, and organisational readiness to change. The least common factor is that of the physical environment. Table 4.1 below illustrates the description of the context dimensions.

Table 4-1: Description of the context dimensions

(Source: Nilsen and Bernhardson, 2019:14

Context Dimension	Description
Micro level of health care Patients	Patients' preferences, expectations, knowledge, needs and resources that can influence implementation
Meso level of health care Organisational culture and climate	Shared visions, norms, values, assumptions and expectations in an organization that can influence implementation (i.e. organisational culture) and surface perceptions and attitudes concerning the observable, surface-level aspects of culture (i.e. climate);
Organisational readiness to change	Influences on implementation related to an organisation's tension, commitment or preparation to implement change, the presence of a receptive or absorptive context for change, the organisation's prioritisation of implementing change, the organisation's efficacy or ability to implement change, practicality and the organisation's flexibility and innovativeness.
Organisational support	Various forms of support that can influence implementation, including administration, planning and organisation of work, availability of staff, staff workload, staff training, material resources, information and decision-support systems, consultant support and structures of learning.
Organisational structures	Influences of implementation related to structural characteristics of organisation in which implementation occurs, including size, complexity, specialisation, differentiation and decentralisation of the organisation
Macro level of health care Wider environment	Exogeneous influences on implementation in health care organisations, including policies, guidelines, research findings, evidence, regulation, legislation, mandates, directives, recommendations, political stability, public reporting, benchmarking and organisational networks
Multiple levels of health care Social relations and support	Influences on implementation related to interpersonal processes, including communication, collaboration and learning in groups, teams and networks, visions, conformity, identity and norms in groups, opinion of colleagues, homophily and alienation.
Financial resources	Funding, reimbursement, incentives, rewards, costs and other economic factors that can influence implementation.
Leadership	Influences on implementation related to formal and informal leaders, including managers, key individuals, change agents, opinion leaders, champions, etc.
Time availability	Time restrictions that can influence implementation.
Feedback	Evaluation, assessment and various forms of mechanisms that can monitor and feedback results concerning the implementation, which can influence implementation.
Physical environment	Features of the physical environment that can influence implementation, e.g. equipment, facilities and supplies

Nilsen and Bernhardson (2019) mention two different context conceptualisations, such as concrete and passive contexts (e.g. the physical environment in which implementation occurs); abstract but potentially dynamic contexts (e.g. active support from colleagues and management). Most of the frameworks identified in this review emphasise the active view of context, indicating that it is widely recognised that context is not merely a passive backdrop to implementation. The view of context as a physical place implies a positivist notion of context, that is, the context as an objective entity that can be observed; whereas the view of the context as something more intangible and active represents a more subjectivist perspective that acknowledges the complexity and multi-dimensionality of the context (Nilsen and Bernhardson, 2019).

MomConnect is an mHealth initiative and intellectual property of the National Department of Health (NDoH) of South Africa. MomConnect is aimed at improving maternal, children's and women's health services by registering all pregnant women to receive health messages via mobile phones. Unlike most mHealth initiatives in the country, the MomConnect initiative was never piloted. The following pictorial presentations show various MomConnect scenarios.

Image 4.1: Former Minister of Health's MomConnect structure and processes

MomConnect was implemented nationally by means of roadshows initiated by former Minister of Health, Dr Aaron Motsoaledi in each of the country's nine provinces.

Image 4.2: Former Health Minister outlining the MomConnect objectives and its delivery methods and messages

4.2 MomConnect Subscription Process

In order for women to subscribe, a specific USSD code is used. Other key information such as the facility code and the ID number or date of birth of the woman are used. According to Xiong, Kamunyori and Sebidi (2018) the majority of the pregnant women were accessing the MomConnect helpdesk "for maternal information rather than for discussing health services received". The expected date of delivery is also required. Different measures were used for to load personal information into the initiative. In some cases, subscription is in groups where women are guided by a health care worker who assists the group in loading information. The health care worker will go through MomConnect's directions of loading information into pregnant women's mobile phones, or a single woman would be assisted alone following the same steps. After loading the necessary information, the user receives a welcome note and confirmation via short message service (SMS) that she is active and connected to MomConnect.

At the inception of MomConnect in 2014, USSD and SMS were opted for respectively as the preferred registration channels and messaging. This option was based on their universal accessibility on all handsets, affordability, and familiarity to the target population. The rationale was also that South Africa's adult literacy rate of above 90% made text-based solutions viable (Peter et al., 2018).

The use of digital technologies to improve access to health is gaining traction in Africa (Mehl et al., 2018). The success of MomConnect has unequivocally de-emphasised the continuity of 'pilotitis', and that integrated large-scale digital health initiatives (especially among LMICs) are no longer a futuristic pipe dream (Mehl et al., 2018). This is more realisable with the increasing accessibility and penetration of mobile phone technology and the internet, as well as the

continuing demand for innovative strategies to support the implementation of the health-related Sustainable Development Goals and Universal Health Coverage on the continent (Ngoc et al., 2018).

Image 4.3: Primary health care staff and a quote from the facility's operational manager

4.3   MomConnect as Responding to Sub-optimal MCH Indicators.

As an mHealth initiative, MomConnect is strengthening information systems by introducing a mechanism for electronic registration of pregnancies in the public health system using a unique ID number (Presentation); strengthens the demand side of the health system by sending targeted health promotion messages to pregnant women to improve their health and infants; and provides an interactive feedback mechanism for pregnant women in order to ask questions, rate the service, and to either complain or compliment the service rendered.

4.3.1   MomConnect's Achievements Since August 2014

- Over 1.9 million pregnant women linked to SMS messaging;
- Women ask 1000 questions a day – helpdesk;
- 9 times as many compliments (14818) compared to (1573) complaints received;
- Specific eMTCT additional messaging for HIV positive women (from Sept 2016); and
- Some impact on the supply side of health system.

Notwithstanding its noted success factors, Ngoc et al. (2018) contend that the immense benefits of digital health to advance access to health services delivery is still to be harnessed in Africa largely due to critical challenges such as proliferation of pilot projects, poor coordination, inadequate preparedness of the African health workforce for digital health, lack of interoperability and inadequate sustainable financing, to mention a few of these bottlenecks.

4.3.2   Examples of MomConnect Messages

- Opt Out: "*If you don't want any more messages around HIV (to unsubscribe), reply by sending 'STOP' to this SMS. You will keep getting the normal messages from MomConnect*";

- General: "*All live births must be registered within 30 days at the nearest Department of Home Affairs office''*. To stop reply 2*stop*'";

- Reminder: "*Don't forget to go to your next antenatal appointment. Staff can make sure that you are prepared for labour, and that your baby is well*".

4.4   NurseConnect

NurseConnect is a MomConnect sub-component established to empower and support nurses with regular content; encourage study and peer support groups; and provide feedback mechanism for nurses to make suggestions. Nurses are able to communicate with pregnant women using NurseConnect on their cell phones free of charge. They are also able to receive relevant information to help them on maternal and child health. NurseConnect further enables nurses to give feedback, ask questions about their work and work environment. They are also able to set up learning and support networks.

Examples of NurseConnect clinical messages

- *"Remember the Golden Minute. If a new-born baby is not crying or breathing well after drying, you will need to help the baby breathe";*

- *"Take care not to perform a digital vaginal examination if antepartum bleeding is present. You must first rule out placenta praevia"; and*

- *"Remember: check mom's HIV status. Make sure that she and her baby are getting the care they need as outlined in the latest PMTCT guidelines".*
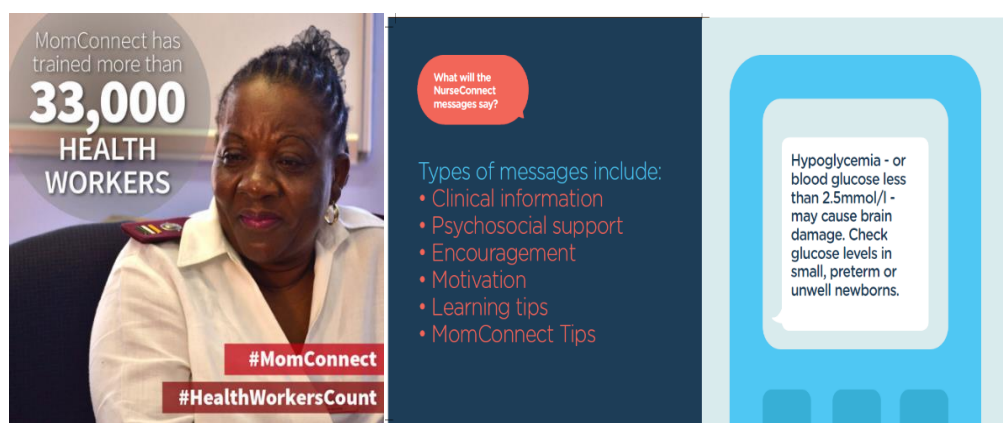
Image 4.4: South African nurse in uniform and indicating progress in training nurses on the MomConnect initiative

4.5 PMTCT MomConnect

PMTCT is a component of MomConnect where HIV-related messages supplement main MomConnect for HIV-positive pregnant women and mothers, who are educated on health care and prevention of the transmission of the virus to unborn babies; as well as promoting the health of new-born babies. There were over 100 messages covering pregnancy and delivery, until the baby's first birthday (final reminder for 18-month test). When this study was conducted, the PMTCT MomConnect was introduced and operational in 5 (five) districts since September 2016. Presently, PMTCT MomConnect has almost 11 000 subscriptions of pregnant and lactating women, and there were plans to scale-up to the remaining districts. However, these are non-pilot sites subscribing and contacting the helpdesk according to reports such as the Health Enabled Closing Report.

Image 4.5: PMTCT MomConnect wall posters in English and Tsonga languages used at facilities (These posters were available in all 11 official South African languages)
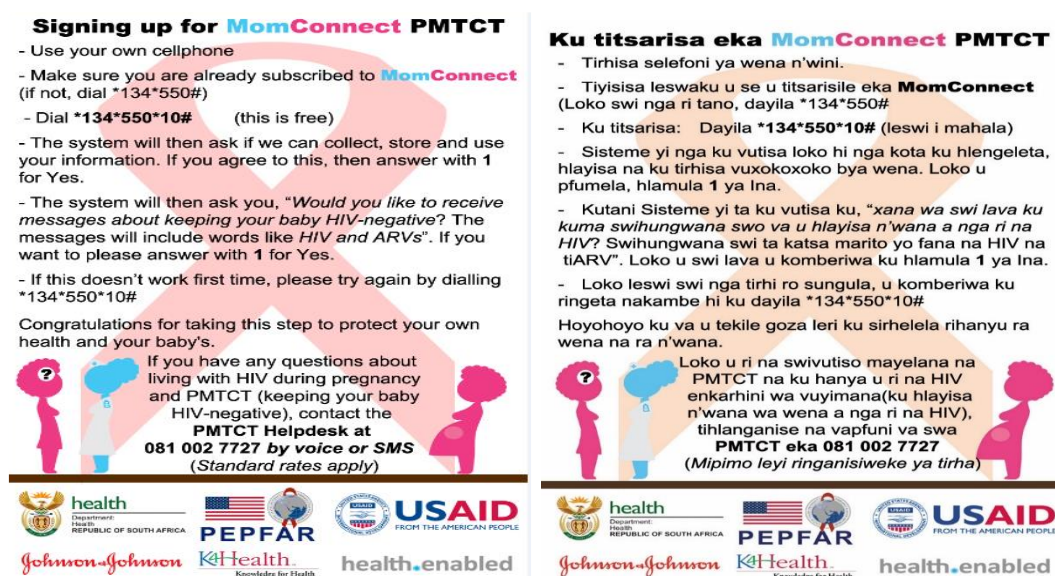
Image 4.6: A business-size card information on PMCTCT MomConnect subscription instructions

4.6   The MomConnect Task Team/ MomCTT

The MomConnect Task Team was involved in the development, design and implementation of the MomConnect initiative. It comprises of representatives from all implementing partners and chaired by the Deputy Director-General (DDG) as a representative of the National Department of Health. The DDG is responsible for maternal and child health. The DDG is supported in the day-to-day oversight of MomConnect by a senior technical assistant, who provides strategic guidance on priorities, convenes meetings of the MomConnect partners, oversees reporting on monitoring and evaluation, and supervises helpdesk staff.

MomConnect's daily operations are sustained by contributions from the more than twenty different partner organisations, including non-profit, for-profit, academic, and donor organisations. The National Department of Health does not have (and does not need to have) the skills and capacity to run MomConnect's technical operations. However, the NDOH sets the priorities of MomConnect and provides strategic guidance and clear channels for decision-making and communication to maintain alignment across the range of stakeholders in all nine provinces (Peter et al., 2018).

4.7   The Ministerial Advisory Committee on eHealth (MACeH)

The Ministerial Advisory Committee on eHealth is appointed by the Ministry of Health, and is responsible for all eHealth matters. In terms of powers vested to the Minister of Health (Dr Aaron Motsoaledi at inception of the first MACeH) by Section 91 of the Health Act (No. 61 of 2003), and as advised by the National Health Council, available MACeH vacancies are advertised openly in both the electronic and non-electronic media. The Minister then appoints the following incumbents to the MACeH:

- An ICT Specialist or Senior Manager from each province, responsible for the ICT;
- A Deputy Director-General from the National Department of Health;
- Five members with experience of at least ten years in ICT and/or Public Health from the private sector, academic or research institutions and non-government organisations;

The main function of the MACeH is to advise the Minister on the implementation, monitoring and evaluation of the NDOH's eHealth Strategy. Such advise should include:

Strategy and leadership; Stakeholder engagement; Standards and interoperability; Benefits realisation; Capacity and workforce; e-Health foundations; Applications and tools to support health care delivery; Any other matter including emergency issues.

Furthermore, individuals appointed to the MACeH were renumerated "in accordance with the levels prescribed by the National Trasury" (National Department of Health, 2015).

4.8   The Facilities

The facilities are fixed structures such as clinics and community health centres where pregnant women and mothers consult clinicians and/ or nurses for their ante-natal care and other health services.

4.9   The Users (Pregnant Women and Mothers)

MomConnect users are mainly the pregnant women and mothers who use PHC facility services, and are subscribed to the MomConnect initiative to receive SMSs. Based on its quantitative usage, the MomConnect initiative does have the potential to contribute as part of an integrated information system to support and complement clinical services as well (Heekes et al., 2018).

4.10 Conclusion

Notwithstanding its functionality and intended purposes, the MomConnect initiative does not clarify implementation strategies and the achievement of outcomes, and how these relate to reproductive health decision-making in different contexts. Understanding of this question is fundamental in the future design and implementation of maternal and reproductive mHealth, and other mHealth interventions in low to middle-income countries (Ilozumba et al., 2018).

CHAPTER 5: SITUATIONAL INQUIRY AND THEORISING (PHASE 2)

CHAPTER ONE: Rationale and Scope of the Study

CHAPTER TWO: Theoretical and Empirical Foundations and Location within Literature

CHAPTER THREE: Description of the Research Methodology

CHAPTER FOUR: Local Practice as The Case: MomConnect Innitiative

CHAPTER FIVE: Situational Inquiry and Theorising (Phase 2)

- Introduction
- Review of MomCTT Minutes
- MomConnect Task Team Interviews
- Ministerial Advisory Committee on eHealth (MACeH)
- Facility Level (PHC) Data
- Conclusion

CHAPTER SIX: Stakeholder Analysis (Phase 2)

CHAPTER SEVEN: Practice Based Analysis: Phase 3 (NASSS Framework)

CHAPTER EIGHT: Practice Based Analysis: Phase 4 (Principles of Digital Development)

CHAPTER NINE: Practice Based Analysis: Phase 5 (Global Digital Health Index)

CHAPTER TEN: Synthesis as Convergence of Findings from Phases 1 to 5: Using Strong Structuration Theory as Lens

CHAPTER ELEVEN: Practice Enhancement: An Evolving Stakeholder Centred Strategy for Mobile Health re-Engineering

CHAPTER TWELVE: Discussion of The Findings As a Mechanism to Highlight Insights From The Study

CHAPTER THIRTEEN:

5.1   Introduction

In this chapter, the triangulated data collection is presented, interpreted and discussed as collectively derived from four different sources (Saunders et al., 2016). The presentation and discussion also entails thematic categorisation in accordance with the source from which the data was obtained. A summary of the overall findings of the various data sources and methods is also included. Subsequently, the overall findings are compared and evaluated against the study objectives. In detail, the overall findings that were categorised into themes are then adapted in order to answer the main research question and its sub-questions (Braun and Clarke, 2006).

Thematic analysis was conducted in accordance with the six-step proposition by Braun and Clarke (2006) as follows:

1. Familiarisation with the data;
2. Assigning preliminary codes to describe the content;
3. Searching for patterns of themes across the four data sources;
4. Reviewing the themes;
5. Defining and naming the themes; and
6. Finally, producing the research report.

Figure 5-1 below illustrates the overall thematic analysis process.
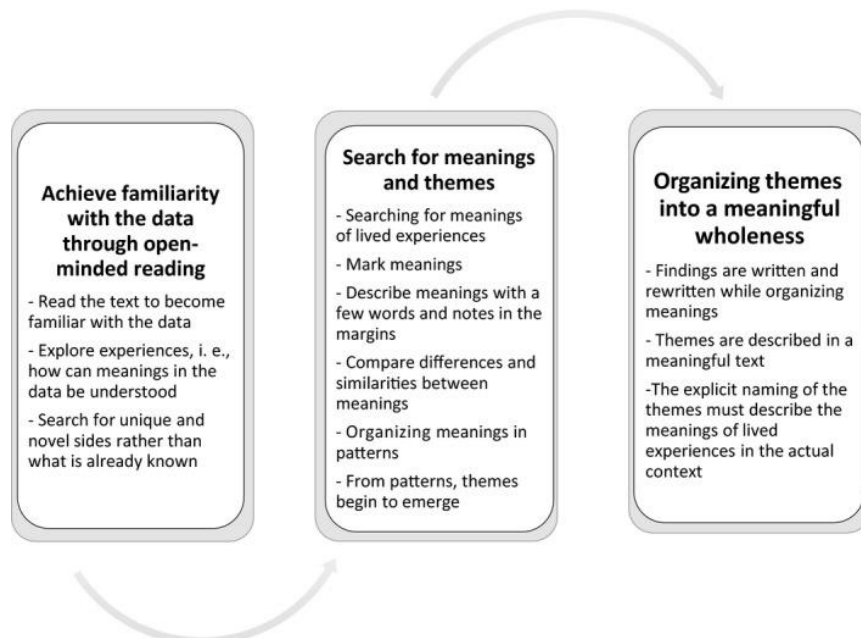
Figure 5-1: Summary of thematic analysis process
(Source: Braun and Clarke, 2006:16).

5.2 Review of MomCTT Minutes

The MomConnect Task Team (MomCTT) has been explained briefly in Chapter Four. The MomCTT is one of the four data sources. This section presents the MomCTT's demographic characteristics and thematically analysed information obtained from their minutes.

5.2.1 Demographic Characterisation of MomCTT Members at Meetings

Table 5-1 below shows the demographic details of this team.

Table 5-1: Demographic information of MomCTT members at meetings

Title (File Name as per Records)	Date	Delegates	Apologies	For Info
20140227 MMH Task Team Working Group Meeting	2014, Feb 27	4	1	2
MNCH mHealth Task Team mtg 15 May 2013 Minutes pb	2013, May 15	6	2	2
Mobile project task team meeting	2014, July 31	14	10	5
Minutes Task team meeting 05062014_AFpb	2014, June 05	11	8	6
Minutes Task team meeting 07082014_AFpb	2014, Aug 07	12	11	6
Minutes Task team meeting 12022014 AF_V1pb clean[2] CJS[2]	2014, Feb 12	100	1	6
Minutes Task team meeting 25092014_AF_pb	2014, Sept 25	10	10	6
Minutes Task team meeting 26022014_AF rev pb	2014, Feb 26	6	4	4
hhhhh 2015				
Minutes Task team meeting 20150226pbV2	2015, Feb 26	17	1	7
Minutes Task team meeting 20150326pb	2015, Mar 26	17	1	5
Minutes Task team meeting 20150326V2	2015, May 28	17	2	3
Minutes Task team meeting 20150625AFpb final (4)	2015, July 30	13	7	3
Minutes Task team meeting 20150827pb	2015, Aug 27	12	6	3
Minutes Task team meeting 20151001pb	2015, Oct 01	17	4	3
Minutes Task team meeting 20151105af	2015, Nov 05	16	5	3
Minutes Task team meeting 20151210af pb	2015, Dec 10	16	5	3
hhhh 2016				
Minutes Task team meeting 01092016_AF_pb	2016, Sep 01	21	3	3
Minutes Task team meeting 06102016_AF-PB	2016, Oct 16	14	13	3

Title (File Name as per Records)	Date	Delegates	Apologies	For Info
Minutes Task team meeting 08122016pb Final	2016, Dec 08	18	8	3
Minutes Task team meeting 09062016_AF.docx	2016, Jun 09	14	7	3
Minutes Task team meeting 10032016AF_pb	2016, Mar 10	18	2	3
Minutes Task team meeting 10112016_pb	2016, Nov 10	11	15	3
Minutes Task team meeting 12052016 AF_pb	2016, May 12	15	5	3
Minutes Task team meeting 14042016RA_pb	2016, Apr 14	12	6	3
Minutes Task team meeting 28012016AF _1_PB	2016, Jan 28	15	5	3
Minutes Task team meeting 28072016Final pb_AF	2016, Jul 28	15	6	3
hhhh 2017				
Minutes Task team meeting 13042017_AF-pb	2017, Apr 13	19	8	3
Minutes Task team meeting 18052017_AFpb	2017, May 18	14	4	2
Minutes Task team meeting 28092017 pb_JS		17	7	2
Minutes Task team meeting 31082017_AF-pb		17	6	2
Minutes Task team meeting 27072017pb	2017, Jul 27			
Minutes Task team meeting	2017, Nov 23			
Minutes Task team meeting 29062017_AF Final-pb	2017, Jun 29	23	7	2
Minutes Task team meeting 28092017 pb_JS (1)	207, Sep 28	21	6	2
Minutes Task team meeting 02032017_af_pb	2017, March 2	19	7	3
hhhh 2018				
MCTask team meeting minutes 18042018pb	2018, April 18	20	1	2
Task team report MomConnect%2F April 2018 (Draft B) (1)-1.docx		16	4	3
MCTask team meeting minutes 22022018pb	2018, Feb 22	17	9	2
MomConnnect Task Team Meeting 22 March 2018.docx	2018, March 22			
MCTask team meeting minutes 22022018pb (1)	2018, Feb 22	18	9	2
Minutes Task team meeting 23112017jspb (1)	2017, Nov 23	22	8	2
MCTask team meeting minutes 22022018pb (1)	2018, Jun 21	19	7	2

The researcher's field notes were the source of the information in the table above, since no outsiders were privy to the documented record of the minutes. The 'insider' advantage was also enhanced by the researcher's familiarity and exposure to the working of both the MomConnect Task Team and the Ministerial Advisory Committee on eHealth (MACeH -a factor of the practitioner-researcher approach (Heeks, 2002; Mehl et al., 2018). For the gathering of 12 February 2014, the number 100 shows that the occasion was not an ordinary meeting, but an event requiring the attendance of multiple stakeholders from all nine provinces.

5.2.2 Clusters, Themes and Sub-Themes of MomCTT Minutes

Table 5-2 below represents the thematically organised body of information relating to the issues discussed at the meetings. In terms of Table 5-2, the main cluster is premised on service conceptualisation, the ecosystem, roll-out, and service continuity. It is worth noting that the supporting verbatim responses of all four data sources have been captured comprehensively in Appendix Q. Furthermore, the verbatim responses appearing throughout this chapter are indicated in the allocated tabular spaces together with their codes.

Table 5-2: Clusters, themes and sub-themes of MomCTT minutes

Cluster	Theme	Sub-Theme
Service Conceptualisation	Stake holders	Facility Level
		Consultation and Collaboration
	Design Process	Considerations
		Research
		Expansion
Ecosystem	Organisational	Vision, Policies and Guidelines
		Governance and Leadership
		Political
	Privacy and Security	Data Ownership
		The service
	Integration	Technical: Infrastructure & Interoperability
		Programmatic: Maternal, Child and Women's Health
Roll out	The scaling process: National to Provinces	
	Operations and Performance	
Service Continuity	Service Continuity, including Sustainability and Evolution	

5.2.3 Service Conceptualisation

The main themes in this regard pertain to stakeholders, the design process, organisational aspects, privacy and security, integration, scaling-up and operations and performance.

5.2.3.1 Stakeholders

The meeting discussions showed that there was a discussion around the implementation and facility level. The mHealth initiative was intended to reduce the workload from the already

overloaded clinical staff, as well as reduce long queues and procedures that may need to be conducted in every patient (Xiong et al., 2018). It was also recorded that there should be a process of user experience and/or consultation and training for the nurses at the facilities regarding the MomConnect initiative. From the records it also shows that the MomConnect Task team understood and acknowledged the importance of user centred design. Records also show that the interaction between the staff and patients, particularly nurses are short and the mHealth subscription should be short so that it does not prolong the interactions significantly from what it was initially.

• *"make it as easy as possible (for nurses)"* • *"Research with the nurses to improve design to user centred".* • *"...nervous having two options as nurse-patient interactions are very short"*
Verbatim Quotation 5.1.1.1.A

The process of getting stakeholders from different backgrounds involved was recorded as indicating the need to have an open call, in such a way that role players with interest in mHealth may be involved and probably bridge the gap among the teams working in silos (Gupta, 2016). There was an agreement to enquire on how to approach potential data integration between different departments such as the Department of Science and Technology. Documents were submitted to the National Health Council for input. The terms of reference for the Task Team was also submitted.

• *"The NDoH would like this process to lead to a natural coalition of mHealth organisations. Now the terrain is too difficult".* • *"How to get people involved: "It was agreed that this be a public and active process. These minutes and other working documents will be made public to the "mHealth Community"."* • *"This process will develop an initial draft (including questions for research) to be sent to all partners interested in mHealth. Comments will be requested from interested parties (including service providers and MNCH organisations)."* • *'We should not only be asking operators for free services , but join value creation"*
Verbatim Quotation 5.2.1.1. B

Every point noted and discussed in the minutes was implemented. If there was a need for immediate action to be executed, further discussions were conducted and concluded as a matter of urgency. In areas where consensus was not reached, a certain individual would be given a task to research further and bring feedback in the next meeting, or to share the discussion with potential advisors that may input and/ or give suggestion on the matter. In cases where there were members in the task team who changed jobs or resigned from the company or organisation, their posts were replaced by individuals who would also take their positions in the task team.

5.2.3.2 Design process

The records also show that the team had to make decisions regarding subscriptions. The decision had to be made between the waiting area or in the consulting room with the nurse. The patient flow within the facility was considered and explored, whether it was reasonable to subscribe during nurse-patient interaction or in the waiting area. In cases where there were problems such as network issues, or users forgot their phones at home, an option to use a third party's phone to subscribe to the service would be suggested and later implemented. Using a third party's phone meant that the patient should provide their mobile number to the facility, where a staff member would facilitate the subscription. Only then would the patient be able to receive messages on their own phones notifying them that they have been subscribed to MomConnect. The records also indicated that the health system needed to be taken into consideration during the design process to check the technology's compliance with the health system's design and normative standards (Aranda-Jan et al., 2014; Heeks, 2002).

- *"If we design the system properly we might be able to have them enter data in the waiting room".*
- *"This initiative will enable 3ʳᵈ party to enrol mothers and children up to 2 years into MomConnect using different technology either that we are using MomConnect".*
- *"In moving forward in this initiative there is a need to understand the health system perspective before moving to technology".*
- *"For the ID can we please break this down into a format that will match the H17 specifications?"*

Verbatim Quotation 5.1.1.2.A

Existing mHealth initiatives in the country, especially the maternal and child health were discussed for opportunities of learning and benchmarking. About 98 mHealth services, of which 25 were reported to be maternal child health in SA, were also cited for collaboration and consultation during the design process. The execution of situational analysis was also mentioned as a key activity. However, there was no follow up notes on whether it was executed and completed. The following items were discussed in one of the very initial meetings.

- *"back-end system, mobile operators, service providers, messaging subgroup rep, registration process, communication strategy, launch, field testing, M&E".*
- *"task team members were encouraged to send their suggestions"*

Verbatim Quotation 5.1.1.2.B

Although the minutes did not indicate where and how users themselves were engaged in the process in an explicit manner, it was recorded that the users' types of phones should be considered as there was a need to obtain further information from them as part of the design of the service (Jun, 2014). This process might have been recorded in other reports such as research reports, however this study only focused on the minutes. The records also show that the team had a target in terms of users. Furthermore, other records showed that the team was

interested in knowing the kind of handsets their users have. However, it was not clear how to the information would be obtained, subsequent to which research was suggested as the means to gather this information. However, no detailed information of the said research was available.

• *"There is a need to pull users on a number of issues. As such there is a plan to create a systemic way of getting information from selectively targeted users"*   • *"They are also going to do research that will allow us to understand which handsets our clients are using"*
Verbatim Quotation 5.1.1.2.C

5.2.4 Ecosystem

5.2.4.1 Organisational

From the records, MomConnect was confirmed as an intellectual property of the National Department of Health, in collaboration with stakeholders from different fields such as NGOs, independent consultants, as well as research and academic institutions. However, the much-cited directives recorded were mostly from the Minister of Health, which also reflected a degree of political oversight (Kuziemsky et al., 2009; Leon et al., 2012). It was always implemented as per the ministerial advice, and there has always been a need to report back. The record shows that even during the launching process, the Minister "championed" the initiative. It also emerged from the minutes that the Minister was the one giving directives in this project through constant communication with other managers within the NDOH.

• *"Minister wants a single unique number (code) for all network operators"*   • *"… gave a brief account on minister's meeting at Emperors Palace on 30th July and informed that the minister has announced that he will be embarking on a road shows to introduce MomConnect to the health professional in each province"*   • *"the minister has confirmed the date to launch MomConnect (21st Aug 2014)"*
Verbatim Quotation 5.1.2.1.A

The task team has always been conscious of the Departmental vision, mission and other practices of the public sector. Partnering stakeholders worked together, guided by the mission and vision put in place by the Minister of Health as the custodian of MomConnect. There was agreement on how stakeholders could represent MomConnect with regards to presentations, conferences, papers, operational and other research arising from MomConnect, and agreement on process and rules to handle *ad hoc* requests. Also, all communication regarding the MomConnect initiative had to comply with the NDOH's communications policy. The content of the information to be sent was also supposed to be linked to the Department's clinical policies and guidelines to ensure that there was integration and coordination (Skinner et al., 2018).

> - *"We need to take into account the vision of the department which is to computerize the facilities and the eHealth strategy and interoperability framework"*
> - *"Content of messages is aligned to NDoH policy for MNCH".*
> - *"MomConnect is a NDoH project. Any partner should run all activities by the department at the first opportunity so that the department cab review and direct as required. This applies to all discussions with the funders, presentations, conferences, communications with external stakeholders and so forth"*
>
> ***Verbatim Quotation 5.1.2.1.B***

MomConnect issues were handled and referred to the relevant Directorate within the NDOH. For instance, complaints were addressed according to the Complaints Policy and referred to the Quality Assurance Directorate. Governance issues were also addressed, and workshops were planned and recorded. The scale was measured by targets. At 50% subscription rate, the team looked at new ways to improve and increase total subscriptions. The targets were monitored based on the indicator of first antenatal visits. The record shows that the antenatal care first visits were supposed to subscribe into the MomConnect on their first visits.

> - *"Feedback on MomConnect weekly reports was followed by clarifying the process of handling complaints which had to be in line with the NDoH's complaints management policy: "These are sent to the district and provincial focal points."*
> - *"objectives of the departmental strategy to increase registrations mainly due to the fact that after one year of the implementation we only reached 50% of all the antenatal booking at the facilities, this strategy is focused on mainly 3 areas: (1) retraining of staff, (2) batch registrations, (3) improved communication".*
> - *"MomConnect governance/sustainability: a date for the governance workshop is set."*
>
> ***Verbatim Quotation 5.1.2.1. C***

5.2.4.2 Privacy and security

Privacy and security issues were always raised, including privacy for the patient in terms of the care they receive, cyber security and protecting data generated through the MomConnect initiative. There was no evidence of how these security measures were implemented, and also no records addressing attempted cyber theft of data, irregularities or other security issues that the project suffered. There were no records of incidents or security emergencies that were reported or complaints from the users themselves. However, data security policies and guidelines were also recorded as being considered in making decisions. Based on the minutes, there appears to have been a gap between decision making and implementation concerning data and service user privacy and security, which could render the applicable policies to be more rhetorical than practicable (Barron et al., 2016).

> - *"authenticating the cell phone number".*
> - *"Start looking at security issues that may influence the project".*
> - *"Consent & POPI – "At present MomConnect does not ask for consent for each additional activity, looking at general approach that can reduce the number of consent requests"*

• *"Privacy and data protection issues being paid enough attention and will the project be compliant with the protection of information act"*
• *"Centralisation of data at NDoH was also discussed. "due to problems with data definitions there were problems with data accuracy"*
• *"A pilot done on early childhood development found that women change frequently cell phones or SIM cards and as a consequence they do not receive messages. There is a need to look at this and have a mechanism to address the issue"*
Verbatim Quotation 5.2.4.2 A

5.2.4.3 Integration

The will and desire to integrate the MomConnect initiative and not implement it as a silo was noted. However, there was no record of MomConnect integration to the existing health information systems data for reporting. There were records that the team wanted to access and compare successful mHealth.

• *"which projects are working, and which ones aren't"*
• *"Interoperability of data with existing NDoH systems (e.g. DHIS)"*
• *"Determine a system specification for mHealth, including reviewing interoperability of data collected by various systems and software"*
Verbatim Quotation 5.1.2.3.A

The issues of ID numbers and unique identifiers for the users was discussed. South African Identification (ID) was integrated into the biometric identification system in terms of which one's ID would be characterised by fingerprints; and facial identification systems. The biometric identification would also be enabled to do DNA analysis. The MomConnect team realised that the facilities are used by both South Africans and foreign nationals. This was one of the facility-level realities that had to be addressed. Even if foreign nationals have passports. The total number of digits on the foreign nationals' passports was different from South African ID numbers. In that regard, the system had to be designed such that passport numbers could also be accepted by the system `to complete the required MomConnect subscription. The system also had no option to accept the date of birth in cases where a pregnant woman is underage, does not have an ID, or a foreign national who for some reason, passport is unavailable. All these factors highlight the indispensability of system design integration (Chatzipavlou et al., 2016).

• *"To allow for maximum interoperability there should be a number of ID types which will allow all people eligible to receive care to be registered. In SA everyone has a right to emergency medical treatment. Therefore, identifiers which cover foreign nationals, refugees and people without documents should be used"*
Verbatim Quotation 5.1.2.3.B

5.2.5 Roll out.

5.2.5.1 The scaling process: national to provinces

There were testing, demonstration and materials design processes before the official launch of MomConnect by the Minister of Health (Dr Aaron Motsoaledi) in August 2014. Roadshows were conducted in at least each of the nine provinces. Other follow-up events were also recorded, such as celebrating MomConnect's first anniversary at the venue of its initial launch; as well as its one millionth subscription. The communication materials included posters, flyers and radio adverts in different South African official languages. Such an extensive rollout campaign is consistent with best practice in scaling a national digital health the size of MomConnect (Barron et al., 2016; Kabongo et al., 2019).

> - *"Demonstration sites were selected, communication materials were approved and translated into other official languages"*
> - *"Brief feedback on the event that happened on the … to celebrate the MomConnect 1st Anniversary"*
> ### Verbatim Quotation 5.1.3.1.A

The records of the minutes showed that human resource implications were considered whenever there were changes in the MomConnect initiatives. There were at least two full-time MomConnect staff members, a project manager who was a medical doctor with specialisation in epidemiology, and a professional nurse with advanced midwifery for the helpdesk. Over time, a specialist nurse was employed for the PMTCT component, as well as another nurse specialist for NurseConnect.

A MomConnect repository was suggested and implemented by one of the stakeholders, aimed at keeping all documents relating to MomConnect. All stakeholders had an opportunity to contribute to the design and input. Once the repository was live, the task team members were asked to submit all documents in their possession before centralised storage. There was consensus in this regard, consistent with reference best practice and reference (Kabongo et al., 2019). The fact that there were no records at the National Department of Health for the mHealth projects that happened before, indicated that documentation was also one of the gaps in mHealth implementation.

> - *"Next phases of the project"*
> - *"the team to send documentation that they have on MomConnect…"*
> - *"Finalise one page on the use and maintenance of the repository"*
> ### Verbatim Quotation 5.1.3.1.B

Since MomConnect was a national initiative to be implemented in each province, the task team considered amongst themselves members to distribute in each province in order to strengthen the roll out with existing relationships (Donley and Graueholz, 2012; Wolff-Piggott et al., 2018).

However, the relationship between national health and provincial health has played a major role in attracting local people for provincial coordination and scaling-up. There was documented evidence of formal communication with the provinces from the national department of health regarding coordination of the initiatives within the provinces. There were no records of newly created posts for the MomConnect initiative in the provinces. However, the minutes showed that since this MomConnect Initiative was part of a Maternal, Child and Women's health programming, staff that were part of this program had to among themselves elect a focal person for MomConnect in the provinces.

• *"Determine which interventions have potential to scale and the interventions required"* • *"Determine best ways to implement various of mHealth MCH"* • *"… including scale up, who will work where"*
Verbatim Quotation 5.1.3.1.C

5.2.5.2 Operations and performance

The monitoring and evaluation of the project was one of the items discussed in earlier meetings, the first action in this regard recorded was to approach academics in the field and also there was a recommendation to ensure evaluations are continuously done. There were recommendations recorded of Monitoring and Evaluation (M&E), however, no frameworks or plans were recorded. The team knew where M&E experts would be sourced for this initiative, and the monitoring and evaluation was supposed to be continuous. Operational research was also recorded as key processes that should take place within the initiative.

• *"Establish an ongoing system of formal evaluations and review of potential mHealth projects"* • *"M&E Universities approached"* • *"mentioned possible overlaps with the M&E and it was agreed that there should be linkages between the M&E and any operational research"*
Verbatim Quotation 5.1.3.2.A

Once the users started to subscribe to the service, there were formal feedback on the performance in form of statistics, weekly and monthly report done. Other feedback came from the helpdesk where users engaged with the midwife asking questions by SMS. The implementation process continuous components of training and mobilising the initiative within the provinces. For this reason, feedback also covered training targets. As statistics were shared with the task team, there were suggestions to grow the initiative from supporting up to 5 years child's age, while initially the MomConnect initiative was meant to run during pregnancy until the baby is 18 months old.

• *"feedback on implementation"* • *"A summary of statistics was given: total self-subscription, total subscription by CHW, total registration, total, facilities with at least one registration"*

> - *"Expand MomConnect to include partners of the pregnant woman expand the project to cover the first 5 years of a child's life, introducing HIV special messages"*
> ### *Verbatim Quotation 5.1.3.2.B*

Issues around linking research with M&E were discussed, these included but not limited to, increasing the number of women to visit the facility for their first ANC visit within the first twenty weeks of pregnancy. This was cited as one of the indicators that needed to be monitored in MomConnect. However, the issue of getting women to facility within the first 20 weeks of pregnancy was still a challenge because most women only heard about MomConnect at the time when they visited the facility. Accordingly, marketing strategies were suggested that would inform women of MomConnect even outside the facility which included radio advertisements. Other information gathering and feedback from patients about the general health services at facilities were also received and reviewed. (In this regard, triangulation of data with ideal clinic was also suggested) since women now have a platform to engage with the national departments regarding the care they receive through this initiative.

> - *"See some research into how MomConnect may increase the number of women to register early (ANC first visit before 20 weeks)… marketing strategies for woman to register early already in place may confound this"*
> - *"Service rating report"*
> ### *Verbatim Quotation 5.1.3.2.C*

5.2.6   Service Continuity

5.2.6.1   Service continuity, including sustainability and evolution

The MomConnect initiative is a national project that is operational in all nine provinces of South Africa. However, the continuity of this service required solid sustainability measures. During the collection of this data, the task team were discussing the issue of sustainability. There were recorded discussions and suggestions for long-term planning and business models. However, specifically for the long-term plans and business models, it was not indicated who should draft these. There seemed to be much focus on the scale and service to the users.

> - *"It was suggested that one should look for risk sharing agreements that create long term possibilities and business models"*
> ### *Verbatim Quotation 5.1.1.4.A*

There are options of moving from USSD to data, however the data option comes with other challenges, are the patients ready to use their own data for a service they once received for free via USSD? Also running both USSD and data in parallel was discussed and the security issues around that option. The PHC service is free, introducing a paid mHealth service was probably going to contravene with the PHC policy, however there were no records of these in the minutes except that it was recorded that USSD is free and using data may mean that

patients will have to use their own data. The records showed that the concern was that patients may not subscribe to the initiative because they need to pay for their own data, and this would affect the scale of the project.

> - *"Inequalities in service provision would be increased by offering smartphone focused service. This may be the case but we need to still continue access for all but use all channels available"*
> - *"The focus was still for universal access but these channels aim to improve the services and reduce costs in some cases"*
> - *Moving towards using data and in particular linking 700 clinic project"*
> - *"Sustainability of the project, looking at decreasing costs"*
> - *"Funding update"*
> - *"How integrated digital health systems can assist in EMTCT"*
>
> ***Verbatim Quotation 5.1.4.1.B***

Collaborations with other departments such as the department of science and technology were also recorded as options to explore in order to sustain MomConnect initiative. The issue of cost was the most critical concern regarding sustainability. There was also a suggestion to seek legal advice and/or assistance on governance issues.

> - *"Funding update how integrated digital health systems can assist in EMTCT"*
> - *"Several initiatives are underway, namely: requesting the minister of communications to zero rate the SMSs and USSD calls. Start using revenue generating schemes. Budget bids from department within NDoH"*
> - *"There is a desire to introduce 3rd party subscription and registration channels in order to increase the reach of MomConnect, and to reduce the cost of enrolling into MomConnect messaging"*
> - *"Drafting vision for MomConnect"*
> - *"Governance to be appointed to oversee the grant. The team will be led by (a lawyer) who will be engaging with the TT members".*
> - *"Look into ways to make MomConnect more sustainable and generate funds. Two possible ways were looked into which are still in the exploratory mode: - the first one was to reduce costs by using WhatsApp and this was seen as an avenue to assist increasing sign-ups. – the second was to explore MomConnect data to be used by other organisations other that NDoH for research at a cost".*
>
> ***Verbatim Quotation 5.1.4.1.C***

The minutes were typed with a lot of "we", suggesting collective decision-making and responsibility.

5.2.6.2 Exclusion

Conferencing, general operations and another non-implementation information were excluded. By the end of June 2018, the sustainability issue allocated a degree of autonomy for MomConnect to become an independent organisation.

5.3 MoMConnect Task Team Interviews

The MomConnect Task Team interviews yielded clusters of themes and sub-themes. Table 5-3 below reflects the major cluster themes of MomConnect as a case example in the context of the Task Team Members. These clusters are exclusively the voices of the team (stakeholders) capturing what they said, which differs from other clusters that clearly emerged as focusing on research and development, and other related aspects. As a researcher, a stakeholder emerged as a team member first, before their response emerged as a theme. The attendant sub-themes are derived from the main themes, which are: stakeholders, critical considerations, the Ministry of Health, perspectives, operations, recommendations, and outliers. Examples of sub-themes or categories are discussed below the table itself.

Table 5-3: Clusters, theme and sub-themes of the MomCTT interviews

Cluster	Theme	Sub-Theme
MomConnect as a case example in the context of the Task Team Members	Stakeholders	Selection
		Involvement of nurses
		Life Span within the NDoH
	Critical Considerations:	mHealth and eHealth Strategy
		Consideration of Ethics in Service Implementation (Including data security and ownership, content sent to mHealth Consumers)
		Uncertainty regarding Sustainability (Including culture of the team, consistency over time and evolution of the Initiative)
		Cost for mHealth Service Consumer versus Cost for mHealth Service Provider
		Different Views on the Necessity for Piloting
		Integration of Initiative within Health Programming
		Research & Development (Including the Design Process, Evidence-based initiative, tech environment, Compliance with Normative Standards, Inclusions of clinicians
	Ministry of Health	Responses that were about the National Department of Health.
	Perspectives	Top-Down Communication / Power Issues
		Privileges for MomConnect
	Operations:	Operations: M&E, DHIS, HR, Link to Care and Implementation Process
	Recommendations	Includes, but not limited to, User Centred Design, Sustainability, Privacy and Security, Change Management and Stakeholder Management
	Outliers	Traditional Beliefs, the importance of telecommunications network, Pepfar partners at districts. Need for information centre for eHealth

Similar to the archived minutes of the MomCTT, Table 5-3 above depicts the thematically organised data of the self-same team in respect of the interviews conducted with them.

5.3.1 Stakeholders

The process of selecting stakeholders was not uniform. Most stakeholders were approached due to their expertise and the roles they played on eHealth as a field. Other stakeholders were supporting the national department of health on specific programs and their objectives was to support eHealth. Their involvement with MomConnect was when it was introduced by the Department of Health. There was consensus among the task team members that everyone who desired to be involved, was welcome to do so. The team remained open to add those who could add value, also acknowledging that the lack of uniformity of stakeholders'/ participants' involvement was due to the lack of a proper framework to involve everyone. The team has always suggested external consultation to experts that could assist in specific issues. More than half of the participants were there from the beginning of the MomConnect initiative. Stakeholders were keen to be involved, given the national scale of the project as opposed to small mHealth projects that were always implemented in silos.

• *"Approached by …. For M&E"* • *"M&E was not involved in stakeholder analysis"* • *"From right at the beginning as part of the task team, I was part of the group, that designed the technology for the architecture for MomConnect"* • *"The task team I think started to be operational since 2012 and we only got involved in 2014"* • *"Because of clinical experience – based on SMS, totally inappropriate for SA"* • *"Approached by … to do the M&E and we drafted M&E strategy which has to be approved by NDoH"* • *"I also coordinated operational research on MomConnect and also manage technical updates, participated in task team where we provide technical advice"* • *"Everybody realized this was NDoH project and were keen to be involved"*
Verbatim Quotation 5.2.4.1.A

Regardless of the lack of a uniform or clear selection process, the task team members seemed to have solid and relevant experience in both eHealth and eHealth.

• *"Emeritus professor – independent consultant 2010 since eHealth"* • *"8 years in eHealth, I'm mostly involved in requirements standards and system design, and implementation itself"* • *"I am a health informatics professional, working in designing and implementing mHealth 15 years"* • *"I have on solutions for the NDoH, mainly for the public health system"*
Verbatim Quotation 5.2.4.1.B

5.3.1.1 Involvement of nurses

From the responses of participants with midwifery background, the process of designing MomConnect services, as well as ANC and labour ward clinical processes, it was realis that the health system was disconnected. The involvement of nurses or midwives in the design

process could address this gap. The nurses only became involved during the implementation and design processes. In this instance, nurses were part of the task team, not at facility level.

• *"I have maternal and child health experience, I am a midwife I also have PHC experience, the largest part of my life I worked as a midwife and can relate ANC to what happens in the labour ward, and you cannot really separate the two but in the health system is completely separate"*
• *"When I started the design was already half-way"*
Verbatim Quotation 5.2.4.1.C

The issue of nurses' involvement was responded to by other task team members, and the response was that they could not get nurse representative organisations such as DENOSA (Demographic Nursing Organisation of South Africa) or nurse academics to attend task team planning meetings. It was also noted that the NDoH has now a Nursing Directorate which is headed by a Chief Nursing Officer at director level and with a doctorate in nursing. That directorate is perceived to be dealing with all nursing issues including the clinical practice of nursing among others, this directorate would be now invited to participate on behalf of nurses. The fact that the task team had a lot of external organisations and independent consultants was due to the fact that there was no internal capacity within the NDoH to implement this initiative, however, members of this task team have been involved in eHealth at various times and projects at the NDoH.

• *"We couldn't get nurse representatives, such as Denosa to give a view, to support whether they have this add more work to the nurses"*
• *"We were asked by department to get expertise, department lacked"*
• *"The NDoH couldn't do it by itself, there was no internal necessary capacity"*
"It was the first one of its kind so people wanted to be involved, wanted it to succeed, each"
Verbatim Quotation 5.2.4.1.D

5.3.1.2 Life span within the NDoH

Some of the task team members had limited time to be involved in the MomConnect initiative while others' role remained key as long as the initiative is still operational. The task team members had clear roles every organisation and/or independent consultant involved has a clear responsibility to themselves and the rest of the team.

• *"After submitting report"*
• *"Our involvement got terminated, but basically our job was done"*
Verbatim Quotation 5.2.4.1E

5.3.2 Critical Considerations

5.3.2.1 mHealth and eHealth strategy

Participants' views on application and strategy were varied, but complementary. There were participants who expressed that there was no compelling need to consult the eHealth strategy. For example, the alignment of the messages with the MCHW guidelines was not directly related to the eHealth strategy. Also, there were participants who were involved in the drafting of the strategy only because they worked in the Department on different eHealth initiatives. They knew what was in the strategy and did not have to review the initiative work plan against the strategy. There were also participants who felt their roles were very operational and did not need any reference to the strategy. They intimated further that an international organisation visited the MomConnect offices to benchmark on the initiative. Consequently, it became difficult to explain the relationship between the initiative and the strategy because the particular organisation expected a clear linkage between the strategy and the initiative. In interacting with the participants regarding the strategy and MomConnect initiative, there was no indication that this initiative was a response to the eHealth and/or mHealth strategy. However, it was articulated and supported at the highest level within the Department.

• *"The immediate need for me to use it is not that great"*   • *"we have not used really applied it our line of work is not really implementing we are just doing qualitative review of how nurses are using mHealth. We are not implementing mHealth ourselves"*   • *"We had (UNICEF) visiting and wanted to see the relationship between MomConnect and eHealth strategy and that we do not have (in writing)"*   • *"Not as much for our pieces of work… because our technology were mostly patient facing or nurse facing, those pieces that face the end user" – does strat cover end user?*   • *"We did not refer to the strategy. However, the people who were at driving the project knew the eHealth strategy"*
Verbatim Quotation 5.2.4.2.A

Participants who explicitly mentioned having consulted the strategy were those doing evaluation and or research related work. Some only considered looking at the strategy at a later stage when faced with issues that were directly linked to the strategy. The fact that the project was driven by the minister made it a priority project and got buy in from all stakeholders without having to question its link to the strategy.

• *"Yes, absolutely have used mHealth strategy, my main focus has been evaluating the usage of mHealth by nurses".*   • *"I started with development of the strategy"*   • *"Yes, some of our work were the direct result of us reading the strategy, interoperability"*   • *"Later on we had to take the strategy into consideration"*   • *"Because it was driven by minister and the people involved already had background on the strategy – there wasn't formal consultation around it"*

There are views from the participants that the mHealth strategy should be a component of the eHealth strategy and this should not be two separate strategy documents. There were participants that referred to the strategy only when their organisations were getting involved, however, they do not find it to be key such as clinical guidelines when dealing with patients.

- *"It's supposed to be a component of the eHealth "*
- *"I referred to those documents mHealth when I started, but I don't refer to them on day to day basis and I don't know them like my nursing act. I know they are there as basis and regulations that guides practice and I know I should because now they do have impact on nursing practice"*
- *My organisation was involved in initial draft of mHealth strategy so and the implementation plan but it never got much attention from NDoH because a lot of that was included in eHealth strategy*

Verbatim Quotation 5.2.4.2.C

The mHealth strategy is reported to be unclear, and lacks practical step by step guidance which is very key to its implementation. There is perceived lack of sufficient, if any, governance for the strategies from the NDoH.

- *"I have worked with both eHealth and mHealth strategies outside MomConnect in my role and my general assessment about those documents is that they are very theoretical and difficult to implement in real terms especially the eHealth strategy is very high level and doesn't really explain concrete how to do the things that are recommended. So my feeling is that there need to be concrete objectives that are achievable that people can easily understand. So take it away from the theoretical and make it more practical"*
- *"The other thing about the eHealth and mHealth is the lack of governance, it's just a document that is sitting there and nobody in the government who is following up with the implementations they don't even know who the implementers are. So it is one thing to tell people what to do you also need to check on them"*
- *"It's so high level, if you look at this implementation plan it doesn't tell an individual implementer the things they need to do in order to be in compliance with this implementation strategy all of that is good but it's government level"*
- *"What does it mean for me as an implementer? It is more of a political document. As much as they call it an implementation plan it is more of an mHealth justification from a political point of view. Instead of having these justification statements have aim that you need from each mHealth implementer in order for them to fit into your strategy and tell people what they need to do to meet those requirements"*

Verbatim Quotation 5.2.4.2.D

5.3.2.2 Consideration of ethics in service implementation

Service implementation ethics included data security and ownership, as well as content sent to mHealth consumers. These ethics were considered, but not in detail. It was only when the initiative was launched that details were addressed. When the PMTCT component was launched it also called for more focus on the privacy and security due to the sensitivity and

stigma around HIV and AIDS, they had to make sure that no individuals status is disclosed as a weakness of the service's confidentiality weakness.

• "There was little considerations of ethics, that came after the launching, things like data privacy and such" • *"No clear coordinated data security assessment of MomConnect"* • *"POPI Act to propose data security assessment"*
Verbatim Quotation 5.2.4.2.E

The content of the messages were reported to be written in such a way that a lay person can understand, and were made available in the 11 official south African languages. The messages had to link to the clinical guidelines.

• *"We ensured that messages aren't clinical or technical, we wanted to make sure that the clients understand the messages"* • *"Engage users, the target group"* • *"Design was good using SMS – to reach everyone"* • *"Making sure that the message used fit in the DoH guidelines"*
Verbatim Quotation 5.2.4.2.F

5.3.2.3 Uncertainty regarding sustainability

Uncertainty regarding sustainability included aspects such as the culture of the team, consistency over time, and evolution of the initiative. There is a concern amongst participants that the sustainability is at risk. The former minister of health (Dr Aaron Motsoaledi) championed and supported this initiative however, he served two terms as minister of health and a new minister of health has been appointed . The concern amongst the task team is whether the new minister of health will continue with the previous minister's project.

• *"There's great fears that it won't be sustainable. The future/funding is definitely weak"* • *"To be blunt internally, we are likely to keep going as long health minister is still there, this is the sweetheart project of Dr Motsoaledi"* • *"From start how can continual funding and organisational capacity"* • *"The disadvantage is the cost to the department, it could be reduced but then it will reduce the availability of the services"*
Verbatim Quotation 5.2.4.2.G

Participants reported to have remained consistent in the goal of MomConnect, however there were components added as the initiative grew older, which still complement the original goal.

• *"I think we maintained the original goal especially the registration of all pregnant women and mothers"*
Verbatim Quotation 5.2.4.2.H

Stakeholders who joined the task team later after the formation of the initiative, had some challenges understanding the role in the task team because the rest of the team already knew each other. There was a process of adapting in their new roles. Most task team members who are clinicians seem to have some technical skills around ICT and there was a view that all members are technical while they are not. Those who joined the team later, had to actually clarify that they are not as technical, however, they had assistants who helped them with technological issues from their organisations. Different organisations also went out to seek funding to support MomConnect, the culture was in such a way that if a member of task team can secure funding elsewhere, they can come with a concept note for anything they would like to add to the initiative and with the approval of the NDoH they could implement a new component. There were views that other stakeholders who are in the mHealth space would like to know what is happening and how to get involved in MomConnect but did not know how they can be part of this initiative.

• *"First few months it took me the understand my role"*
• *"My organisation is responsible for providing data in a format that the DOH can understand and are used to it"*
• *"people expected me to do as ...., but I am not technical"*
• *"Two months before I leave the project my colleagues were shadowing me in different aspects. Hands on transitioning"*
• *Role: "I had a dual role, as project manager and a database manager"*
• *"It created a lot of competition between the partners" – had to get funding for our own work.- "to find pieces of money to maintain a government work"*
• *"Stakeholder – Clinician: Stakeholders: "Make it easy for suppliers of mHealth to know what is going on and now to get in"*
Verbatim Quotation 5.2.4.2.I

5.3.2.4   mHealth service consumer cost versus mHealth service provider costs

The usage of USSD was vital to the user because it was free of charge although current trends are pushing towards the usage of data because of the fast growing trend of social media. For the users, especially, the women, the issue of cost is very key. When a service is free seems to be well accepted. Also, PHC services are free in South Africa perhaps the patients expect everything to be free from that level of care. As much as they may have smart phones they still prefer SMSs which is free unlike using data at their own cost.

• *Cost / Sustainability: "For mHealth to be sustainable it has to be cheap/free for the user to eliminate most barriers like using (unfortunately)"*
Verbatim Quotation 5.2.4.2.J

5.3.2.5   Different views concerning the need for piloting

Feedback from nurses was not sufficient, if any. Participants did mention that nurses or their representatives were less involved in the planning. During interviews it was clear that the

involvement of nurses is key because they are the highest population of clinicians in South Africa and at PHC level, also the fact that they are the ones running the facilities. For example, involvement of nurses in initiating ART is regarded to have contributed positively because it could be rolled out to all facilities because there are nurses in every facility, if only doctors were initiating there would be still back log. There were two views regarding the piloting, other participants see no need to pilot mHealth anymore because more pilots never scale, so they are of the view that scaling nationally is a good idea from the beginning. However, others felt the need to have piloted MomConnect first.

• *"Getting feedback from nurses to find gaps before we rule out nationally"*   • *"I would have preferred to pilot it first and see what could go wrong"*   **Verbatim Quotation 5.2.4.2.K**

5.3.2.6 Integration of initiative within health programming

There was no risk assessment process mentioned by participants however, the participants seem to have considered the key risks that the initiative may bring. The fact that this initiative only focused on patient, created a risk factor where the expectation of patients would be high and the nurses were not prepared to offer services that are promised in the SMSs sent to the women. There were also perceptions that MomConnect was created to report clinical stuff by the patients than actually supporting them. This led to an agreement that a similar and parallel initiative should be started to support nurses. The initiative has evolved to a point of having a PMTCT component and the use of data WhatsApp group during this study.

• *"There was potentially a great danger in this programme"*   • *"One huge danger of MomConnect, and that is you are going to empower women, give them information expectation and they are going to expect that quality of service from the clinics and hospitals, unless the clinics and hospitals are equally empowered to that information the woman is going to demand a service that can't be provided and that potential raise conflict because staff cannot deliver the expectation"*   • *"Consistent but now evolved, it stand just now with PMTCT, NurseConnect and WhatsApp*   • *"Also develop parallel program for health workers"*   **Verbatim Quotation 5.2.4.2.L**

There were views that this initiative is not integrated with other programs within the department, it was implemented as a solo high-profile initiative of the former minister. The issues around integration, included but not limited to data, compliance with HIS reporting and data management. For instance, the HIS unit has specific rules, but they were perceived to be not fully applied by the MomConnect team.

• *"It has to be sustainable it has to be integrated"*   • *"Different complete – interoperability – aggregated data"*

- *"First it was events with registrations, transaction completed"*
- *"Silo: what I am used to, seen as a separate entity"*

Verbatim Quotation 5.2.4.2.M

The integration of MomConnect to the services at provinces was mentioned. The services on the ground, the facility level, had to be integrated into MomConnect. As much as it is a national project it had elements of being implanted as a silo project which is not talking directly to other health programs. This showed that having it scaled nationally did not directly mean it is interoperable or integrated.

- *"It has to be integrated within the provincial services, maternal services"*
- *"Services on the ground and MomConnect has to be linked the two are interdependent"*
- *"MomConnect is seen as separate entry and is not part of, look at the two units, HIS and HIV/AIDS. From HIS we have specific rules, with MomConnect, those rules do not fully apply, egg and chicken kind of a situation"*

Verbatim Quotation 5.2.4.2.N

5.3.2.7 Research and development

Research and development (R&D) includes the design process, evidence-based initiatives, the technology environment, compliance with normative standards, and inclusion of clinicians. Participants from research and monitoring and evaluation background highlighted that there was not enough research done to substantiate national scale of this kind of an initiative, and this was perceived by them as a weakness when the impact and evaluation process has to be done. Participants who were right at the beginning of the initiative did mention that research was not prioritised, and discussion was limited. The need to involve researchers was highlighted and in this case it was a gap.

- *"Whenever refer to eHealth strategy there's two sides of the story basically at the time MomConnect was rolled out there was not enough substantiated evidence to support national roll out of but clearly there was political. It was high profile political project to support meeting MDGs"*
- *"Something that was a huge problem, is that, we didn't talk at all around research which I think is an ongoing real problem"*
- *"Impact contribution etc, there wasn't space for that"*
- *"Reporting on the impact is difficult – other confounding factors"*
- *"Academics should be involved… not what donors want to hear"*

Verbatim Quotation 5.2.4.2.O

Clinicians need to be capacitated on eHealth. MomConnect's integration to other services or clusters remains a concern.

- *"We didn't support them, we just gave the, hence the resistance. Lot of nurses do not know what eHealth is, even doctors"*
- *"MomConnect has done a poor job in terms of integrating it as one of the tools that ANC uses in their work"*
- *Integration: "MomConnect has not been integrated with the rest of the department, a lot of nurses"*

Verbatim Quotation 5.2.4.2.P

During the design process the messages were reviewed if they are appropriate for SA, particularly the local clinical guidelines. There was no time for benchmarking with other national mHealth initiatives during the process of reviewing the messages.

- *"Some messages weren't appropriate for SA, some weren't in line with the national protocol"*
- *"Hence we had to review"*
- *"little benchmarking – I was not in a position to benchmark with anybody"*

Verbatim Quotation 5.2.4.2.Q

The participants did say that the tech used for this initiative was compliant with normative standards. There was very little time for design of the program because it was a political mandate it had to be done in any case and as soon as possible.

- *"Other partners whose tech have to comply with normative standard would say yes"*
- *Design: "The design of the program was a beat of a challenge because it was a political imperative to implement it a bit being a short space of time so"*
- *Design-Pilot:*

Verbatim Quotation 5.2.4.2.R

Interoperability is one of the over emphasised issues in mHealth, however, other participants did mention that integration and interoperability are two different things and should be both addressed.

- *"Interoperability should be covered"*

Verbatim Quotation 5.2.4.2.S

Participants were very much aware of how the tech environments have rapid changes and a proactive culture within the task team was required. They mentioned that their monthly task team meetings became very resourceful because they were proactive.

- *"A challenge is to keep all people up to date because tech changes quickly"*

Verbatim Quotation 5.2.4.2.T

5.3.3 The Ministry of Health

5.3.3.1 Responses concerning the National Department of Health.

In all interactions with participants, it was very clear that the owner of the MomConnect initiative is the NDoH. It was mentioned that before a minister visited a certain province he would ask for the MomConnect data and/or report from that province and check amongst others the complaints, compliments and the performance of that province in reaching MomConnect targets. This was said to have made provinces to support the initiative because the minister would name and shame the underperformers in in this initiative.

• *"NDoH are the main stakeholders"*   • *"The minister, the big boss of MomConnect"*
Verbatim Quotation 5.2.4.3.A

Ministry: Internal NDoH

Internally, within the national department of health, the initiative was operating from the office of the Deputy Director-General (DDG) for HIV/AIDS and MCHW, the other clusters were not involved. There were views that if their clusters were involved there could have been a better success. There was a fear that the initiative might collapse now that there is a new minister.

• *"If we had a lot of support from different clusters in the NDoH we could have done much better"*   • *Service Integration: "Messages cover all clusters, EPI, PHC, NHI – if all clusters can contribute certain percentage"*   • *"The idea that led to MomConnect was from the minister"*   • *"Unless we can embed it to move institutionally, its uncertainty of it will keep going as such a project after Motsoaledi leaves which is almost certain because he has already served two terms"*
Verbatim Quotation 5.2.4.3.A

Leadership and Management

The MomConnect leadership from the NDoH side was very strong and working. However, the HIS directorate was not visible in the management or their contribution in the initiative.

• *"MomConnect has been good at leadership coming from the department, nobody does anything unless the NDoH signed on it, it is very clear that the government is the leader on this implementation, and I think that has been good".*   • *"The part of NDoH that is responsible for mHealth is not strongly leading the eHealth strategy expired in 2016 I think and in 2018 we do not have a new one".*
Verbatim Quotation 5.2.4.3.A

Teamwork

The task team had a very strong team-work spirit.

• *"Everyone was quite collaborative and cooperative"*
Verbatim Quotation 5.2.4.3.A

There was consensus that the implementation of MomConnect was done correctly regardless of the gaps. There were reports that other developing countries do reach out to benchmark from South Africa.

• *Strength: "It was done professional, other developing countries are copying we'd do it same way"*
Verbatim Quotation 5.2.4.3.A

Some participants questioned the outsourcing of the resources for MomConnect, they were of the view that the department could save a lot of money if it the resources were not outsourced. However, it was also mentioned that the reason for outsourcing was lack of internal capacity.

• *"Why outsource? It would have saved a lot of money for NDoH"*
Verbatim Quotation 5.2.4.3.A

<u>USSD Viability</u>

The use of USSD was complemented by most, if not all, participants. The use of USSD made it easy to scale the initiative nationally because there was less training needed because clinics are already using SMSs in their personal lives. There was less infrastructure work that needed to be done for this type of technology.

• *"1. Was available. 2. Could work in any clinic. 3. There was no need to train people because people use it to check airtime balance etc".*   • *"Using USSD which everyone is used to"*   • *"As an organisation we were involved on the design of it, how mothers would interact with it and how nurses would interact with it, that whole USSD interface that's what we designed and that's what we built"*   • *"We could launch in 4000 clinics on same day without any pilot, massive training, technology outlay"*
Verbatim Quotation 5.2.4.3.A

5.3.4 Perspectives

<u>Top-Down Communication / Power Issues:</u>

From the participants, academics were only involved at a later stage in the project not right from the beginning. The communication from the national department top the task team was viewed as being top down. Stakeholders were only informed what in the view of the department was critical for their work, however the participants wanted to know everything. There were participants that felt if they were involved from the work go, it could have made a difference.

• *"We were always at the back as academics"*
• *"Communication was quite top down"*
• *"The information we got was a need to know basis, so it was a top-down structure which made it difficult for me"*
• *"It must be as participatory as possible… there was so much behind the scenes"*
• *"It is crucial that people are involved from the word go"*
Verbatim Quotation 5.2.4.4.A

There were views that other roles were key and others were also support, from the participants. However, there were participants that felt that even if they had opinions on the initiative to either start later or do some research first, that would not be considered because this was a politically motivated career, if the higher power gave an instruction no one would question the implementation, they had to work with what they had.

• *"My role has always been peripheral"*
• *"I do not think our involvement could have made much difference given the high- profile political profile"*
Verbatim Quotation 5.2.4.4.B

Privileges for MomConnect

The highest level of executive support was key and the collaborations from different sectors

.

• *"The methodology, having high level, ministerial equivalence as DG, to have sponsorship at high level is key"*
• *"To have leadership from the NDoH is key"*
• *"Having PPP consortium"*
• *"Open architecture that would allow people to contribute within that framework"*
• *"Having hardware software infrastructure that is inherently scalable"*
Verbatim Quotation 5.2.4.4.C

With its gaps, participants still believed the initiative was well done. They used what was available and doable. They embraced the opportunity to scale nationally regardless of the challenges and lack of formal processes that have not been followed. It was the only way it could be done, and they regard the initiative as successful. Participants could give reasons why specific gaps were there and what led them to continue regardless.

• "I can't think of much that would do differently, it really worked well"
Verbatim Quotation 5.2.4.4.D

The experiences of stakeholders that are originating in south Africa but have worked in mHealth outside the country was positive. They appreciated being involved in the team and being able to give input in the entire program regardless of being a tech organisation. This has shown how stakeholders need to have the bigger picture regardless of their role in the initiative.

• *"In other countries we are seen as outsiders"*
• *"We were involved in all other aspects of the program, as well, not boxed in as a tech company, don't talk to us about content, user experience, just about the tech"*
Verbatim Quotation 5.2.4.4.E

The national scale of this government owned initiative was regarded as its strength, including its choice of simple technology that includes almost everyone.

• *"This is the first mHealth project that the department calls a success that you can do mHealth through formal health system"*
• *"Strength, it is available to everyone using lowest common denominator technology so it's as widely available as possible. Free to the users, it's built as an substantiate of the normative standards framework"*
Verbatim Quotation 5.2.4.4.F

5.3.5 Operations

<u>Operations: M&E, DHIS, HR, Link to Care and Implementation Process</u>

The indicators for MomConnect were not developed well according to task team members who had M&E expertise, and they happened to join the task team at a later stage when the indicators were already developed. The NIDS requirements were not followed, sufficiently, if at all. The suggestion was that when initiatives around mHealth are implemented there should be and M&E consultation with the NIDS perhaps through committees like NHISSA where there can be formal inputs on indicators.

• *"The MomConnect indicators were haphazardly developed, they would say things like, registrations, when I started looking at the data I say what do you mean by registrations, these is all women that are registered, and the fact that I asked it clearly means that the element/indicator is not described properly"*
• *"The problem is not even communication, always playing catch up. The principle is all indicators should comply with NIDS requirements"*
• *Registration: "Pregnant women registered – Mothers with babies 1-2 years"*
• *"There will have to be some criteria or guideline that a project should comply with and one of them would be indicators"*
Verbatim Quotation 5.2.4.5.A

There were processes that had to be done retrospectively such as the M&E strategy and others that were left from the beginning because all that was critical was the implementation. The members of the task team were very familiar with the DHIS, which made it easy to monitor the data, however, this was through the WebDHIS and there were sometimes connectivity issues. Patients also expressed a need to be able to log in somewhere to check for messages that they may have deleted, there was no way for them to check messages once they lost a phone or deleted messages.

> - *"We were not involved in the design of the operations and to do the M&E strategy, we should have done the stakeholder analysis, it had to be done retrospectively"*
> - *"Remember the DHIS was initially tested in the EC and we were part of that and we as part of the equity project, and we did 2 years management course through the university and really that got us the path of using and knowing information"*
> - *"One of the disadvantages of webDHIS is connectivity"*
> - *"Once patient delete messages can't log in somewhere to check, we be great to access messages somewhere."*
>
> ***Verbatim Quotation 5.2.4.5.B***

Participants did mention that statistics around ANC was reviewed as part of implementing this initiative. However, the process of measuring impact or how care has improved seemed to be difficult because there were confounding factors such as services from community health workers.

> - *"Genuinely the first thing we looked was statistics about women coming early to ANC and what the problems with maternal health were"*
> - *"How has the intervention improved care – measure that around other ways. For example – messages or CHW visit them"*
>
> ***Verbatim Quotation 5.2.4.5.C***

MomConnect database was reported to be linked to the DHIS which is a national reporting database. However, it had specific differences because the DHIS was mainly used for aggregated data and MomConnect had events and transactions that were monitored.

> - *"MomConnect database linked to the DHIS, to monitor maternal and child indicators and subscriptions"*
> - *"You would have mHealth instances that do not talk to each other"*
> - *"Aggregated stuff at times but this is different because 1. Event with registration 2. Transaction s keep posted"*
>
> ***Verbatim Quotation 5.2.4.5.D***

The marketing of the MomConnect was not done properly especially to the nurses, MomConnect was viewed as a process where patients can anonymously report nurses to the national department of health by the users. However, with time it was made clear that there were 3 times more compliments than complaints at MomConnect data. Incidents where patients would record nurses during interactions and send complaints to the department were also noted. However, there was a process of reorientation of nurses regarding MomConnect and also the NurseConnect at facility level.

> - "*It was not positively sold, some – now we will get you because you are not rendering proper service"*
>
> ***Verbatim Quotation 5.2.4.5.E***

The helpdesk staff was mainly appointed on contracts and when contract ended it was difficult to find replacements. HR planning is something that had challenges.

• "It takes time to replace someone, it depends on funding"   • "The planning should start with staffing before anything else"   • "You cannot run a project with 2mil users with three staff members on helpdesk"
Verbatim Quotation 5.2.4.5.F

The role of HR staff working on this project on full time bases was not well planned. Also, there are still health professionals who do not know what MomConnect is, regardless of its national scale, so the process of training and awareness was recommended to be continuous not once off.

• *"HR, low, we undermined the role of HR. The project was not sold enough to the department. Even after going to all nine provinces we still have people who don't know what MomConnect is"*
Verbatim Quotation 5.2.4.5.G

The staff from helpdesk express a need for case management system since they communicate with patients. For instance, they expressed a need to be able to view the women's blood results because lack of access to such information limited the clinical advice they could give to the patients.

• *"There should be a referral system, I should also be able to see the blood results"*   • *"System must be user friendly to follow up a patient, see that was linked to care treatment was given"*   • *"Real case management that links to clinic"*
Verbatim Quotation 5.2.4.5.H

The members of task team had different positions from their organisation, and were also getting internal support in managing MomConnect. So, even if there is only one representative for an organisation who is a task team member, they would be working with a team from their organisation on the background.

• *"They call me a project manager" matrix-management principles – you involve managing process that involve even managers that are senior – and you also work with junior people that have skills.*
Verbatim Quotation 5.2.4.5.I

The former minister of health attended the launch of the initiative in the provinces and during that process the provinces had to select focal people for the MomConnect, so that the NDoH knows who to liaise with from each specific province and vice versa.

• *"Before it was launched we had a roadshow. The minister called all senior management to sensitize them on MomConnect. The minister ensured that before we leave the province we have focal people who will actually liaise with the NDoH"*
• *"Political members were also sensitised"*
• *"He named and shamed that were not doing well"*
Verbatim Quotation 5.2.4.5.J

5.3.6 Recommendations

User Centred Design, Sustainability, Privacy and Security, Change Management and Stakeholder Management

Participants also gave their views on issues that they regard as critical considerations in mHealth initiatives such as MomConnect. Those considerations included, user centred design, the issue of cost as it affects sustainability, privacy and security, section of technology that can scale nationally and regulation amongst others.

• *"Three things that came immediately in my mind. 1. The people that you expect to use this, the end user, the client. Health workers have to be involved and recognize the need for it and its going to be easily for them and what is in it for them, and when we did reorientation, there was a lot of misunderstanding. 2. Sustainability, the cost of messaging, a major component. 3. Confidentiality, I know MomConnect does not have so much information"*
• *"There needs to be balance between all those different considerations you mentioned"*
• *"One of the major things that influenced the design was that we had to design the service on the tech that already existed and could work in any clinic immediately – we had a launch within two months. No time to pilot. Hence we chose USD – it's no perfect"*
• *"1 - There was a regulatory policy framework in place which was the health normative standards framework which was used to guide the design of the system, to make sure it was designed according to regulatory framework prescribed by the NDoH. 2 - To have the design and development coordinated by the NDoH and ensuring that it meets the requirements. 3 - Having a sat of partners to work on the actual solution and to work on the open architecture, to make sure that its open to others to contribute. 4 - Using free and open software that was readily available and could be cost effective and easily procured"*
Verbatim Quotation 5.2.4.6.A

Stakeholder Management

The stakeholder management was reported as having no contracts, their members worked on utmost good faith, and it was also alleged that these stakeholders have an existing relationship with the department health of which legally they may be at risk. This stakeholder management issue could contribute to sustainability issue.

• *"There is no contracts etc, all partners are taking some level of risk, no formal agreement, to say this is how we gonna sustain the program going forward"*
Verbatim Quotation 5.2.4.6.B

Change management and clearly defined theory of change with regard to mHealth initiative was suggested as a recommendation. There was not reported change management process in implementing MomConnect.

• *"Change Management"*
• *"Change – do it differently from the beginning"*
Verbatim Quotation 5.2.4.6.C

Recommendations:

The recommendations were to priorities finances for the sustainability. To involve different sectors such as private. The way in which it was done as top down, there should be involvement of broad stakeholders.

• *"Start firstly with finances"*
• *"MNO – buy into the whole thing mtn, voda etc"*
• *"Not being top-down, make sure we involve the hands- on people. " – they attend meetings and do not share information*
• *"Private sectors should come on board"*
Verbatim Quotation 5.2.4.6.D

The issue of having USSD error messages when subscribing women was raised as a challenge that could have been addressed during when it was designed. It was not clear whether the network operators and the MomConnect system would be able to process bulk subscriptions in the mornings considering that women visit clinics in the morning and most subscriptions nationally would-be done around the same time. MomConnect was reported to be run differently, for example, their complaint resolution was done differently from the NDoH's complaint system. However, in terms of complaints, the help desk nurses did mention that some of the complaints received needed an immediate action, for an example if a HIV+ woman says she gave birth but did not get Nevirapine, they had to call the woman and facility at the same time to get this sorted on the same day unlike the NDoH policy which has 21 days period for complaint resolution.

• *"Basic implementation. They did not consider that most ANC women come to clinic in the morning and about 2500 clinics they do the registrations same time and the system cannot just take that"*
• *"MomConnect has been implemented in silo, the part of NDoH that administers and in charge of mHealth strategy has absolutely nothing to do with MomConnect, has no involvement and that is where the governance is weak"*
• *"The MC complaint resolution is different from the department's resolution even with timelines"*
Verbatim Quotation 5.2.4.6.E

<u>Sustainability</u>

The sustainability side of MomConnect was not given much attention in the beginning of the initiative.

• *"The NDoH did not go beyond the launch"*
• *"No good planning ahead of time, it's more like we will cross the bridge when we get there"*
• *"Try as early as possible to look for funding"*
Verbatim Quotation 5.2.4.6.F

When participants asked about their views on sustainability of MomConnect, they expressed that funding and/or cost is the obvious threat to its sustainability. It was clear that the initiative is to be accepted at different levels of care and women were happy about it. However, the cost of MomConnect seemed to be a responsibility of national department of health and not the provinces.

• *"Eish, difficult question to answer but at a rate that we are going, I don't think its sustainable, when you compare it with Ghana and Kenya, their countries have WiFi everywhere we still have to buy data. Unless data is less than now. It is expensive"*
• *"It is expensive to maintain"*
• *"Cost is a huge factor where sustainability is concerned"*
• *"Our biggest challenge is cost"*
• *"We did not know the financial part or sustenance of MomConnect"*
Verbatim Quotation 5.2.4.6.G

<u>Infrastructure & Scalability</u>

Feedback from the stakeholder that had to do with infrastructure showed that they did their homework and also were experienced in working with the NDoH around issues of infrastructure. The choice around infrastructure was guided by normative standards, the eHealth strategy and use of the technology that could scale easily nationally.

• *"Our role is the backend architecture"*
• *"At an architectural level we made sure that the system was part of the national health system – following same guidelines"*
• *"We used technologies that have previously been shown to have the potential to be scalable"*
• *"We used also technologies that would not be limited to certain geographical, in other words that would work only in urban areas and not rural areas were available across"*
• *"We use technologies that were also available to clients, healthcare workers and users"*
• *"Open source"*
• *"To make sure that the licence fees were reduced or non-existent, we also included telecommunications technologies that were as cost effective as possible"*
○ *Architecture*
• *"And we developed an open architecture that would allow as many third party contributors as possible to try… funders stakeholders as possible"*

- *"Matches the interoperability objectives of the eHealth strategy"*
- *"The strategy was published recently, but the system we have was developed before that but is consistent with the strategy"*

Verbatim Quotation 5.2.4.6.H

The use of SMS was reported to be costly, and there were recommendations to move to data and use WhatsApp however, it was questioned whether women will be prepared to use their own data to receive messages because the services has been implemented as free from the beginning.

- *"From users' perspective the service is great, but from sustainability perspective there are still questions about how they are going to continue to fund it, month to month basically"*
- *"The use of SMS is fine but on the cost side it is expensive"*

Verbatim Quotation 5.2.4.6.I

In the initial stages of MomConnect initiative, the task team members knew that the initiative will not depend on donors for ever, however, there was sufficient funds for national scale in the beginning, so the issue of sustainability was not discussed in details. During collection of data, there was a process going on of sustainability, in which there were plans of registering MomConnect as a separate entity and there was a legal consultation on this process.

- *"We knew that donors are not gonna just pop money into this thing"*
- *"There was very little discussion on cost, surprisingly little, because various donors came up"*
- *"To be honest there was very little discussion on sustainability"*
- *"We are looking at MomConnect governance going forward"*
- *"Register MomConnect as a separate organisation, different legal considerations, central board of directors and central management team*"

Verbatim Quotation 5.2.4.6.J

How the MomConnect initiatives is going to affect operations at facilities was discussed and there needs to be a process of checking the lowest level of care the PHC to check how its effect on operations can affect sustainability. The focus of MomConnect remained constant, however, at this point sustainability was the main focus.

- *"How is this process going to impact on their daily life, the outcomes, etc."*
- *"The focus hasn't changed but now the focus is sustainability, we know that it works, we know that it is scaled"*

Verbatim Quotation 5.2.4.6.K

The recommendations for rationalisation were around connectivity, data security, and also planning for the NHI. There was also mentioning of capacity building especially with regards to the clinicians, as one of the key recommendations.

> - *"Connectivity, unique identifier would make data more accurate, NHI, telemedicine and confidentiality because they say once it is on your phone is not confidential anymore"*
> - *"I was involved in reorientation after phase one, I was advising on capacity building side, the nurses initially"*
>
> ***Verbatim Quotation 5.2.4.6.L***

Infrastructure & Scalability

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> - *"We used also technologies that would not be limited to certain geographical, in other words that would work only in urban areas and not rural areas were available across"*
> - *"We use technologies that were also available to clients, healthcare workers and users"*
> - *"open source"*
> - *"to make sure that the licence fees were reduced or non-existent, we also included telecommunications technologies that were as cost effective as possible"*
> - *Architecture*
> - *"And we developed an open architecture that would allow as many third party contributors as possible to try… funders stakeholders as possible"*
> - *"Matches the interoperability objectives of the eHealth strategy"*
> - *"The strategy was published recently, but the system we have was developed before that but is consistent with the strategy"*
>
> ***Verbatim Quotation 5.2.4.6.M***

The role of political leadership in success of this kind of initiatives was emphasised. Not necessarily because of the South African case example but even experiences from stakeholders who worked in other African countries.

> - *"You can't do anything like this without political buy in, will and leadership"*
> - *"In other countries they mention that we have planned this but the ministry of health did not see it as a priority they saw it as our priority"*
> - *"That is really the critical success factor of MomConnect, this is not something that we came up with, the minister said, I want this. He went to nine provinces himself. 2.Start with the end-user" – you can't design something that will work. "design for sustainability and scale from the start" 3 "Work with tech that is out there and accessible to people, if you get that wrong, you will design a beautiful system but no one will use it"*
> - *Recommendation: R&D- "Start with research, basically make it clear what is it that we are trying to prove to allow project to continue after initial funding"*

- *Recommendation: "It would be great to start slightly smaller, or much smaller and testing out to see what works and what does not work"*
- *"The limitations in terms of the amount that data could be connected?"*
- *"A challenge in terms of collecting unique identifiers"*
- *"There are ways of reducing the cost like rolling the basically to make it data driven"*
- *"In App – notifications rather"*
- *"WiFi connections"*
- *"Use alternative data methods"*
- *"Not much really, I think it was executed in a very good way"*

Verbatim Quotation 5.2.4.6.N

5.3.7 Outliers

Traditional beliefs;

Importance of a telecommunications network;

PEPFAR partners at districts; and

Need for information centre for eHealth.

There were suggestions that traditional beliefs should also be addressed by MomConnect this was mainly from the helpdesk nurses who had received queries that related to the messages and the traditional beliefs that women have. For women who cannot read nor write there were suggestions to have the MomConnect voice component.

- *"I think for the end users they should incorporate traditional beliefs that are not incorporated in the messages"*
- *"Those who can't read and write are not catered for, maybe there should be a video that can cater for those listen to audio"*

Verbatim Quotation 5.2.4.7.A

The participants did acknowledge that this initiative would not have been successful without the telecommunications network role. The telecommunications network were reported to have given special charge for the MomConnect SMSs.

- *"The role of telecommunications network was explained and the project would have crushed without them"*
- *"Zero rate 20c"*

Verbatim Quotation 5.2.4.7.B

Participants also acknowledge the role of Pepfar partners at the districts who also assisted in implementing the initiative as part of their technical support in MCHW.

- *"It was through the PEPFAR partners that it was able to scale so fast in most facilities in the country"*

Verbatim Quotation 5.2.4.7.C

There was a need expressed where the public, can actually access information on eHealth, if they want to implement an eHealth service where to get support or any information from nationally.

• *"Some are trivial , some clear place which organisations can find information"*
Verbatim Quotation 5.2.4.7.D

5.4 Ministerial Advisory Committee on eHealth (MACeH)

This section presents the MACeH's thematically constructed data in relation to the study objectives and related questions. In this regard, Table 5-4 below presents the relevant clusters, themes and sub-themes that were analytically generated from the interviews with thus group of key informants (Macura et al., 2019).

Table 5-4: MACeH clusters, themes and sub-themes

Cluster	Theme	Sub-Theme
Governance and Leadership	Centralisation of mHealth	Rationalisation and harmonisation of mHealth services
	Strategy	Perceptions on both the eHealth and mHealth strategies
		Feedback on applying the strategies.
	Stakeholders	Clinicians, technophobia/ capacity building as users
		Engaging with and between mHealth providers and consumers
Research & Development	Evidence-based **i**mplementation, with emphasis on impact & outcomes	
	Perspectives on the piloting of mHealth	
Continuity of Service	Sustainability	Total cost of ownership and cost utility
		The ongoing culture of outsourcing, including funding and consultants
	Scale	NDoH: Both human and financial resources
		Provincial realities that are regarded as barriers in mHealth
	Design Thinking	South Africa learning from itself: MomConnect as a demonstration case.
		Issues relating to computing infrastructure
	Service Implementation	
Ecosystem	eHealth as a clinical service	
	Grey areas in IT, Data, Mx & eHealth	
	Fast paced tech environment	
	Sustainable Development Goals: NHI	
	The MAC members background: Demography	
	Legal, policy or regulatory issues	Compliance
		Privacy and Security

Cluster	Theme	Sub-Theme
		Data ownership
Recommendations	Recommendations from the MAC on eHealth	
Outliers		

5.4.1 Governance and Leadership

The centralisation of mHealth and rationalisation of concomitant services emerged as major focal points of governance and leadership.

5.4.1.1 Centralisation of mHealth

Centralisation of mHealth governance or control of mHealth initiatives by the National Department of Health has been suggested by most of the members. This was due to a number of initiates that take place throughout the country of which the department is mostly not involved.

5.4.1.1.1 Rationalisation and Harmonisation of mHealth Services

mHealth centralisation was rationalised on the basis that there may be some form of database or register in order to know what is happening around the area of mHealth. These would also allow a closer look to the issues of both scalability and sustainability right from the introduction of the concepts by the department. This is also regarded as a transparent process of minimising duplication, so that different implementers can know what others are doing and they may build on what is already existing and learn from their experiences.

- *"Limit the number of projects so that you can support those that can come to scale"*
- *"Advice for rationalization of mHealth projects. Ensure you keep number to minimum. Maturity levels. Rationalise projects that come to government. Do they make impact any"*
- *"There should be a database of what is happening in the space, there's lots of duplication of projects, every telemed eHealth filed. That way we minimize duplication of projects"*
- "Infrastructure is with the department of premier, all government institutions, centralized under corporate services"

Verbatim Quotation 5.3.1.1.A

5.4.1.2 Strategy

5.4.1.2.1 Perceptions on both the eHealth and mHealth Strategies

Having one strategy that covers all eHealth initiatives was something that was cited by almost all the members. They suggested that there should be one eHealth strategy and no more separate mHealth strategy.

- *"No separate strategies for mHealth and eHealth"*

- *"Have one eHealth strategy, where mHealth will be part"*
- *"The idea would be to merge, the eHealth and mHealth strategies, actually mHealth as a subset of eHealth, to have a single strategy rather than two separate ones"*

Verbatim Quotation 5.3.1.2.A

The format in which the current strategies were written were regarded not giving sufficient guidance to implementers to use. The strategy must be very clear and easy to use not only for people who are in the eHealth industry but even to other stakeholders. For instance, people that are doing sales and or procurement should be able to refer to it and make sense and execute the functions accordingly. We can have a checklist of what needs to be there, however is critical to bear in mind where the information will be sources from. If we know that specific information is not retrievable then we should not prescribe that information to anyone for any implementation. Perhaps there should be an open call to retrospectively submit all information centrally so that it may be used.

"There is no need to have checklist of information but the information that in the checklist is not available"
"For example, if you want to buy a fundoscopy, and need to know how many ophthalmologists you have and no one will give you that information"
"Everything that informs the framework needs to be available. You cannot put a checklist and say 1 – 10, but you know that 5 and 6 people will have a problem finding
"Where to find each and every one of each block"
"Whether a person is on procurement or sales they should be able to pick up the document and understand what it says, and in its current format it doesn't do that"

Verbatim Quotation 5.3.1.2.B

5.4.1.2.2 Feedback on applying the strategies.

The participants gave feedback on the usage of the eHealth and mHealth strategy documents. App participants at least knew the strategy documents however their application of the document in their work on MomConnect varied. Most participants were of an opinion that it is not practical or written in a way to make its implementation clear and/or replicable

- *"No, the strategy hasn't been explicitly applied".*
- *"Strategic case- where is it taking us as a country?"*
- *"My impression is that there is not much awareness of the mHealth strategy"*
- *"What national has done very well is that they've written this eHealth strategy, with implementation in mind".*
- *"It is too vague, it doesn't provide information on what needs to be done"*
- *"Make it easy to implement"*

Verbatim Quotation 5.3.1.2.C

The health act needs to be taken into consideration in the mHealth area. The need to get support from senior management in order to implement and integrate implementation of

mHealth into other strategies as well as health act was raised. The mHealth and eHealth strategies were also suggested to rather become one document.

> *"The fact that it's in the health act we need to implement it, but as I said we need the senior decision makers to understand that and support it to ensure that it happens – I am not saying nothing has been done"*
> *"The mHealth strategy is not sufficiently integrated into both eHealth strategy and the health strategies of the country and I think through that we are missing an opportunity to ensure that the various types of mHealth that is being practiced in the country is fully aligned with the health transformation work that is being led by the ministry and the department"*
> ***Verbatim Quotation 5.3.1.2.D***

Participants also highlighted that having strategy and implementing it are two different things, emphasising the need for work written in the strategy to be done. From the participants responses it seemed the documents were not utilised as they should. With the previous strategy that expired in 2017, there wasn't much implementation done. Only the HPRS and unique number was mentioned to be one of the known implementations from that strategy.

> *"No implementation, nothing, except the HPRS and unique identifier that they are working on"*
> *"If you see the action plan and timelines, nothing was adhered to"*
> *"I think the framework for implementation needs to be there, because part of that looks at the feasibility of the project beyond just six months"*
> *"The mHealth strategy, in my opinion, is very… a strategy is only as good as its implementation. A mHealth strategy needs to be backed by a solid implementation strategy"*
> ***Verbatim Quotation 5.3.1.2.E***

5.4.1.3 Stakeholders

5.4.1.3.1 Clinicians, technophobia/ capacity building

As capacity building for users, the inclusion of clinicians in the process of design of mHealth or other eHealth services was emphasized. Clinicians are the one that interact with their patients in rendering clinical services, they know their patients and understand the needs and routines involved in facilities, especially primary health care facilities which is mostly the first touch point of clinical services by the patients. If clinicians are told why a specific technology has to be implemented they will be able to contribute and support the implementation thereof with understanding of the aims and objectives. If adding a new technology will be adding more on their workload these may be solved at an earlier stage unlike rolling out new technology which will be viewed as an extra responsibility to clinicians and then they put it aside.

> *"Clinicians, the key stakeholders, consider their workload whenever adding new technology"*
> *"Explain why they have to do things so you're on same page"*
> ***Verbatim Quotation 5.3.1.3.A.***

There is an assumption that people are using mobile phones, then they will be able to use a certain type of technology. However, there should be a formal way of doing needs assessments and understanding of support that may arise. Most clinicians, especially in the rural primary health care or that are older generation are not interested in technology and tend to hold on the old way of doing things than having to learn new technology. They need to be supported and included in the design. It is regarded as some sort of selection bias having to include on the people that are interested in technology during the design and implementation of mHealth services since at the end of the day the users is everyone that is in touch with the service regardless of their interest in technology. Even users that may be classified as having technophobia, should be included, and their unique needs be addressed.

"Do we just assume that because people are using phones they will be able to use this one that you are piloting" *"The one thing about clinicians and technology – clinicians tend to hold on to what they know, there are clinicians that are very well vest about technology"* *"Selection bias of including people that are interested in what we want to talk about"* *"The users are not necessarily the people that are interested in technology that we're talking about"*
Verbatim Quotation 5.3.1.3.B

5.4.1.3.2 Engaging with and between mHealth providers and consumers

Participants regarded the issue of ensuring and striving for buy in from the different stakeholders as key. The inclusion of different sectors and forming partnerships in mHealth services was recommended such as governments, non-governmental organisations, research institutes and innovation hubs among others. This collaboration would create an eHealth community that knows what is happening in the ecosystem if they keep engaging each other or updating each other on new developments. The responsibility of forming partnership should be shared by all stakeholders, not only one stakeholder should be responsible for that, but it must also be a need that each one find it key to at least understand the work of others in this area.

"Ensure buy in, for sustainability, partnerships are key, NGOs", Universities, CSIR, Innovation hubs" *"As health, because of priorities, we have limitations in terms of spending o eHealth but if we partner with other government departments like DST that have budget for research and development"* *"Strong partnerships not just funding but for tech as well"* *"The stakeholder environment is very broad in eHealth, hence I think we haven't done enough, we have started but we haven't done enough and it is important to include everyone you could possibly include that has role to play definitely"* *"It's a shared responsibility, we can't wait for the other person-One has to work with other institution.*
Verbatim Quotation 5.3.1.3.C

Once patients are involved in the design, implementation or even evaluation of the mHealth services they will have a sense of recognition as a beneficiary and not feel like decision are being made on their behalf. They will know that they are consulted by the service providers in the processes of enhancing health services through mobile technology. One way of including patient, in addition to selecting them from facilities, would be to use patient representatives, such as clinic committees or hospital boards that have feedback to community on health issues.

"I have inputted, I am the beneficiary" *"Patient representatives"* *"Critical aspect is the users"*
Verbatim Quotation 5.3.1.3.D

Stakeholder engagement was one of the mostly used work by most participants, at times they referred to both public and private sector collaborations that are key in mHealth services for scale ad sustainability in reference to the eHealth strategy. There is a need for a platform to be created or strengthened if it already exist in support of stakeholder engagement. From the responses it seemed the private sector and public sector has the biggest goal in terms of engaging each other. There were NGOs, universities and research institutions mentioned but very little public sector involvement mentioned.

"Stakeholder engagement should cross public and private sector because either one not being involved could be a disrupter in the implementation of the strategy" *"I am very keen to see more work done on areas such as stakeholder engagement, I think we need to put a lot more effort into creating a strong stakeholder platform in South Africa that brings in a whole wide range of different types of stakeholders particularly health workers and patients"* *"We need to find balance between the two sectors: private and public"* *"You can't have all stakeholders in one room, that's just impossible to manage, but there should be key times where there are separate discussions with all of them"*
Verbatim Quotation 5.3.1.3.E

The participants did reiterate the need to involve users during design and other areas of mHealth services in order to succeed. They mentioned how designers and other experts may go ahead and deign apps that in their opinions may be useful to the users without hearing or considering the opinions of the users. According to the responses given, users need to be more involved and their input valued just like other stakeholders.

"User experience is something that we need to look at, unlike designing something that a team of experts believe and train them on" – *their behaviour…* *"Building our apps in the best possible way now…"* *"User interface design"*
Verbatim Quotation 5.3.1.3.F

Health Information system is regarded as an important part of the national heal system, there have been initiatives of paperless consultations but done by NGOs and not the health department as expected.

"The HIS are regarded as an integral part of the national health… not regarded as add on', like having electricity supply, having water"
"I know that there's some NGO that tried to introduce tablets for clinical consultation"
Verbatim Quotation 5.3.1.3.G.

5.4.2   Research and Development

5.4.2.1   Evidence Based Implementation, with emphasis on impact & Outcomes

A need to implement with the aim of making impact was recommended by participants. Participants mentioned that there is very little, if any, impact assessment reports or even research around mHealth due to the short-term nature of the initiatives at times.

"The overall strategy need to be set on within impact framework, what I mean by that is some work is need to be done to understand where the benefits, what value needs to be delivered and value for money so there is a cross benefit component to this"
"An impact framework for eHealth needs to stretch beyond economic model"
Verbatim Quotation 5.3.2.1.A

Monitoring and Evaluation

The need for monitoring and evaluation of mHealth initiatives was indicated and also the sufficient skills in this area. The need to monitor the implementation and operations versus targets and also to evaluate if goals are reached at the end of defined circles. This is something that is applicable even to other departments of government other than health.

"Put in key indicators, that are going to measure… an M&E framework has to form part of this"
"If South Africa can teach itself to evaluate any initiative that they have piloted, I know DPME is pushing evaluation"
"There must be reporting and evaluation, M&E is only a reporting unit, is only doing the 'r' not the evaluation"
Verbatim Quotation 5.3.2.1.B

5.4.2.2   Perspectives on mHealth piloting

The issue of going ahead with pilots because the funder has provided funding for a specific technology – there should be proper planning and outcomes that backs the need for the pilot in the health service. The participants highlighted a need for research to be done and evidence in order to implement any mHealth initiative. The technology brought should be evidently a solution to the problems at hand.

> *"Support is key, funding and also they might be supporting a specific program not just for the sake of technology and also you need champion"*
> *"There must be a clear need that you are trying to address because sometimes people bring technology thinking that it's going to solve"*
> *"We will allow the private sector to do R&D but will be scalable for public sector"*
>
> ### Verbatim Quotation 5.3.2.2.A

There were different view on the continuity of pilots in mHealth. Some do not see a need to continue piloting mHealth because they believe it I evident that the familiarity with mHealth has grown, so the focus should rather move to sustainability thereof. Participants highlighted that there is always fund for pilots from the donors but after the pilot the government does not manage to continue with the initiative because of budget and sometimes because there has not been sufficient consultation with government before such pilots are executed.

> *"A lot of work has been done on mHealth, there's no need to pilot anymore"*
> *"Most of the money goes into that and beyond that nothing happens"*
> *"It does address the issues, but there is no funding for eHealth and mHealth in provinces and national – that's why we have more pilots"*
> *"We have to build on our understanding of platforms that are there already, so for me it's been working very well"*
>
> ### Verbatim Quotation 5.3.2.2.B

5.4.3   Continuity of Service

Sustainability and total cost of ownership and cost utility emerged as major factors of MomConnect service continuity.

5.4.3.1   Sustainability

There is no consideration for long-term sustenance and related costs when an mHealth initiative is implemented, or an implementation decision is made.

5.4.3.1.1   Total cost of ownership and cost utility

The government should actually assess whether funding has been planned for continuing with mHealth projects past the piloting stage. There needs to be a process of assessing sustainability of the mHealth initiatives by the relevant stakeholders in order to ensure that all risks have been evaluated.

> *"We do not look at running cost"*
> *"Lack of total cost of ownership understanding, a lot of people would see a piece of software and think that is the best thing… consider infrastructure, people to implement etc"*
> *"Entire cost of ownership, between 3 to 5 years. At times we look at initial cost, in the long run it is costly"*
> *"Upfront, do clear assessment of this process before accepting, know the cost of ownership"*
> *"When we take over will we manage"*

> *"Not brought in proper channels of acceptance"*
> *"From onset, look at applications holistically"*
> *"Theft – most people not permanent"*
>
> **Verbatim Quotation 5.3.3.1.A**

When mHealth services are designed there should be a consideration that it is a service and has to continue in the interest of the patient, just like other health initiatives where continuity of care is critical.

> *"That's a key point the continuity of service"*
> *"There hasn't been so much on the continuity of care"*
>
> **Verbatim Quotation 5.3.3.1.B**

5.4.3.1.2 The ongoing culture of outsourcing

The extant culture of outsourcing includes funding and consultants. The government has to put itself in a position where it can sustain mHealth services, factors that were raised included over dependence on consultants or other external means than internal. There is a need for digital health capacity within the government's department of health to ensure sustainability from within.

> *"As an implementing authority one must be self-sufficient, so that including having people with necessary skills to not depend on external provided for the system that needs to be sustained"*
> *"You are more on a sustainable position if you don't depend more on external people"*
> *"How can we sustain anything if 50% of it is from donors – our sustainability is at risk"*
> *"The NDoH uses consultants, that consultant has a life span at the department, you can only employ that person for so long"*
>
> **Verbatim Quotation 5.3.3.1.C**

The government is regarded to be too dependent on vendors and SITA. Departments need to hire their own software developers and other ICT professionals in order to ensure to protect them from vendors who may prescribe platforms that will end up making government to be dependent on them for the longest term because vendors are focused on profit. Government should prescribe requirements for vendors coming into government. There needs to be sufficient capacity in government in order to make decisions that are in best interest of the government when dealing with vendors.

> *"We must have clear specifications"*
> *"We do not need to be dependent on SITA"*
> *"Departments should hire their own"*
> *"Vendors will hook you into their platforms for life"*
> *"Home governance structures on how vendors can land"*
>
> **Verbatim Quotation 5.3.3.1.D**

The work round mHealth has been mostly done by NGOs and working mostly with PEPFAR partners in specific districts. The provinces are not involved much due to lack of capacity. Mobile health should be owned by provinces just like other eHealth initiatives. There is at least a province with a data centre and central management of data is assisting the province to manage other digital initiatives at provincial level.

"Most of the things done on mobile phones are from the NGO part not from the department province"   *"Only mobile, but concepts serve as other eHealth initiatives"*   *"We have provincial data centre, we call it data centre because it is not data intelligence, is also not a warehouse"*
Verbatim Quotation 5.3.3.1.E

5.4.3.2 Scale

South Africa Learning from Itself: MomConnect as a demonstration case.

Leadership and coordination is one of the areas where most, if not all, participants mentioned that there is a great need especially as a responsibility of the national department of health. The fact that there is a strategy document available was regarded as only one of the milestones but there was more leadership and coordination that needed to be done by the NDoH. The poor and/or lack of leadership and coordination by the department was linked to the duplication of mHealth projects or pilots and lack of central database or record of all mHealth initiatives happening in the country. There were also suggestion for the department of health itself to have its own plans around mHealth unlike jumping to every mHealth funded opportunity funded by donors of which the funding has a life span.

"Issues of coordination and rationalisation, you find lots of projects piloted over the period, you find that they could not come to scale"   *"Government coordination"*   *"What is key at national level is to provide guidance, to provide strategic direction"*   *"Nobody is asking that question, there's so many initiatives happening and there is nobody evaluating anything. Even at provincial offices we do not know what is happening at clinics, people have got no idea"*   *"One thing that is very important is that we should not rely on donors only, we should have our own planning, we should have our own funding on the project we want to embark on and we should follow our own strategy. We should not be haphazard. Just because USAID comes with this project we should not run for it – that's a key message"*
Verbatim Quotation 5.3.3.2.A

5.4.3.2.1 NDoH: Human and financial resources

The need for the department to budget for eHealth was raised. Provinces especially highlighted that there is no sufficient budget to sustain mHealth at provincial level. MHealth as a service,

needs strategies that manage projects within mHealth and also change management process that comes with its implementation to ensure success.

> "The department needs to come up with the budget for eHealth"
> "We need proper project management and change management strategy"
> **Verbatim Quotation 5.3.3.2.B**

Government needs to be responsible and enforce standard approach that will allow support from different vendors unlike being limited to specific vendor. Also, the government must be aware that vendors may put government in a position where they depend on them for support. Therefore, the selection of vendors should also consider their compliance with technical prescriptions of the government unlike enforcing their own that in later stage may not be supported by other vendors due to competitions and business advantage between them.

> "If you want to be scalable and sustainable you must write a standard approach that is not vendor biased and can be supported by any software vendor"
> **Verbatim Quotation 5.3.3.2.C**

5.4.3.2.2 Provincial realities regarded as mHealth barriers.

Provinces have challenges with budgets, not necessarily in eHealth, but even other components. Provinces are also reported not being involved in planning processes for mHealth they usually get instructions from national department and are expected to support the initiatives. It is also suggested that funders should check with the government if they can fund initiatives that are already budgeted for sustainability.

> "Provinces are struggling with budget are being cut every year are going down – the challenges that the provinces are facing are big"
> "There has to be allocation of funding, nationally, if we leave it to the provinces it's gonna fail"
> "Only when they are about to handover that's when they involve us"
> "I would blame the funders than the system, because as a funder you have this money, you pilot the system but you do not think about long-term"
> **Verbatim Quotation 5.3.3.2.D**

5.4.3.2.3 Issues relating to computing infrastructure.

Participants did agree that majority of mHealth initiatives do not come to full scale. The issue of scalability needs to be addressed as much as sustainability.

> "Majority do not come to scale"
> "mHealth projects have not gone out of pilot for five years and haven't gone full implementation"
> "They don't do proper use case analysis in terms of where they want to implement and whether is feasible to do it"

Infrastructure issues also contribute to the challenges of scalability.

> *"The thing about scalability and where we can have economies of scale, is with an mHealth App, all we require is a good hosting environment, stable infrastructure environment. It must be health owned, to host several instances of mHealth, they must invest in a solid infrastructure that will allow some level of interoperability with some provincial data centres so that we can harness our data"*
>
> *"For scalability the first thing is to look for platform and where this platform is…"*
>
> **Verbatim Quotation 5.3.3.2.F**

The collaboration and consultations between national government and provinces seems insufficient as far as mHealth initiatives are concerned. Province as well do don't work together or share resources.

> *"The national Health Council should be involved so that they can plan to take over"*
> *"Provinces do not share they compete"*
> *"There are critical things than your mobile phones projects"*
> *"There's this tendency of national to come up with projects and provinces are told that there's this project to be implemented"*
> *"A beautiful system, a necessary system but when it comes to budgetary implications it is struggling"*
> *"When provinces take decisions do not adhere to what the NDoH has decided…"*
>
> **Verbatim Quotation 5.3.3.2.G**

5.4.3.3 Design thinking

5.4.3.3.1 South Africa learning from itself: MomConnect as a demonstration case

The need for interoperability has been highlighted emphatically.

> *"It doesn't make sense to scale any system that doesn't link to other systems"*
> *"Well, interoperability is one thing, but the flow of information from one system to the other systems"*
> *"But if you collect patient data, monitor etc then you consider how that links to other systems. This has been a limitation to most systems"*
>
> **Verbatim Quotation 5.3.3.3.A**

The infrastructure considerations were mentioned. The fact that mobile health may have specific infrastructure needs because of its mobile nature and the key contribution of mobile networks, especially in rural areas. For instance, assessments whether ten transactions can happen at the same time need to be verified and connectivity issues.

> *"The other thing is the infrastructure, it's a major issue I think that the 'm' has a major role to play given that we have infrastructure in different settings."*
> *"You can't have mobile app if you don't have mobile network"*
> *"The infrastructure may not be resilient they have to take into account that fact"*

5.4.3.3.2 Issues relating to Computing Infrastructure.

The infrastructure considerations with regards to standards was mentioned, and participants were trying to point out that at time the focus may be the software and what it can do and forgetting the infrastructure issues in terms of maintenance. The use of open source was also pointed out as something that needs some attention, especially on the view of maintenance.

"The issue of standards is critical" *"We all focus on software and we are not focusing on infrastructure"* *"A major gap in government is infrastructure layer"* *"If we're too prescriptive about in what platform write our apps it's going to make it difficult…"* *"We must be very assertive that there's various Android developers out there and we don't want to be too loose. Open source is very expensive from the point of maintenance perspective"*
Verbatim Quotation 5.3.3.3.C

The government department need to put their foot on the ground in terms of governance.

"One of the things that I picked up when I got here about 7 years ago, we are very poor in managing our own home-grown solutions. We don't put a lot of rigor you know the governance, like the change control, you know if you want to make a change to the system it feels like a free for all because it is internal. A vendor will not let you rock up make the change without proper due diligence performed where they first assess if the changes are warranted and their proper sign off for it, do statement of work"
Verbatim Quotation 5.3.3.3.D

5.4.3.4 Service Implementation

Frameworks need to be clear for mHealth implementation. The mHealth strategy limits potential for proper implementation. Implementers may start having interest in complying and referring to the strategy once they find it clear and the frameworks to be positive contribution to the initiatives. There should be continuous consultation with the health act in order to support implementation that is in line with the act.

"Create clear framework, so that the project is implemented within a clear framework and that is guiding implementation to ensure sustainability" *"The mHealth strategy is not clear, and I think that's a limitation in terms of potential for implementation"* *"There are important things in that act but we have not implemented it"*
Verbatim Quotation 5.3.3.4.A

Opinions from some participants is that South Africa was doing well compared to other countries in the past, however the limitation in implementation has contributed to the regression.

> *"We were the leading country in telemedicine and eHealth 10 years ago and now we're behind because we talk, we talk shop and not do implementation. So implementation is key"*
> **Verbatim Quotation 5.3.3.4.B**

There is a great need for implementation, however , it seemed the integration did not affect the success of MomConnect if its only viewed as an information giving initiative. However, the fact that there was helpdesk amongst other services in MomConnect the integration gap becomes as important. The need to integrate MomConnect to existing health services was expressed. The fact that MomConnect was using basic technology USSD made it easier for provinces to support it, but integration to other health services remained with gaps.

> *"I think if the system is just giving information to patients (only) the link to other systems is not that important"*
> *"There needs to be integration, the MomConnect is there but is it integrated to the existing health services"*
> *"I'm quite aware about MomConnect"*
> *"MomConnect is one of those projects that were very well managed, one of the projects better implemented by national. On two accounts. When we were planning on how we are going to support MomConnect in the province we knew every mom had a cell phone so there was not so much infrastructure layer required"*
> **Verbatim Quotation 5.3.3.4.C**

5.4.4 Ecosystem

5.4.4.1 eHealth as a clinical service

There was a consensus among most participants that there is a need to capacitate health professionals in the area of eHealth, this included even for public health specialists. Another responded actually went ahead and said there should be a need to specialise in this area because at this point the SA Colleges of Medicine do not recognise eHealth. The health professionals' council also have a role to play in the area of facilitating capacity building or even an area of specialty in eHealth.

> *"Public Health specialist need to be capacitated in business analysis stakeholder approach-support for clinical scientist in digital health*
> *"HPCSA needs to come to the party because if you say you are a clinician, for continuity of care you will require access to this data"*
> **Verbatim Quotation 5.3.4.1.A**

eHealth as a service was regarded to be an important service in health, however not something that will solve all the challenges the health sector, especially public health is facing. The need for communication and collaboration between both the clinical and the ICT in the department was highlighted. The clinicians and ICT have worked separately in terms of providing the

clinical service to a patient, clinicians need to be capacitated on how ICT can enhance the health services.

"To provide eHealth services and ensuring that the service delivery is…" *"I don't believe eHealth, as in electronic information system is all we need"* *"The communication between IT and Health – the bridging between them is a critical role"* *"mHealth is not an add on but it is an integral part"*
Verbatim Quotation 5.3.4.1.B

Due to the changing nature of technology it is difficult to prescribe what the strategy should say, however, there should be continuous engagements so that the strategy remains relevant. eHealth is regarded as a work of health professionals due to their understanding of the health programming and what it need to address, an IT person can only support the technology part which may affect the impact of the program offered to patients. This is regarded to be a matter of priorities between a health professional and an IT person.

"Technology evolving so fast you can't really prescribe what eHealth strategy should say" *"It's important, if eHealth has to be implemented there has to be somebody with clinical background, who understand the technicalities required to support…"* *"You cannot get IT person to manage eHealth"* *"If you have IT person managing eHealth, their priorities are different, there priorities are managing connectivity etc from IT level not clinical perspective"*
Verbatim Quotation 5.3.4.1.C

The health professionals, considering their ethos as a background in dealing with clinical and sensitive patient information should lead eHealth. A career path of following digital health was also mentioned for health professionals. The reporting lines should be in such a way that professionals are put in committees in which support and link to their job descriptions. The same way funding is set aside for health programming, eHealth should be budgeted for.

"There's a model that works well in Canada, all eHealth Coordinators are either doctors, nurses, pharmacists etc, anybody with clinical background" *"There must be an option to become a clinician scientist in digital health"* *"The reporting creates problem because there's IT steering committee as per DPSA, the Provincial HIS Committee, which is provincial subcommittee of NHISSA per health act. The 80% of discussions at NHISSA is data management."* *"There should be funding that needs to be allocate, eHealth should become a priority"*
Verbatim Quotation 5.3.4.1.D

5.4.4.2 Grey areas in IT, Data Mx and eHealth

There are views that eHealth programs should fall under clinical and not IT because it is offering health services however, the electronic is used to enhance it. It is viewed that if health professionals manage eHealth there will be progress in addressing the issues unlike when it is led by ICT professionals.

> *"It must not fall under IT, it must fall under clinical health"*
> *"eHealth person to engage POPI regulator on this matter as well"*
> ### *Verbatim Quotation 5.3.4.2.A*

The redefining and usage of terms around eHealth was mentioned. The difference between eHealth and digital health was one of the pointed grey areas for the purpose of standardization of terms and elimination of grey areas.

> *"To just say you are doing eHealth is sufficient, I think we must say we're doing digital health"*
> ### *Verbatim Quotation 5.3.4.2.B*

There needs to be a clarification of roles in health, with regards to roles of IT and eHealth. People that are appointed on IT roles become less interested in data management and eHealth meetings. The committees need to be designed in such a way that all parties can contribute and link to their job descriptions. Health technology is also another area that needs to be clarified, if any, roles in eHealth because their role has been viewed as maintaining and procurement of medical equipment and not software that may contribute or part of eHealth. The IT, Strategic Information and eHealth have different priorities and there should be clarification of roles and clearly defined integration plans. There is a recommendation that clinicians should lead eHealth with the support of ICT professionals.

> *"Currently there is still a difference as to where is the difference between IT and eHealth in Health"*
> *"CIOs are appointed based on IT background, they get bored in those meetings are data management, they get bored they don't attend. My take on that, the CIO of health should not be like any other departments, we should not really have CIO with IT background only"*
> *"IT person is not interested in those things"*
> *"Telemedicine, we are talking the use of medical equipment there, the IT person is not interested in managing and supporting those systems…"*
> *"When it comes to tech they aren't – engineering is responsible for maintaining equipment not software"*
> *"How do you link the systems to service delivery"*
> ### *Verbatim Quotation 5.3.4.2.C*

Provinces that have an eHealth directorate have expresses how their mission and vision of eHealth links to the national health mission. Universal coverage, the National Health Insurance to be specific in South Africa is also regarded to be calling for establishment of eHealth as a directorate in order to meet the strategic development goals.

> *"Our vision is to improve health outcomes that matter to the people by aligning to national strategic objectives of the national health"*
> *Our mission is to establish eHealth as an integral part of transformation and improvement of the healthcare services in the province.*
> *"I can look for this quote for you from the WHO… that says universal health coverage will not be possible without eHealth"*
> *"NHI is based heavily on information and using information to manage healthcare"*
>
> ***Verbatim Quotation 5.3.4.2.D***

5.4.4.3 Fast-paced technology environment

The fast nature of technology calls for frequent engagements between stakeholders in order to remain responsive and relevant to the issues around eHealth.

> *"Because one of the key issues with any strategy in the space of health technology is transforming so fast and alongside we have a health system that is changing with re-engineering in that environment of change having a strategy of five years is actually too little, even if we have a major milestone every five years, we need to have something in between, a more interactive approach to strategically development that will allow us on a more regular basis at least annually to reflect how our strategy aligns country's real needs and also whether we are picking up on emerging technology opportunities that are also changing on rapid grade".*
>
> ***Verbatim Quotation 5.3.4.3.A***

5.4.4.4 NHI sustainable development goals

The Health Normative Standards are key in sustainability of mHealth considering the National Health Insurance process that the national department of health has to implement in due course. Getting things right in mHealth now in terms of compliance with the normative standards will come in handy when mHealth has to be incorporated into NHI.

> *"There has to be some directive, and now we have the health normative standards framework sorted out, and now with NHI on the corner they should take it seriously and allocate some funding"*
> *"The stakeholder aspect in interoperability need to be emphasized as well, especially between private and public sector and looking at NHI we will expect to share information and a lot of interoperability standards need more work to be developed further to make that easier"*
>
> ***Verbatim Quotation 5.3.4.4.A***

Although there are different approaches, especially in different provinces, the focus should be the outcome of which very little is reported on the outcomes of addressing eHealth service issues.

> *"How it is done is less important, that what's is done"*
>
> ***Verbatim Quotation 5.3.4.4.B***

5.4.4.5 The MACeH members background: Demography

The MACeH on has individuals with relevant experience in eHealth who could advice and give direction in addressing the issues at hand around eHealth.

"I was part of the team that developed eHealth strategy"   *"I have been involved in eHealth, to be exact since 1978… in Hospital Information Systems"*   *"I worked for eHealth company in the UK"*   *"Worked with WHO on eHealth Advisory Committee, headed informatics in hospitals"*   *"I basically look after all applications within health implementation, to support, business analysis, user registration, user experience design, vendor management to procurement and all those"*   *"I was in a division responsible for telemedicine and mHealth"*
Verbatim Quotation 5.3.4.5.A

5.4.4.6 Legal, policy or regulatory issues

A need for mHealth initiatives to comply with specific standards before and after implementation was mentioned. Also, the lack of data and documentation of the best practices and lessons learned from the initiatives were highlighted. There seemed to be a lot of experiences of the participants that have not been recorded or published. The participants in this group were observed to be busy individuals in their positions and the knowledge they have is not documented in order to assist in future mHealth initiatives.

"Each mHealth case should comply with this".   *"Lack of documentation is a limitation, I am totally guilty myself of not documenting well enough to be able to share"*   *"Look at which of those are working best and where they are working and how can we learn from it or start to expand on it to other provinces or areas".*
Verbatim Quotation 5.3.4.6.A

Legislation is also one of the mentioned critical considerations.

"Critical considerations… legislation, based on specific legislation"
Verbatim Quotation 5.3.4.6.B

The regulations that are applicable to eHealth need to be revisited and enforced. There should be support and evidence-based decisions from the strategic management of national health to support this.

"Comply with national health standards framework"   *"Another piece is regulation, I think we have been quiet passionate from the eHealth side in the kind of regulation change that we've been pushing for that deals with issues around confidentiality and privacy and there are a number of gaps on POPI when one looks at electronic health records"*   *"The health act makes provision for regulation"*   *"Top decision making is very critical"*

"GDPR-EU, POPI covers most of it but not all of it"
Verbatim Quotation 5.3.4.6.C

There are gaps in documents that are supposed to be supporting regulation for eHealth, a review of those documents is recommended.

"Review the NHA, because within the NHA the national health by definition cannot have access to patient identifiable information. If we host at NDoH, it means somehow they will have patient identifiable information somehow. POPI is very clear in terms of clinical care, POPI says… its quiet lenient on the continuity of care on the patient in terms of sharing information, that if your using this information trying to have a life or proper clinical care you will need all relevant information about this patient to give them the best possible care or health outcomes"   *"PAIA Public access to information act, the legislation around PAIA is that any patient can have access to any record via this mechanism and is how we give access to patients via this"*
Verbatim Quotation 5.3.4.6.D

eHealth includes dealing with sensitive patient information, making privacy and security critical. The pace in which the MAC on eHealth engages so far is slow, there should be frequent engagements that ensure the department is ahead in terms of protecting their data. The social media networks was given as one of the examples where privacy and security has contributed to the faith in which their users have today in those networks and if government can follow that route there would be trust to adopt and infuse the eHealth services, especially mobile.

"Some verification of patients via mobile number"   *"Other emerging issues like cyber security"*   *"Critical data is secured and keep reviewing security protocols"*   *"Privacy considerations for patients"*   *"If we are going to look at security and privacy every 5 years we are going to have major security breaches"*   *"There is one thing that this social apps, Facebook, Instagram etc got right, they were in a space where they looked at privacy of their client information and gave the client the right to what they share and what can be shared"*
Verbatim Quotation 5.3.4.6.E

The data from most pilots conducted in South Africa indicates no clarity when submitted to the NDoH on who legally owns it. There should be measures put in place for the data ownership during and after the pilots.

"The data from these pilots is not shared with the department of health. The credibility of data for reporting".
Verbatim Quotation 5.3.4.6.F

There needs to be understanding that information is a resource in government and managed as such so that even budgeting for it is not questionable.

"One of the things it needs is the understanding, in the decision-making about services if people understood that information is a resource that you need in order to run a service, than the idea that you must budget for information systems is not a question" **_Verbatim Quotation 5.3.4.6.G_**

5.4.5 Recommendations

5.4.5.1 Recommendations from the MAC on eHealth

Implementation of change management process whenever mHealth is implemented was recommended in order to ensure success of initiatives and both adoption and infusion of mHealth into daily routines of clinicians. Change management would also include involving users of health services such as patients in the change in the way services are rendered as inclusion of mHealth or the use of their mobile phones.

"Change Management. What we normally talk about with any kind of eHealth including mHealth we talk about change because of the technology used we don't want people to continue doing things the old way with the technology helping them we want them to fundamentally change the way they behave as a citizen or in the healthcare practice, as a health worker. That fundamental change is usually not backed in the design of the project and far too often we are missing an opportunity by simply giving people a device and say this will help you do your job better and missing the point that by simply conceptualising the apps in the right way we can fundamentally change and improve the way the health system function, so change management is critical" "Leadership we need in mHealth space… transformation leadership" "Change Management – without that it is not going to happen" **_Verbatim Quotation 5.3.5.1.A_**

There is a need to be consistent in addressing privacy and security issues from design throughout the process of service rendering. The privacy and security is key especially when dealing with health programs such as HIV and TB where there is still a lot of sensitivity and stigma.

"Security dealt with deliberately and assertively in all our eHealth programs, we have to address it strategical and at design level" "The reality of the matter is that without paying the due diligence to data diligence, access controls, good governance policies, access to data…" **_Verbatim Quotation 5.3.5.1.B_**

A centralised hosting of mHealth apps by and/or for government was recommended a d capacity for national government to support the provinces and not NGOs doing the work.

"Centralised hosting environment" "Capacity to support and maintain – not NGOs"

Verbatim Quotation 5.3.5.1.C

A business model was recommended to address mHealth initiatives. The management of apps in government should have a model more like private sector that will ensure key factors such as timelines amongst others.

"We need a business model"
"They do not actually say what we are going to do and deliver and who is accountable"
"Put some realistic timelines to it, and the technology has changed as well one has to look at that tech"
Verbatim Quotation 5.3.5.1.D

5.4.6   Outliers

At a facility level, HR is a challenge, whenever new technology is implemented someone has to take that responsibility even when it was not part of their job description.

"HR as well"
Verbatim Quotation 5.3.6.1.A

Health professionals are not taught ICT in health at university or nursing colleges, it is recommended to include this in the curriculum.

"We need to change the curriculum at the medical school"
Verbatim Quotation 5.3.6.1.B

Operational managers at health facilities should have information management as part of their responsibilities in order to ensure data issues such as reporting and security amongst others are addressed. There should also be capacitated in information management and eHealth accordingly.

"Every manager must have information management as part of their responsibilities, must be in the job description of every manager.
"Leadership and orientation, 80% of the time you are an administrator and 20% are clinicians – they don't know that".
Verbatim Quotation 5.3.6.1.C

5.5   Facility Level (PHC) Data

The facility-level data was obtained from the professional health care staff and pregnant women and mothers visiting health care facilities for maternal, child and women's health at the clinics. Table 5-5 illustrates the demographic information of pregnant women subscribed to the MomConnect service.

Table 5-5: Demographic information of pregnant women

Age	Frequency	Race	Highest educational level	Percentage
18-21yrs	5			11%
22-25yrs	13			29%
26-30yrs	14			31%
31-35yrs	7			16%
36 years and above	6			13%
Total	**45**			**100%**
Undisclosed		3		7%
Black		42		93%
Total		**45**		**100%**
Degree			1	3%
Diploma			2	4%
Matric			33	73%
Below Matric			7	16%
Undisclosed			2	4%
Total	**45**	**45**	**45**	**100%**

From Table 5-5 above, the majority of pregnant mothers (n=14, 31%) were aged between 26 and 30 years, with the minority (n=6, 13%) aged 36 years and above. The majority (n=42, 93%) were Black, and only 33 (73%) of the women had acquired matric education.

Table 5-6 below shows the type of handset and preferred text messaging. These were important to determine, in order to ascertain affordability factors and MomConnect's efficacy to its users.

Table 5-6: Handset type and messaging preferences

Basic	Basic/Smet	Own/ Share phone	Preferred text messaging/ WhatsApp/ Other	Percentage
Basic	8			18%
Smart	37			82%
Total	**45**			**100%**
Own Phone		40		89%
Share phone		5		11%
Total				**100%**
SMS			24	53%
WhatsApp			17	38%
Undisclosed			2	4%
Both SMS & WhatsApp			2	4%
Total	45	**45**	**45**	**100%**

Table 5-6 above indicates that a majority of the women (n=40, 89%) owned phones. Of these phones, the majority (n=37, 82%) were smart phone devices. The implication is that the women have the means to receive messages predominantly by SMS as preferred by 24 (53%) of these women. Table 5-7 below is a representation of the facility clinical staff's demographic information.

Table 5-7: Demographic information of facility staff

	Designation	Level of Education	Race	Gender	Percentage
Prof Nurse	5				100%
Other	-				-
Total					
Diploma		5			100%
Other		-			-
Total		5			100%
Male				4	80%
Female				1	20%
Total					
Coloured			1		20%
Black			4		80%
Total			5		100%
Clinical					100%
Total	**5**	**5**	**5**	**5**	**100%**

Table 5.7 above shows that the majority of the consulted clinical staff were professional (n=5, 100%), with diploma qualifications, and male (n=4, 80%), and black (n=4, 80%). Table 5.8 below is an illustration of the demographic details of the non-clinical staff at the facilities.

Table 5-8: Demographic information of non-clinical staff

Non-Clinical Staff						
Sector: NGO/ Government / Private/ Independent Consultant/ Other	Designation	Education level	Race	Gender	Background	Percentage
Government	3					50%
NGO	2					33
Independent	-					-
Consultant	1					17
Other	-					-
Total	**6**					**100%**
Health-Promoter		4				67%
Counsellor		2				33
Total		**6**				**100%**
Bachelor's Degree			2			33.3%
Diploma			2			33.3%
Matric			2			33.3%
Total			**6**			**100%**
Male				5		85%
Female				1		17%
Total				**6**		**100%**
Black				6		100%
Total				**6**		**100%**
Health Promotion					4	67%
Support Service					2	33%
Total	**6**	**6**	**6**	**6**	**6**	**100%**

Table 5.8 above shows that the majority of the non-clinical staff (n=3, 50%) are in the government sector, 4 (four, 66.6%) are health promoters, the same number (2, 33.3%) each

has a bachelor's degree, a diploma and matric qualification; while the majority (n=5, 85%) are male and 4 (67%) have a health promotion background. Table 5-9 below is a representation of the clusters, themes and sub-themes emanating from the facility-level (PHC) level.

5.6   Clusters, Themes and Sub-Themes

Table 5-9: Clusters, themes and sub-themes of facility-level data

Cluster	Theme	Sub-Theme
Service Touch Point: Facility Level	Stakeholders	Mothers, Pregnant Women and where applicable, care givers.
		Clinicians (Capacity Building, NurseConnect)
		Foreign Nationals as users of mHealth, and barriers associated
	Service Implementation	Content of information as an mHealth service: Push and Pull SMSs
		Ethical considerations
		The MomConnect Helpdesk: Interactive communication with nurses
		Subscription & Marketing
		Service Rating / Feedback / Feeling
	Facility Environment	
	Operations	
	Recommendations	

Table 5.9 above shows that the service touch point is the main cluster, with the main themes: stakeholders, service implementation, facility environment, operations and recommendations.

5.6.1   Service Touch Point: Facility Level

5.6.1.1   Stakeholders

The stakeholders theme integrates both the users' and the health care givers' experiences.

5.6.1.1.1   Mothers, pregnant women and where applicable, care givers

The staff and women who participated in the study, have reported that they were not part of MomConnect's implementation process at their facilities. They were only informed to register patients.

5.6.1.1.2   Clinicians (Capacity Building and NurseConnect)

Participants had no knowledge of NurseConnect.

5.6.1.1.3   Foreign nationals as users of mHealth, and associated barriers

The issue of language barrier regarding foreign nationals was raised by staff members who are assisting patients with registration on MomConnect. Although, it seems the design team

has not looked at the language barrier issue. This barrier has led to slow registration process and breach of confidentiality.

• *"Due to language barriers, patients don't receive information"* • *"Break confidentiality due to language barrier"* • *"Confidentiality must get broken to get information via interpreter"* • *"our biggest challenge is language barrier as most of our clients are from out of our south African borders"* • *"first time I used to do it as a group, but I realized there is a challenge, the challenge is language barrier"* • *"There is a language barrier as we cater for foreign nationals"*
Verbatim Quotation 5.4.1.1.A

5.6.1.2 Service Implementation

5.6.1.2.1 Content of information as an mHealth service: Push and pull SMSs

Nurses reported that they only heard about MomConnect when they started to work in antenatal, this is due to the fact that they rotate in different consultations, this meant that those who were at ANC when the MomConnect was implemented were now rotated elsewhere in other instances even left the facility.

• *"Only heard of MomConnect 4 weeks ago when I started in Antenatal care"* • *"Content: I do not know the content of the messages our mothers receive"* • *"Need to get the messages so that the content can be used as part of health education"* • *"Only when I started doing ANC, I was doing TB before"*
Verbatim Quotation 5.4.1.2.A

Nurses reported that the content of the messages that the women are receiving was never shared with them, they only hear from patients when they ask for clarity about specific messages or when they confirm to know specific elements of antenatal care from the elements. Some nurses have reported to have subscribed themselves to the MomConnect with the aim of getting to know what their patients are receiving.

• *"I registered myself in order to get messages to know content"* • *"I am registered so I know the messages"*
Verbatim Quotation 5.4.1.2.B

There was consensus amongst nurses that the messages do serve patients well in terms of teaching them, however, the messages must be made available to the nurses as well either in a form of a poster which shows what the patients receive at what stage of pregnancy.

• *"We need to know the content of the messages, receive them ourselves so that we can use them as reference when mothers ask regarding them"* • *"Have messages put on poster in consultation room"*

• *"MomConnect is helpful teaching tool for patients"*
• *"Messages can be used by staff as health education tool"*
• *"It would be good to know message content"*
Verbatim Quotation 5.4.1.2.C

5.6.1.2.2 Ethical considerations

Only one member reported that she was given choice to register. The rest have registered as if it is part of the procedure when they are at facility, they did not now they have a choice to register or decline, however they were all happy about the MomConnect service. Participants reported that they got registered into the MomConnect service on their first visit into the facility. Few participants reported having registered within the first twenty weeks of pregnancy. Most members reported to have registered after 20 weeks of pregnancy and the reasons given were laziness only one member reported that she was attending a general practitioner before utilizing the public PHC services.

"They asked for my number, then when I got home I got an SMS saying welcome to MomConnect"
"We were registered at the waiting area before we do the vitals"
Verbatim Quotation 5.4.1.2.D

5.6.1.2.3 The MomConnect Helpdesk: Interactive communication with nurses

<u>MomConnect Helpdesk</u>

Over half of the participants have not interacted with the helpdesk and they did not know how to get in contact with the helpdesk.

<u>*Subscription & Marketing*</u>

5.6.1.2.4 Subscription and marketing:

Because nurses do not usually register patients on MomConnect, they reported that it does not affect their clinical workload. However, the counsellors and health promoters they did report that it does add to their workload.

• *"MomConnect does not affect clinical workload"*
• *"Clients do ask us questions regarding messages they receive (mostly those that are talkative)"*
• *"It is additional work on daily functions as registration is done at first visit when there is a lot to be done in the morning and it takes time"*
Verbatim Quotation 5.4.1.2.E

5.6.1.2.5 Service rating / Feedback / Feeling

Almost all women participating have indicated that they are happy with their messages and have commended the service on the content regarding nutrition, getting ready for labour trip,

and the language used must be easy to understand. However, they have indicated that they opted to register in English than their vernaculars because the translation in their vernacular is bombastic.

"Teaches me about what is best to eat"   *"When to go to the hospital"*   *"The importance of drinking safe clean water"*   *"Language used is understandable"*   *"MomConnect is support to expecting moms"*   *"Do not only deal about pregnancy, handles social issues like about and what to do if one experience it"*   *"Reminds me to take my medication"*   *"What to prepare when going to the hospital for labour"*   *"How to handle stressors"*
Verbatim Quotation 5.4.1.2.F

The women have also described how they feel when receiving the messages, the researcher prompted to understand how they feel as they receive the service each time.

"Messages remind me that I am pregnant and how to better take care of myself"   *"Messages make me feel the government knows that I am pregnant"*   *"Feel informed"*   *"Labour signs" "if you are bleeding go to the clinic"*   *"When you experience that which is in the message"*
Verbatim Quotation 5.4.1.2.G

Participants have also indicated that they do share messages with their loved ones. They also indicated that they do not see the need to opt out from receiving the messages because they find the messages to be helpful.

"Share messages with partner"   *"Have not opted out as the messages are helpful and interesting"*   *"MomConnect is helpful as it teaches mothers about their pregnancies"*
Verbatim Quotation 5.4.1.2.H

Service Feedback

Participants were not interested in unsubscribing from MomConnect. This served as an indication that the mHealth service was appreciated at facility level.

• *"MomConnect is helpful there is no need to disconnect"*   • *"Please add another day where we can receive the messages of encouragement / empowerment"*
Verbatim Quotation 5.4.1.2.I

Nurses have also mentioned that some clients actually enquired if they would continue to get the messages even after giving birth.

• *"Had a client ask if they will continue receiving the messages after delivery"*
Verbatim Quotation 5.4.1.2.J

Women are happy with the messages, as opposed to opting out they actually enquire if they will get the messages even after delivery.

• *"MomConnect is an initiative of NDoH to give information"* • *"Teaches us on how to take care of our coming babies"*
Verbatim Quotation 5.4.1.2.K

During the focused discussion groups women did ask the researcher if they would continue getting the messages even after giving birth. The researcher advised them to reply with the word 'baby' after delivery in order to start receiving baby care messages as soon as possible after delivery to avoid delayed messages.

• *"Can we continue getting messages after delivery"* • *"I believe MomConnect is helpful more so to first time mothers as they report that they receive messages according to gestational age"*
Verbatim Quotation 5.4.1.2.L

Random feedback was given regarding the SMSs themselves by the women.

• *"Health promoter always asks about messages that we receive when we come to the clinic"* • *"At home no one has time to teach about pregnancy as MomConnect does"* • *"Taught me that baby can hear my voice so I can talk to my baby now"* • *"I live on my own and this is my second pregnancy my first baby is 16 years old I feel like a first time mom I have forgotten about child care"*
Verbatim Quotation 5.4.1.2.M

There was positive feedback that messages received are in line with the gestational stage.

• *"Received y messages according to my gestation"* • *"Importance of breastfeeding"* • *"Feel cared for as these messages teach us about our unborn babies"* • *"This is great follow-up on pregnancy development"* • *"Shared messages with my partner to teach him about pregnancy as well"*
Verbatim Quotation 5.4.1.2.N

5.6.1.3 Facility environment

At the facility, the professional nurses are not the one registering patients on MomConnect (except in PMTCT MomConnect component where it has to be presented to the patient by a professional nurse due to the stigma and sensitivity around HIV). Nurses reported that some patients assume that the messages are coming from the facility and not the national

department of health and sometimes they would receive a specific message and act immediately thinking that their midwife is contacting them. Nurses also reported that they never go training on MomConnect, they got to know about it when they rotate to ante-natal care. Staff also reported that the registration system cuts off when entering ID numbers, this step should be removed, however they were advice to use an option of date of birth where ID number is an issue.

> - *"You get patients who thinks that the messages are sent from the facility e.g. Go to the clinic to get your HB tested" – they then come for tests on random days not per appointments.*
> - *"It would be better if patients were given a better understanding why they are on MomConnect and what to expect".*
> - *"I have witnessed registration done, never once did it myself".*
> - *"Never received training on MomConnect was only told that it is vital to ensure that every client is registered on MomConnect".*
> - *"Remove ID numbers on the registration – the system kicks out on that stage – most do not know their ID numbers – they do not bring IDs for risk of being robbed".*
>
> ***Verbatim Quotation 5.4.1.3.A***

5.6.1.4 Operations

Counsellors and data capturers feel that clinical staff do not assist them with MomConnect registration and feel that it is also not their responsibility to register patients. Clinicians have long ques to deal with and do not have time to assist with subscribing patients to MomConnect.

> - *"MomConnect registration is my responsibility alone. If I am attending training out of the facility registration will not be done. I rely on the counsellors to take the numbers and EDD so that I can register them later" – other facilities, counsellors don't register.*
>
> ***Verbatim Quotation 5.4.1.4.A***

Staff reported that they usually do group registration for MomConnect. Where a specific woman has a problem then they follow up individually.

> - *"If a person does not have a phone with them, we provide them with number and clinic code needed to register at home. At next visit we check if registration was done.*
> - *"Stats we submit. From national do not correlate. Few share phones. Have to leave phones at home to avoid being robbed"*
>
> ***Verbatim Quotation 5.4.1.4.B***

Network problems were reported at facility level.

> - *"At times there is network problems"*
>
> ***Verbatim Quotation 5.4.1.5.B***

Data from the MomConnect initiative was reported to be used for quality improvement.

- "If we aren't reaching the target, we use our statistics to improve our registration targets"

Verbatim Quotation 5.4.1.6.C

The support from the national department of health was reported to be insufficient. It was mentioned that the national health should reach out to the facilities to understand their realities with regards to MomConnect.

- *"National needs to follow up more regularly on services added as to see challenges and correct, since 2015 this is 1st interaction with anyone on the MomConnect program"*

Verbatim Quotation 5.4.1.4.D

5.6.1.5 Recommendations

When women receive messages, the messages are from a long number written on their text messages. There was a suggestion that instead of receiving text message from an unknown long number, it is better to have the message being written MomConnect so that they do not ignore the messages confusing them with other random marketing messages. Women have also suggested to have group chat with other pregnant women due to the fact that text responses from helpdesk take some time before they get replied to. They also gave feedback that some helpdesk messages feels automated, however they were advised by the research team that only the FAQs may appear to be automated otherwise there are professional nurses who attend to individual messages.

"remove/change the long number it should indicate it is MomConnect like it does on WhatsApp"
"We might overlook the messages thinking is advertising or creditors"
"Make it in a chat group type of platform to talk to others in same situation as me" "help desk takes long to respond"
"Helpdesk messages feels automated as you receive same response as message received"
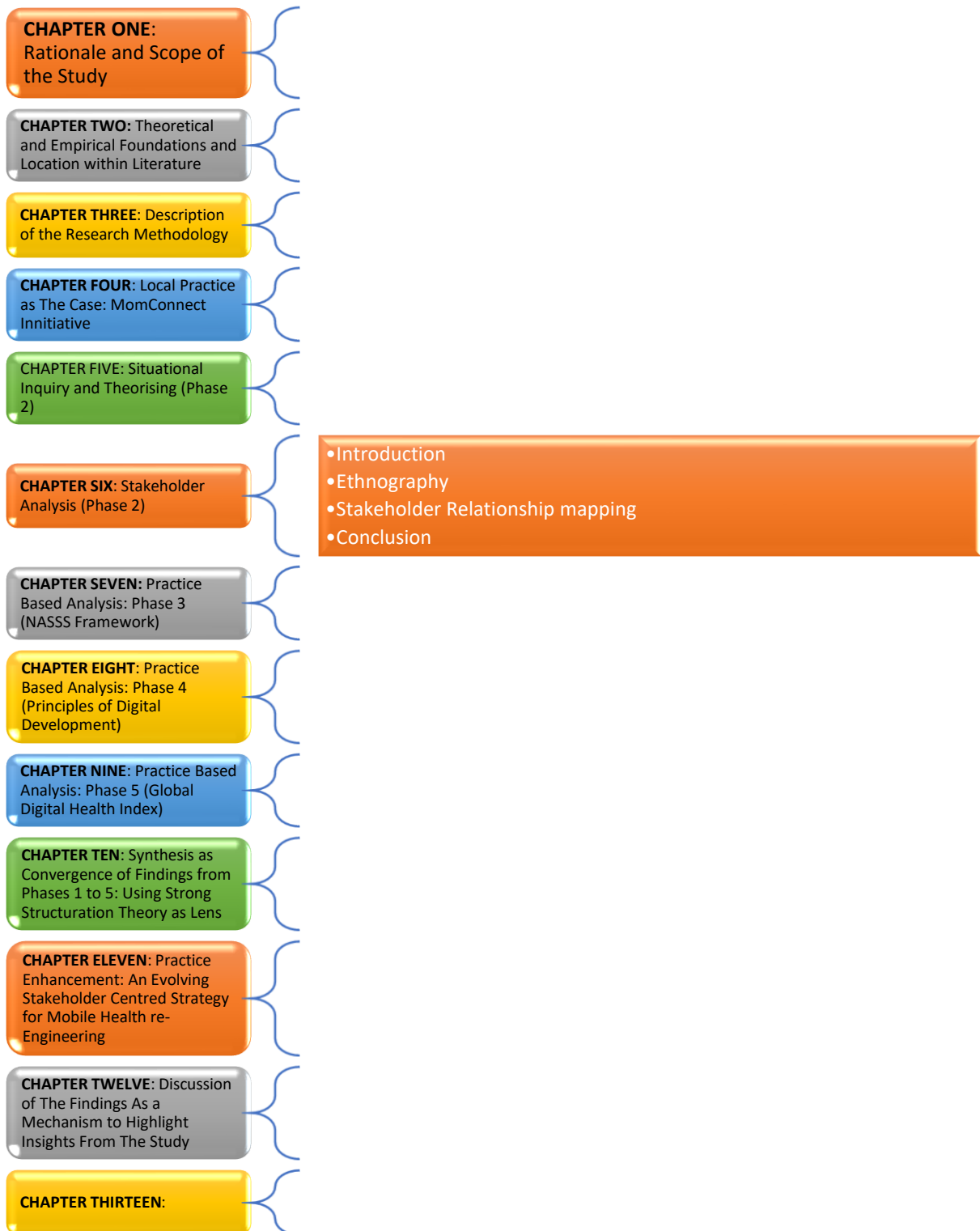*"Group chat is important to discuss with these in similar situations"*
"Send automated reminder to take treatment for chromic patients on similar platform"

Verbatim Quotation 5.4.1.5.A

5.7 Conclusion

This chapter has provided a thematically coherent discussion based on data obtained through various research methods. In that regard, the crux of the discussion is a reflection of the convergently synthesised outcomes of the various empirical engagements with the different groups of participants. The next chapter focuses on the conversational and discourse analysis aspects.

CHAPTER 6: STAKEHOLDER ANALYSIS (PHASE 2)

CHAPTER ONE: Rationale and Scope of the Study

CHAPTER TWO: Theoretical and Empirical Foundations and Location within Literature

CHAPTER THREE: Description of the Research Methodology

CHAPTER FOUR: Local Practice as The Case: MomConnect Innitiative

CHAPTER FIVE: Situational Inquiry and Theorising (Phase 2)

CHAPTER SIX: Stakeholder Analysis (Phase 2)

- Introduction
- Ethnography
- Stakeholder Relationship mapping
- Conclusion

CHAPTER SEVEN: Practice Based Analysis: Phase 3 (NASSS Framework)

CHAPTER EIGHT: Practice Based Analysis: Phase 4 (Principles of Digital Development)

CHAPTER NINE: Practice Based Analysis: Phase 5 (Global Digital Health Index)

CHAPTER TEN: Synthesis as Convergence of Findings from Phases 1 to 5: Using Strong Structuration Theory as Lens

CHAPTER ELEVEN: Practice Enhancement: An Evolving Stakeholder Centred Strategy for Mobile Health re-Engineering

CHAPTER TWELVE: Discussion of The Findings As a Mechanism to Highlight Insights From The Study

CHAPTER THIRTEEN:

6.1 Introduction

Whereas the previous chapter presented a thematic focus of the analysed data, this chapter presents a stakeholder conversational and discourse analytic perspective of the essential data patterns that emerged from both the ethnography and stakeholder relationship mapping. In doing so, the objective is to establish a framework in terms of which the decoded ethnographic and stakeholder relationship mapping messages are posited in the context of the main study purpose and its attendant research questions (Kaufmann, 2017; Shaw and Bailey, 2009). To the extent that ethnography relates to the gathering of information from key informants in their natural surroundings or environment, both conversational and discourse analyses focus collectively, among others, on the behaviours, attitudes, spoken and/ or unspoken thoughts and language/ words of the self-same informants as a reflection of their reality and the world (Depperman, 2018). In any particular environment involving people, their words/ conversations and actions towards each other also portray the nature and extent of their interpersonal relationships (Macura et al., 2019). In both conversational and discourse analyses, contextual inference is essential for meaning-making, because the denotative meanings of words may apply differently in different social environments (Albury, Hall, Syed, Ziebland, Stokoe, Roberts, Webb and Aveyard (2019).

6.2 Ethnography

In any group setting relationships among stakeholder are critical (Kabongo et al., 2019; Serrano et al., 2020). In this regard, the study also focused on the MomConnect Task Team members' interpersonal relationships as both a feedback (reporting during their meetings) and implementation factor of decisions taken, which could only be applied to the MomConnect task team (Serrano et al., 2020). Accordingly, the researcher attended six of the task team's meetings in order to observe and describe the group dynamics and nature of interpersonal relationships among members of the MomConnect Task Team (MomCTT) members in their monthly meetings.

The MomCTT members reside in geographically disparate areas, and meetings are usually conducted by tele-conference, except for those members who are able to travel and physically attend the meetings at the National Department of Health offices in Pretoria, where they assembled in one room to record and write minutes as a team. The meeting would be chaired by an official of the National Department of Health, mostly the Deputy Director-General. These monthly meetings (attended by the researcher from January to June in 2018) were usually held on a Thursday from 09h00 to 10h00. During these (six) meetings, the researcher was only an observer and not allowed to audio-record proceedings or even ask questions. It is worth mentioning that during his ten years' experience in public health, including hospitals and primary health care facilities, the researcher was first an NDOH employee (from December 2011 to May 2013) working as Assistant Director (Inspectorate: Compliance Inspection). The

researcher subsequently left the NDOH in pursuance of his Master of Public Health in Medical Informatics degree, after which he was seconded to the self-same NDOH as consultant, firstly by International Training and Education Centre for Health (I-TECH), University of Washington, South Africa and served as Technical Advisor: Human Resources for Health (HRH) Information Systems from April to September 2019). He was again seconded to the National Department of Health (November 2015-June 2018) by the Health Information Systems Program (HISP – SA) and served as Senior Facilitator: Health Information Systems Strengthening.

Stated differently, the researcher's 'presence' and exposure to the NDOH was neither accidental nor occasional. As both an employee-practitioner (prior to pursuing his postgraduate studies) and researcher (2016-2018) it could even be mentioned writ large, that he 'fitted' well in the practitioner-researcher mould of scientific enquiry through practical and active participation in the process of generating knowledge pragmatically with the actual people whose lived experiences constituted the foundational data collection process (Groop et al., 2010).

Therefore, observation, listening and note taking were relied on to document information that was later combined with other empirical data accruing from the interviews and focus group discussions. Owing to the NDOH's processes (i.e. limiting public access to meetings of its core structures, and is also applicable to other government departments), the observer ('insider') status allocated to the researcher was indeed privileged and advantageous. It is on the basis of such privileged observer status that the practitioner-researcher perspective was advanced at the same time, with its 'accoutrements' of obtaining first-hand information involving even the highest political office within the NDOH. However, the researcher was not absolved from the observance of all applicable ethical protocol, such as not divulging information considered to be classified or placed on a moratorium by the NDOH (van der Donk and Kuijer-Siebelink, 2015).

Prior to the commencement of each meeting, members introduced themselves as they joined the tele-con call, and the minute taker would tick on the attendance register as each member present in the room or participating from far away, joined in to signify their participation. Table 6.1 below is an indication of the key ethnographic elements the researcher observed and noted during the six MomCTT meetings he attended between January and June 2018. For each ethnographic element, a corresponding feedback code was assigned, and its relevant analysis is presented in the horizontal block next to it, as represented in sub-sections 6.2.1 to 6.2.13 (see Appendix M for guidelines of the researcher's involvement with MomCTT members in their meetings).

The researcher observed and noted some key ethnographic elements, each of which is allocated a brief explanation below. On the whole, the professional interpersonal relations and core activities are explained as well as the *modus operandi* of their meetings. This information is of crucial importance, because it illuminates on the environment in which important decisions are made, especially for a project whose momentum was expected to reach acceptable national scalability and sustainability (Peter, 2018).

1. Interaction (Ethnography Feedback 5.5.1): Members interacted professionally towards each other in a semi-formal environ and semi-casual environment. They also appeared to know each other well.

2. Participation (Ethnography Feedback 5.5.2): Members who joined late in the tele-meeting would not introduce themselves. They would only do so when answering or asking questions.

3. Active Members (Ethnography Feedback 5.5.3): Behaviours valued by the group, emailing information beforehand.

4. Feedback (Ethnography Feedback 5.5.4): Members gave feedback from their organisations on what they did since the previous meeting.

5. Culture (Ethnography Feedback 5.5.5): Members had various specialties. Their discussions ranged from the back end, MomConnect service itself, to continuous design. For instance, if an infrastructure related question was asked, the organisation in that field would respond, make a recommendation, or be allocated a task to explore other possibilities on the matter.

6. Interaction Mode (Ethnography Feedback 5.5.6): The meeting was always chaired by the NDoH representative. Everyone seemed to know all other organisations and names of their representatives.

7. Core Activities (Ethnography Feedback 5.5.7): Monthly discussions on issues regarding MomConnect and its operations, service feedback, and continuous improvement amongst others.

8. Language Use (Ethnography Feedback 5.5.8): The language used was mostly focused on ICT and public health.

9. Overheard Conversations (Ethnography Feedback 5.5.9): Other organisations would mute their microphones and discuss privately and then unmute to answer the questions. Sometimes a member from an organisation would actually answer

questions having forgotten to unmute and later on would unmute and advice the team that they were on mute due to a discussion or background noise.

10. Spatial Layout (Ethnography Feedback 5.5.10): Often, a telephone would be placed on speaker mode for everyone to hear in the room.

11. Rationale (Ethnography Feedback 5.5.11): Due to their different geographical locations, the culture of doing things remotely seemed normal to most, if not all members.

12. The 'Unspeakable' (Ethnography Feedback 5.5.12): The NDoH has always played the leading role.

13. Evidence of Attendance (Ethnography Feedback 5.5.13): The attendance list and minutes are available – but will not be made publicly available, for members' privacy.

6.3 Stakeholder Relationship Mapping

Stakeholder relationship mapping basically refers to the identification and categorisation of the main project participants (individuals, organisations or institutions) who directly or indirectly have a vested interest in the ultimate outcome of the particular project based on their levels or stages of involvement in the very same project (Fiordelli et al., 2013). Whereas the previous section (Section 6.2) highlighted on the environmental or contextual aspects of the MomConnect Task Team members' interpersonal relationships, this section presents the actual nature of those interpersonal relationships themselves. Based on the researcher's three-fold involvement with the NDOH (as full-time employee, then seconded consultant, lastly as doctoral research candidate), the researcher was principally motivated by the desire to determine the extent to which the nature and 'capital' of interpersonal relations among the MomConnect Task Team members influenced their roles and decision-making processes.

Table 6-1: Ethnography feedback

(Source: Boaz et al., 2018:5-6)

Stakeholder Engagement Category	Associated Principles
Organisational	Clarification of stakeholder engagement objectives (i.e. inputs, methods, outputs); Embeddedness of stakeholder engagement in research model; Identification of the requisite resources; Plans for organisational learning and reward system; and Recognition of potential role of stakeholder.
Values	Shared project team's commitment to stakeholder values and objectives; Shared understanding of stakeholder engagement as multi-individual; Encouragement of individuals' commitment to organisational values; Recognition of possible productivity-inclusion tensions; and

Stakeholder Engagement Category	Associated Principles
	Shared and sustained commitment to continuous stakeholder engagement
Practices	Planned and integrated stakeholder engagement activity into research programme; Research process flexibility to accommodate stakeholder engagement and its outcomes; Systematic stakeholder input to achieve objectives; Collation, analysis and usage of stakeholder input; and Recognition of iterative nature of stakeholder involvement

Given the methodological (practitioner-research) approach adopted in the study, stakeholder engagement aptly fits "as part of a plan for promoting research use in practice" (Boaz, Hanney, Borst, O'Shea and Kok, 2018). In this regard, the latter authors proposition that there are basically three categories of stakeholder engagement principles, as depicted in Table 6.1.

In terms of the stakeholder-centric aspect of data collection in this study, the MomConnect Task Team (MomCTT and Ministerial Advisory Committee on eHealth (MACeH) constituted a very influential stakeholder constituency by virtue of their proximity to the highest decision-making echelons within the NDOH, as opposed to the lower implementation levels at the primary health care facilities. In terms of the structure of the study, realisable values and organisational aspects of stakeholder engagement principles were reflected in more detail in Chapter Five, especially in Section 5.3 and Section 5.4 respectively.

For purposes of the current chapter, the practices referred to in Table 6.2 were most realisable insofar as the researcher's planned, ongoing and flexible integration of the MomCTT's MACeH's *observed* activities between January and June 2018. The latter coheres with the assertion by both Boaz et al. (2018) and Deppermann (2018); all of whom accentuate the role and value of stakeholder engagement research practice. In this regard the 'mapping' or identification and categorisation of the relationships between (and among) stakeholders and their conversations/discourse provided more insight into the policy domain of MoMConnect's decision-making processes and their outcomes. Figure 6.1 below is a representation of a stakeholder mapping, and depicts stakeholder organisations, nature of relationships and possible motivation of the relationship.

Figure 6-1: A stakeholder relationship mapping

(Source: Shaw and Bailey, 2009:413)

The figure above shows that there are various types of relationships within organisations, each of which has its own motivation; that is, the underlying reasons for members' 'attraction' to each other and one another (Matthew-Maich et al., 2016).

Figure 6.2 below is an indication of the actual interpersonal relationships observed and noted by the researcher among MomConnect Task Team members who were physically present at their meetings over a period of the six meetings observed between January and June 2018.
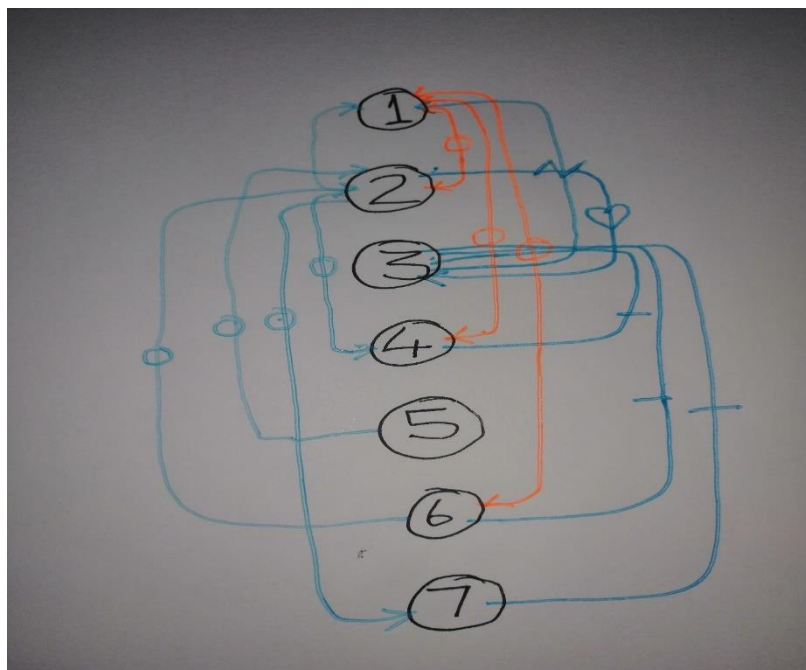
Figure 6-2: Observed MomCTT members' interpersonal relationships.

(Source: Researcher's own construction)

6.3.1   Stakeholder 1

This stakeholder perceived all connections as strong and mentioned only Stakeholders 2, 5, 6 – and the other two mentioned were funders. Stakeholder 1's connection with Stakeholder 2 was only based on receiving resources.

6.3.2   Stakeholder 2

This stakeholder only made reference to the other six stakeholders. Stakeholder 2's relationship with Stakeholders 1, 4 and 7 was based on their giving resources to them; with Stakeholders 5 and 6, it was based on only receiving. There were no stakeholders whose relationships was reciprocally based on both receiving and giving of resources.

6.3.3   Stakeholder 3

There were conflicting relationships between Stakeholder 3 and Stakeholder 1 based on their external business affairs. However, their connection was viewed as strong. Cordial or emerging connection was viewed with Stakeholder 1, who had weak or informal connection with Stakeholders 4, 6 and 7.

6.3.4   Stakeholder 4

Stakeholder 4 cited strong relationship with Stakeholder 5, weak or informal connection with Stakeholder 2, and temporary connection with Stakeholder 6. Stakeholder 4 also cited one more stakeholder who was never mentioned by the others, because there were tense and conflicting relationship. Stakeholder 4 also mentioned specific internal clusters within the National Department of Health as having tense connection due to the relationship of that cluster with the MomConnect Management.

6.3.5   Stakeholder 5

Stakeholder 5 mentioned all other 5 (five) stakeholders as having strong connection with each other. This stakeholder (5) further mentioned another stakeholder whose work was to review messages as another stakeholder with whom there was a strong connection.

6.3.6   Stakeholder 6

This stakeholder had strong connections based only on receiving resources from stakeholder 2. 1,5, and 6, receiving and providing also from another organisation and a funder.

6.3.7   Stakeholder 7

Stakeholder 7 had a strong relationship with Stakeholders 1 and 5. Stakeholder 7 also mentioned that the task team was one entity with strong inter-personal relationships.

From the observed interpersonal relationships above (6.3.1 to 6.3.7), it is clear that there are those relational variables that reflect a MomConnect Task Team organisational culture, and those that reflect on individual or personality characteristics. From the researcher's point of view, the task team's organisational culture is depicted by those strong interpersonal relationships or professional bonds, and those that are not strong reflect on the weak connectivity induced by personal factors such as attitude or reason/ motivation for giving or receiving some form of material resource. Table 6.3 below shows the task team members' scores in relation to their involvement in either sustainability or service design processes.

Table 6-2: MomConnect Task Team members' sustainability/ service design involvement

Stakeholder	Sustainability Participation		Service Design Process Participation						
	Lead	*Support*	Analysis	Design			Development	Implementation	Evaluation
				Conceptualisation	*Specification*	*Prototyping*			
Stakeholder 1	3, 1, 6, 7	2	16	3, 1, 6, 7	1, 6	1, 6	1	1, 6, 7	1, 6, 7
Stakeholder 2	2	3, 1, 4, 5, 6	1, 4, 5	4, 5	4, 5	4, 5	5, 6	3, 5, 6	1, 4
Stakeholder 3		3	3						
Stakeholder 4		2, 3, 1, 5	1, 5	3, 5	3, 1	3	3	3, 5	1, 5
Stakeholder 5	2, 4, 5, 6	3, 1, 7	1, 4, 5, 6, 7	1, 4, 5, 6, 7	1, 4, 5, 6, 7	1, 4, 5, 6, 7	1, 4, 5, 6, 7	1, 4, 5, 6, 7	1, 5, 6, 7
Stakeholder 6	26	3, 4, 5	3, 5, 6	3, 4, 5, 6	3, 4, 5, 6	3, 4, 5, 6	4, 5, 6	4, 5, 6	3, 6
Stakeholder 7		2, 3, 7						7	7

In Table 6.2 above, the numbers are not scores, but representative of stakeholders and their views of each other and one another. For instance, Stakeholder 1, regards Stakeholders 3, 1, 6 and 7 as instrumental on the aspect of Leading/ Leadership, and only Stakeholder 2 as being Supportive. At the same time, the self-same Stakeholder 1 views himself as the only key stakeholder who is effective in Development. This also means Stakeholder 1 is viewed as collaborative by Stakeholders 3, 1, 6 & 7 on Leading/ Leadership. In addition, Stakeholder 1 worked alone under Development and did not see a role nor activity by others there in particular.

When comparing Figure 6.2 and Table 6.3, it is interesting that Stakeholder 3 has a 'crowded' or strong relationship with other members, but has a poor performance record in terms of the core activities assigned to members. It could be that such a contradiction is based on the member's 'giving' reputation or profile.

Furthermore, for sustainability participation, the example of Stakeholder 7 shows that he did not regard any of the other six stakeholders as effective in Leading/ Leadership, but regarded Stakeholders 2, 3 and 7 (himself) as effective in Supporting the team. Stakeholder 7 also

regarded himself as effective on Implementation and Evaluation. It is also interesting that other stakeholders, particularly Stakeholder 5, also recognise the role of Stakeholder 7 on Implementation. In essence, the details of information accruing from Table 6-2 shows the complexity of the relationship mapping, considering also that each stakeholder provided his/ her own views anonymously.

6.4   Conclusion

It is clear that the role of ethnography/ phenomenology could not be ignored in this qualitative study. The researcher's observational intentions were significant insofar as providing information that would not have been ordinarily available.

Stakeholder relationship mapping was of critical importance, especially that poor and weak programme management challenges accounted for the failure of scalability and sustainability capacity required for the delivery of huge national projects such as MomConnect (Mawela et al., 2011). Therefore, stakeholder mapping was only applied to the participant category located within the decision-making and policy development echelons (such as the MomConnect Task Team and Ministerial Advisory Committee on eHealth); rather than applied to the project implementers (e.g. clinical and non-clinical staff) or end-users (i.e. patients at the PHC facilities). In this study, the relationship mapping was only applied to the MomConnect Task Team members by means of a written exercise, filling-in an informed consent form and return to the researcher the same day.

CHAPTER 7: PRACTICE-BASED ANALYSIS: PHASE 3: (NASSS FRAMEWORK)

CHAPTER ONE: Rationale and Scope of the Study

CHAPTER TWO: Theoretical and Empirical Foundations and Location within Literature

CHAPTER THREE: Description of the Research Methodology

CHAPTER FOUR: Local Practice as The Case: MomConnect Innitiative

CHAPTER FIVE: Situational Inquiry and Theorising (Phase 2)

CHAPTER SIX: Stakeholder Analysis (Phase 2)

CHAPTER SEVEN: Practice Based Analysis: Phase 3 (NASSS Framework)

- Introduction
- The NASSS Framework
- Interpretation of Data Using NASSS Framework as a Guideline
- Conclusion

CHAPTER EIGHT: Practice Based Analysis: Phase 4 (Principles of Digital Development)

CHAPTER NINE: Practice Based Analysis: Phase 5 (Global Digital Health Index)

CHAPTER TEN: Synthesis as Convergence of Findings from Phases 1 to 5: Using Strong Structuration Theory as Lens

CHAPTER ELEVEN: Practice Enhancement: An Evolving Stakeholder Centred Strategy for Mobile Health re-Engineering

CHAPTER TWELVE: Discussion of The Findings As a Mechanism to Highlight Insights From The Study

CHAPTER THIRTEEN:

7.1   Introduction

In this chapter, the major themes of the collected data are presented and interpreted in the context of the NASSS framework, which derives from Non-adoption, Abandonment by individuals, failure of local Scale-up, distant Spread and long-term Sustainability (Greenhalgh, 2018). Four different data sources (research methodological contexts) are presented and sorted according to the thematic relevance. A summary of the overall findings from the study is then included in the context of the four different sources. The overall findings are subsequently compared and evaluated against the main research question and its sub-questions. It is worth mentioning that the two critical aspects of MomConnect's scalability and sustainability were instrumental considerations in the construction and development of the themes-categories-research questions nexus (Trilling and Jonkman, 2018).

According to Ngoc et al. (2018) and Schneider and McDonalds (2007), scalability focuses on the institutionalisation of MomConnect interventions and programmes whose success and efficacy has already been established in new contexts for the purpose of producing more positive regular impacts in larger and more heterogeneous populations, systems and contexts. On the other hand, sustainability is concerned with MomConnect's long-term planning, resourcing and success (Power et al., 2019).

7.2   The NASSS Framework

Given that both scalability and sustainability factors constitute indispensable MomConnect factors, the NASSS framework is referred to in this study as a measurement tool for the success and sustainability of the mHealth stakeholder-centred strategy. Despite significant investment and high expectations, the NASSS), has experienced five problematic areas (Greenhalgh, 2018). The latter author noted the following problem areas: digital technologies are either not adopted or soon abandoned by professionals and/or their patients and clients; the technology-supported service succeeds as a small-scale demonstration project but fails to scale up locally and spread to other comparable settings or be sustained over time. Greenhalgh (2018) outlines three key points which may be regarded as relevant in this study:

- Non-adoption, abandonment by individuals, failure of local scale-up, distant spread and long-term sustainability;
- Complexity of technology projects are characterised by complexity (unpredictability, interdependence and emergence) across multiple domains; and
- Identification and location, understanding, reduction and management of those complexities.

Figure 7.1 below is an illustration of the seven-point components of the NASSS framework, all of which are conducive to continuous adaptation.
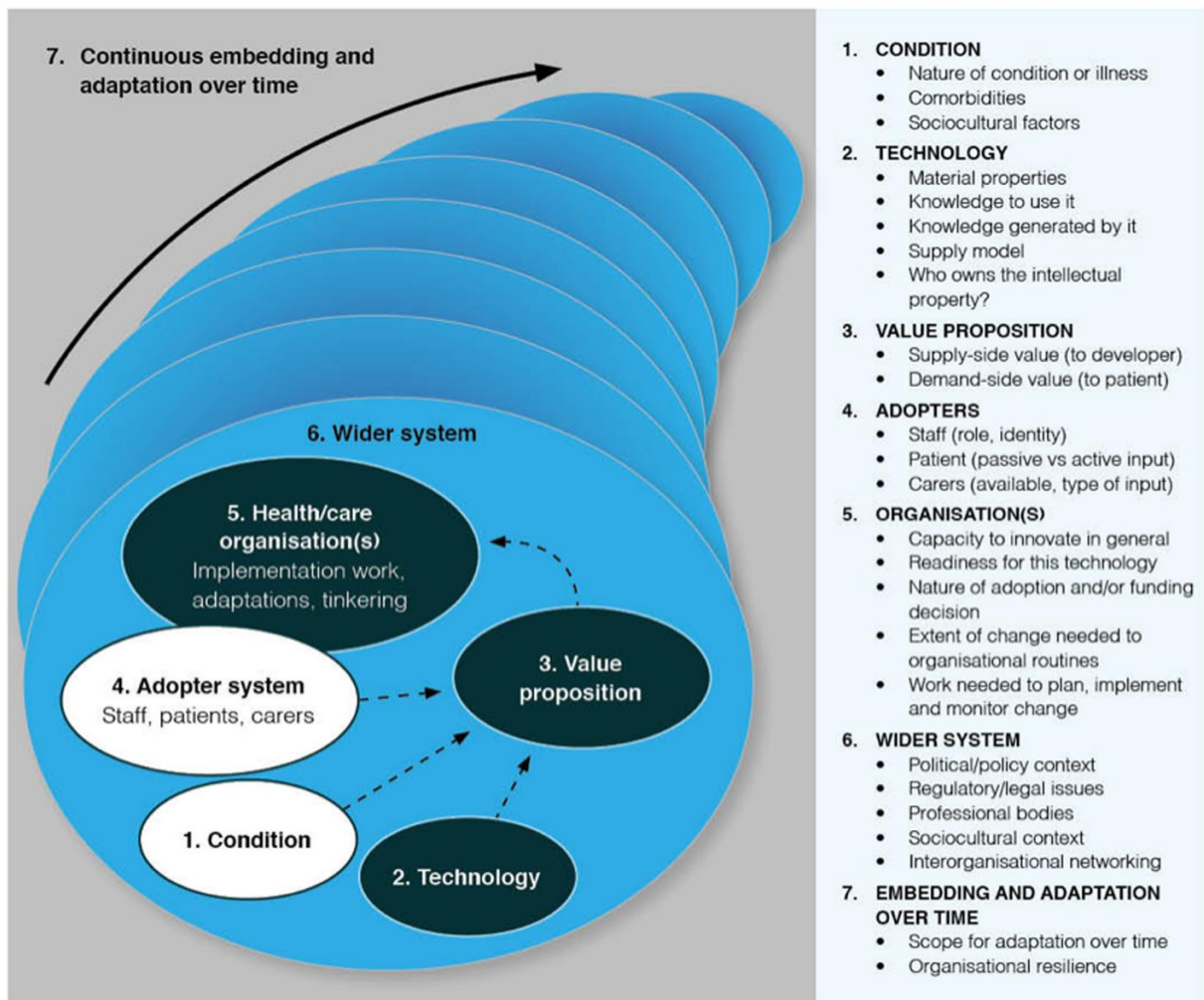

Figure 7-1: The NASSS framework

(Source: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5688245/figure/figure2/)

The empirical application of the NASSS framework has proved to be useful in explaining failures and successes of technology-supported programmes in health and social care (Greenhalgh et al., 2018). Innovation spread is a key policy objective for health systems world-wide (Benson, 2019; Grover and Lyytinen, 2015). However, adoption success varies enormously from country to country, and from one environment to another. In this regard measuring digital health innovation remains critical and may help to predict the success of innovations such as mHealth services (Ikeziri et al., 2019). In order to predict the success of mHealth, the researcher referred to the themes that emerged from the study in conjunction with the NASSS framework to answer questions, score and substantiate the scores. The aim was to use the content of the themes optimally. The findings from this process are not meant to be generalised throughout the mHealth community, but to predict, based on the findings at hand on the success of mHealth (Greenhalgh et al., 2018).

Benson (2019) mentions further that programme failures and successes can help understanding of the NASSS framework. Some projects, which are fully specified before funding, tend to fail because the protocols or contracts are not flexible enough to adapt to emerging changes that were not predicted nor knowable at the outset. Thus, the NASSS framework is used in this study to explain, understand and learn from the implementation of MomConnect based on the empirically generated themes at hand (Ikeziri et al., 2019). Other researchers have used the NASSS framework to map development of new tools, which is welcomed by the authors of the NASSS framework as contributing to this framework and the important outcomes it addresses. Some of these outcomes may contribute to this study, including but not limited to innovation readiness, adoption process and user experience, as indicated in Table 7.1 below:

Table 7-1: Relationship between NASSS framework domains and R-outcomes measures (Source: Benson, 2019:6)

NASSS domain	R-Outcomes measure				
	Innovation readiness	Digital literacy	Adoption process	User experience	Behaviour change
1. Condition	∗	∗	∗∗	∗	
2. Technology		∗	∗	∗∗	∗
3. Value proposition	∗		∗	∗∗	
4. Adopters	∗∗	∗∗	∗	∗∗	∗∗
5. Organisation	∗∗		∗∗	∗	∗
6. Wider system	∗		∗∗		∗
7. Embedding and adaptation	∗		∗∗		∗

7.3 Interpretation of Data Using NASSS Framework as a Guideline

As indicated in Section 7.1, Table 7.2-Table 7.6 below represent the main clusters, themes and sub-themes (categories) against which the context of the NASSS framework has been referred to as a predictor of the success or failure of MomConnect as a demonstration case. As presented in Section 1.8 and Section 1.9 of Chapter One, the main purpose, research question and objectives (ROs), subsidiary research questions, as well as the main research question and its subsidiary research questions (RQs) are:

Main Purpose: *To design an mHealth Stakeholder-Centred Strategy based on best demonstrated practices (considerations and methods) and learnt experiences from the perspectives of the Digital Health Innovation Ecosystem stakeholders in South Africa.*

Main Question: *What are the best demonstrated practice considerations for designing an mHealth implementation strategy based on the learnt experiences and perspectives of the Digital Health Innovation Ecosystem stakeholders in South Africa?*

RO1: *To explore, describe and analyse strengths and weaknesses of previous and existing health care technologies (with special reference to MomConnect as a best demonstration case) as a framework for any lessons to be learnt for a successful and efficacious mHealth Stakeholder-Centred Strategy based on the relationships, collaborations and processes in the public health services;*

RQ1: What are the design considerations of an mHealth service stakeholder-centred strategy in terms of which mobile technologies are infused in health services (scalable), from a stakeholder-centred perspective?

RO2: To propose a stakeholder-centred framework for an appropriately scalable and sustainable mHealth service Strategy involving the integration of development and implementation processes for public health care services.

RQ2: How should a suitable mHealth service strategy be designed and implemented to rationalise the involvement of relevant stakeholders and integrate development and implementation processes of an mHealth facilitated service?

RO3: To explore and describe the perspectives of the Digital Health Innovation Ecosystem stakeholders as the basis for designing an implementable mHealth Stakeholder-Centred Strategy in accordance with best demonstrated practices and principles;

RQ3: What can be learnt from the realities of a local mHealth-enabled health service based on the relationships, collaborations and processes of a specific situation?

The following tables (Table 7.2) only provide a synoptic onverview of the findings, which are presented in varying degreees of focused details in Chapter 5 and Appendix N.

Table 7-2: Alignment of research questions, objectives and main themes in the context of the NASSS framework

Participant Category or Research Method	Cluster	Main Theme	Sub-Category
MomConnect Task Team Archived Minutes	Service Conceptualisation	Stakeholders	Facility level Consultation and Collaboration
		Design Process	Considerations; Research; Expansion.
	Ecosystem	Organisational	Vision, Policies, Guidelines; Governance and Leadership; Political
		Privacy and Security	Data Ownership
		Integration	Technical: Infrastructure & Interoperability
	Service Continuity	Service Continuity; Sustainability & Evolution	
MomConnect Task Team Interviews	MomConnect as Case Example	Stakeholders	Selection & Involvement of Nurses; mHealth & eHealth Strategy
		Critical Considerations	Differing Piloting Views; Integration of initiative within Health Programming
		The Ministry of Health	Top-down Power Relations

Participant Category or Research Method	Cluster	Main Theme	Sub-Category
		Operations	M&E; DHIS; Linked to Care Implementation Process
		Outliers	Traditional Beliefs
Ministerial Advisory Committee on eHealth Interviews	Governance & Leadership	mHealth Centralisation	Rationalisation of mHealth Services
		Strategies	Feedback on Applying Strategies
	Research & Development	Evidence of implementation & Outcomes	
	Continuity of Service	Sustainability	Total Cost of Ownership and Co-Utility
	Ecosystem	eHealth as a Clinical Service; Grey Areas in IT, Data, Mx & eHealth	

Table 7.2 highlights the thematic approach of the study's response to the research questions and objectives. As stated earlier, a more comprehensive approach was presented in Chapter Five and Appendix M respectively.

7.3.1 Summary of NASSS Empirical Context

In conjunction with Section 7.2, this sub-section briefly highlights the participants' perspectives in a NASSS context.

Domain 1: The condition or illness (Complicated)
- Maternal Child and Women's Health (MCWH) programme: Providing support for pregnant women, mothers and care givers from pregnancy up to the age of two of the children. (In cases where there is still birth and/or miscarriage, the mHealth support will cease accordingly);
- The sociocultural factors include traditional beliefs, inability and unwillingness to pay for service, lack of user representation and location of facilities.

Domain 2: The technology (Simple)
- The use of low denominator technology, USSD in particular, insured scale and less user training;
- The knowledge brought by the technology to the users was communicated in lay non-clinical language, and was based on gestational stage which made it more personal to the users;
- No need for support was raised by the users, particularly for the use of the technology. However, as a result of the content brought by the technology, there was a helpdesk where clinical nurse practitioners were available to provide support by SMS and telephone to the users;
- Generic: A simple phone could be used

Domain 3: The value proposition

- Business case underdeveloped, which was a potential risk to investors;
- The technology was cost effective for the users. However, for the service provider it was more expensive to send SMSs than to use data through WhatsApp where users would use their own data.

Domain 4: The adopter system

- At national level, new staff had to be appointed to manage the MomConnect helpdesk;
- At provinces and districts, staff had to add a new KPA of coordinating MomConnect;
- At facility level, the counsellors had to inform the users about the initiative and give subscription instructions;
- There were no expectations, except having a basic phone as your own or anyone from your household.

Domain 5: The organisation

- The MomConnect task team was well-led, although its members were not necessarily the National Department of Health's official staff;
- The National Department was ready for the technology;
- Adoption was easy. However, funding was a threat to sustainability;
- There is a need for both clinical and digital spheres to interact;
- The implementation needed buy-in from provinces;
- Monitoring of impact needed, but at the time of data collection there was no impact evaluation done.

Domain 6: The wider context

- The content of the mHealth service needed to be aligned to the clinical guidelines of the National Department t of Health.
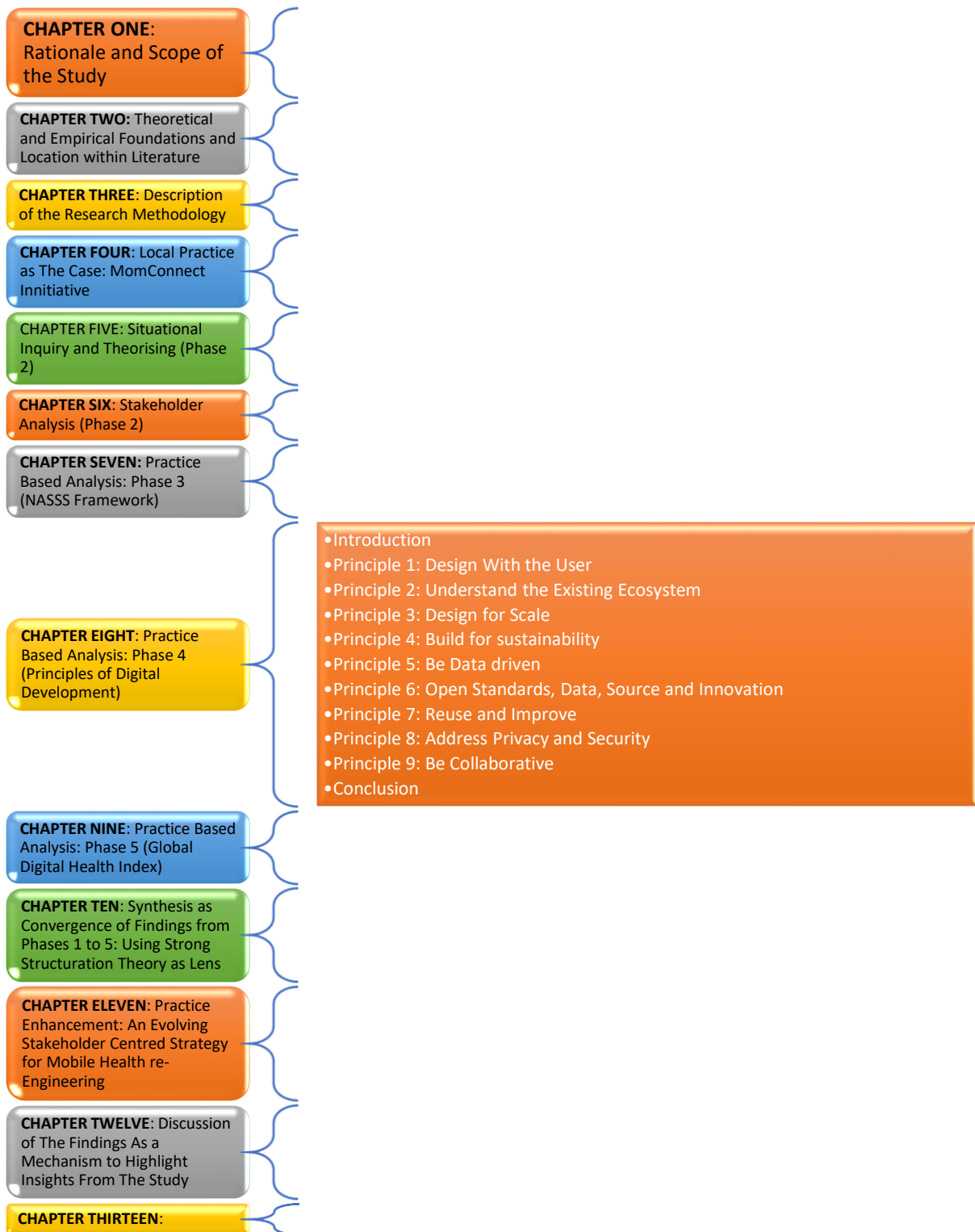
Domain 7: Embedding and adaptation over time.

- The MomConnect initiative has evolved over time, including the addition of a new component such as PMTCT MomConnect; and
- The National Department of Health is resilient, considering its high level of authority; and
- The National Department of Health handles critical events, and has the potential to adapt to unforeseen eventualities.

7.4   Conclusion

In addition to the various data collection instruments and processes, the NASSS Framework was found to be an extremely relevant and useful monitoring and evaluation reference. The use of the NASSS Framework for data interpretation assisted in allocating a modicum of standardised evaluation of the research continuum between the research objectives and research questions (Goldkuhl, 2011; Nyström et al., 2018). In fact, in addition to its

trustworthiness measures, the NASSS Framework not only tested the relevance and efficacy of the adopted research methods; it also tested the worth of the study itself.

CHAPTER 8: PRACTICE-BASED ANALYSIS: PHASE 4 (PRINCIPLES OF DIGITAL DEVELOPMENT)

CHAPTER ONE: Rationale and Scope of the Study

CHAPTER TWO: Theoretical and Empirical Foundations and Location within Literature

CHAPTER THREE: Description of the Research Methodology

CHAPTER FOUR: Local Practice as The Case: MomConnect Innitiative

CHAPTER FIVE: Situational Inquiry and Theorising (Phase 2)

CHAPTER SIX: Stakeholder Analysis (Phase 2)

CHAPTER SEVEN: Practice Based Analysis: Phase 3 (NASSS Framework)

CHAPTER EIGHT: Practice Based Analysis: Phase 4 (Principles of Digital Development)

- Introduction
- Principle 1: Design With the User
- Principle 2: Understand the Existing Ecosystem
- Principle 3: Design for Scale
- Principle 4: Build for sustainability
- Principle 5: Be Data driven
- Principle 6: Open Standards, Data, Source and Innovation
- Principle 7: Reuse and Improve
- Principle 8: Address Privacy and Security
- Principle 9: Be Collaborative
- Conclusion

CHAPTER NINE: Practice Based Analysis: Phase 5 (Global Digital Health Index)

CHAPTER TEN: Synthesis as Convergence of Findings from Phases 1 to 5: Using Strong Structuration Theory as Lens

CHAPTER ELEVEN: Practice Enhancement: An Evolving Stakeholder Centred Strategy for Mobile Health re-Engineering

CHAPTER TWELVE: Discussion of The Findings As a Mechanism to Highlight Insights From The Study

CHAPTER THIRTEEN:

8.1 Introduction

Following the utilisation of the NASSS Framework as a tool for measuring the extent to which the research questions and objectives correspond to the accumulated data in Chapter Seven, this chapter (Chapter Eight) refers to the principles of digital development (PDD) in order to describe the best demonstrated practices learnt from this study. The most critical aspects of the PDD model are: design with the user; understand the existing ecosystem; design for scale; build for sustainability; be data driven; use open standards; open data; open source and open innovation; reuse and improve; address privacy and security; and be collaborative. In this regard, the content-analysed findings are interpreted in the context of the nine core tenets of the principles of digital development outlined in this chapter.

In this study, the extent of institutionalisation of MomConnect interventions serves as the main point of reference in determining its scalability (size or quantitative expansion) and sustainability (qualitative maintenance with resource allocation). Accordingly, Section 7.2 provided a conceptual environment of expected best practices, whereas Section 7.3 allocated the actual context of the application of these best practices in relation to the main study purpose and attendant research questions.

Furthermore, the *entire* sub-section 7.3.1 is reflective of the *actual* (non-conceptual) integratedness and convergence of the NASSS framework principles and findings derived from the researcher's observed practices and documented evidence. The latter accrued from both the minutes and observations of MomConnect Task Team members and the Ministerial Advisory Committee on eHealth as detailed exhaustively in Chapter Five. Most emphatically, the crux of the current chapter (Chapter Eight) details from Section 8.2 to 8.10.5 *how* each digital design principle applies to the study. Such application derives from both MomConnect documents (archived and minuted) and narrated statements of the participants in Chapter Five and Appendix Q. The notion of 'best practices' does not necessarily refer to a singularly applied approach (Chigona et al., 2016; Iyawaa et al., 2016). For instance, participation in digital health communities and the prevalence of a repository with a public domain for sharing of information relating to the initiative; these two aspects are cited as examples of best practices in sub-section 8.10.4. It is worth mentioning that all figures and their related screenshots are derived from the Global Digital Health Index (GDHI, 2019).

8.2 Principle 1: Design with the User

Design With the User
User-centered design starts with getting to know the people you are designing for through conversation, observation and co-creation.

LEARN MORE

Figure 8-1: Screenshot of PDD (Design with the User)

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8.2.1 Incorporate Multiple User Types and Stakeholders

There were no clearly doumented or described user types. However, the main users of MomConnect initiatives were the pregnant women and mothers. The nurses at the helpdesk were also users of the system, but from a service providers side. The data shows that multiple stakeholders were incoporated. There was also a will for the stakeholder incoporation to result in an mHealth cohesion due to the lack of a conducive framework to involve all stakeholders within the mHealth community.

8.2.2 Improve Users' Current Processes

The mHealth service was designed in such a way that it saves time at the facility, the subscribtion was quicker and there were different ways of opting in as an individual, a group or using a third party. This also ensured that when a user's phone was left at home, remote subscription could be effected. During design, there was an exploration of the device's user-fiendliness in terms of saving clinician and patient time. The current processes of clinicians were improved because patient education was conducted through the service. Patients came to the facility having received some information. When clinicians were conducting health education, they informed patients that they were also to receive specific information from MomConnect with similar content. This ensured that patients received information according to their gestational stage. However, reports from non-clinical staff, the counciliors, health promoters and data capturers showed dissatisfaction with the fact that subscribing users to MomConnect was not part of their key performance areas, and it consumed their time.

8.2.3 Context-Appropriate Tools

USSD was the technology used to communicate. It allowed any phone to be used for mHealth. Over time, a data texting message service was introduced for those who opted for such. However, the data shows that even smart phones users prefered SMSs because they were free, and they would not need to use their own data. The content sent through mHealth was reported to be aligned with clinical guidelines and was reviewed to ensure that it was communicated in a language clear to the users and available in at least the 11 official languages in South Africa.

8.2.4 Incremental and Iterative Approach

There mHealth service was designed to provide information per gestational stage, and messages were received twice or thrice a week. Users also had an option to receive additional messages. Those who were HIV-positive received specific HIV-related messages through the PMTCT MomConnect in accordance with the baby's age.

8.2.5 Ensuring Design Sensitivity and Considerations for the Underserved

The mHealth service was available to the most basic phone. In cases where the user shared a phone, a partner could keep the SMSs in the phone until the other user reads it. The service was available in all telecommunication networks.

8.2.6 Iterative Process

The service allowed for users to give feedback by replying to the SMSs received. They could also give feedback for opting out.

8.2.7 Open Expectations and Voluntary Withdrawal From the Design Process

There was also an indication when the stakeholders left the task team. Those who left did so because their contracts had ended with their employers. There were no records of stakeholders who left because of their expectations not being met.

8.3 Principle 2: Understand the Existing Ecosystem

Understand the Existing Ecosystem
Well-designed initiatives and digital tools consider the particular structures and needs that exist in each country, region and community.

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Figure 8-2: Screenshot of PDD (Existing Ecosystem)

8.3.1 Engaging With Target Users and Understanding Existing Research

The data shows engagement with users. However, this engagement seemed insufficient. The nurses reported that they were neither involved nor represented. For instance, they were not conversant with the content of the messages. Some of the nurses had to subscribe themselves as pregnant women in order to receive the content. If proper and continuous engagement was done, such concerns would have been raised and content made available at the local and district healthcare facilities. There was engagement with stakeholders, and there were records of situational analysis and operational research during implementation of MomConnect. Participants did acknowledge that there was not enough time to conduct proper research due to the initiative being politically motivated. There was no research or data that supported implementation of mHealth at a national scale. However, stakeholders were motivated to implement this initiative because it was driven by the National Department of Health rather than the political overseers.

8.3.2 Coordinating With Other Implementing Organisations and Civil Society

There was a need to coordinate with other organisations. However, there was no central location where mHealth benchmarking could be located. The task team did extend invitations to organisations that implemented mHealth initiatives, especially on the maternal, child and women's health to learn from them. However, most implementing partners that were part of the task team were active in mHealth and had a history of being involved in similar initiatives.

8.3.3 Aligning With Existing Technological, Legal and Regulatory Policies

Alignment with existing technological, legal and regulatory policies was recorded and mentioned by participants. However, the need to revise and further enforce such alignment was recommended.

8.3.4 Involving Community Members, Donors, Local and National Governments, and Other Implementing Organisations

The activity of involving community members, donors and national governments and other implementing partners was carried by the MomCTT. However, as a team, they could only do what was possible in their power. This function points to lack of governance and leadership within the National Department of Health. As a recommendation, the National Department of Health was supposed to conduct this activity and also mobilise the provincial governments to do the same (Barron et al., 2016; Kabongo et al., 2019; Ngoc, et al., 2018).

8.3.5 Monitor the ecosystem

There was a record of activities relating to monitoring of the ecosystem. There were proactive initiatives regarding the future of MomConnect. There was also evolvement of the initiative, according to which new components such as PMTCT were added. 'WhatsApp' and 'NurseConnect' were added to support nurses and clinical care to ensure that the service expected by the users through MomConnect initiative was delivered by the nurses.

8.4 Principle 3: Design for Scale

Design for Scale
Achieving scale requires adoption beyond an initiatives pilot population and often necessitates securing funding or partners that take the initiative to new communities or regions.

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Figure 8-3: Screenshot of Principle of Digital Development (Design for Scale)

8.4.1 Plan and Design for Scale From the Start

From the archived records and data from the participants, scale was prioritised by the task team. The choice of technology, implementation and monitoring, amongst others, were all aimed at making national scale implementation possible expeditiously.

8.4.2 Develop a Definition of Scale

The were no records showing the definition of the scale for this initiative. However, the definition of scale by the participants was provided by subscribed women in all the nine provinces. The main indicator was the ANC first visits at the local health facilities. That number of ANC visits was monitored and compared to the number of actual subscriptions to the MomConnect initiative. The facilities, districts and provincial ANC first visits and MomConnect subscriptions were compared for performance and scaling purposes.

8.4.3 Keep Your Design Simple, Flexible and Modular

From the collected data, the design was intended to be as simple as possible, and the evolvement and addition of new components could be attributed to flexibility and modularity as advocated by authors such as Göran et al. (2015); Herselman et al. (2016), and Salgado et al. (2017).

8.4.4 Technology Choices

The choice of technology was guided by its simplicity and functionality in any phone. It is such considerations that influenced the selection of USSD for MomConnect.

8.4.5 Identify Partners

The process of stakeholder involvement covered the identification of partners. However, there was a continuous discussion of the people to involve at certain stages of the initiative.

8.4.6 Consider Your Funding Model

The funding model is one of the major risks recorded and mentioned by the participants. The initiative was funded through external funding, not the internal budget from the National Department of Health. Whenever a question of sustainability was raised, funding would be mentioned first by most if not all participants. The problem of funding has been accentuated by various authors including Fantana and Pretorius (2018); Kruse et al. (2019), and Wolff-Piggott et al. (2018).

8.4.7 Gather Evidence and Demonstrate Impact

The data shows that there was no time to gather evidence and demonstrate it. This initiative was an idea of the Minister of Health, and had to be implemented. It was also mentioned that there was no evidence or research whatsoever prior to the design of this initiative.

8.4.8 Full Validation of Appropriateness of Initiative

There were records that the Minister of Health (Dr Aaron Motsoaledi) engaged with politicians and the National Health Council, which includes all Provincial Heads of Departments of Health prior to MomConnect's implementation. This process may be linked to validation, at least in this study. The HODs who were familiar with the priorities at their provinces were given an opportunity to actually comment on the initiative. However, there were no records of any province that found that the initiative did not address their priorities or refused to implement the initiative.

8.5 Principle 4: Build for Sustainability

Build for Sustainability
Building sustainable programs, platforms and digital tools is essential to maintain user and stakeholder support, as well as to maximize long-term impact.

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Figure 8-4: Screenshot of Principle of Digital Development (Build for Sustainability)

8.5.1 Planning for Sustainability

From the collected data of this study, there was no documented plan for sustainability. From the beginning, the focus was on scale. Once the desired scale was reached, that was only when sustainability was prioritised. Although this principle advocates for sustainability from the start, a national scale itself was an achievement on its own. There were even events to celebrate the MomConnect initiative reaching the subscription levels of one million users. The scale and sustainability are related, but from the data of this study it made sense to sustain something that scaled, unlike planning to sustain something that has not scaled yet. Based on this data, it could then be concluded that in the beginning of the initiative, scale was prioritised more than sustainability. As the initiative grew, sustainability then became the focus. This may apply to countries that are conducting a national scale for the first time (Barron et al., 2016; Ngoc et al., 2018).

8.5.2 Developing a Definition of Sustainability

There was no recorded definition of sustainability. However, the data of the study shows that an understanding of sustainability was based on continuity of the initiative after external funding ended. Sustainability was linked to availability of funds to continue paying staff working on the initiative, technical configuration and maintenance.

8.5.3 Sustainable Business Model

A sustainable business model was one of the recommendations from the participants. During data collection, there was a process of drafting this business model by the task team. However, this was not achieved at the beginning of the initiative. It was at the time where the initiative was matured.

8.5.4 Use and Invest

From the records and responses of the participants, the implementing partners were all South African.

8.5.5 Engage Local Governments

There were recorded processes of engaging other national departments, such as science and technology, and communications. However, in South Africa, local government refers to municipalities or city councils.

8.5.6 Collaborate Instead of Competing

No competition was recorded or mentioned between MomConnect and other healthcare initiatives. In fact, this was the first nationally driven patient-facing mHealth service.

8.5.7 Building an Adaptable Programme

The study did not examine the adaptability of the initiative. However, the initiative allowed user needs to be incorporated and also facilitated change of context as per changes in guidelines when information was needed for updating accordingly.

8.6 Principle 5: Be Data Driven

Be Data Driven
When an initiative is data driven, quality information is available to the right people when they need it, and they are using those data to take action.

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Figure 8-5: Screenshot of Principle of Digital Development (Be data Driven)

8.6.1 Designing Programmes for Continuous and Incremental Impact

At the time the study was conducted, there was no other reported impact study being undertaken. However, there was a proposal which was ethically cleared for a clinical trial for a PMTCT MomConnect component. Indicators were developed to monitor MomConnect, and there was a MandE framework that was approved by the National Department of Health. There were also concerns from other participants that the data elements and/or indicators were not clearly defined. Secondly, the MomComnnect initiative indicators were not part of the NIDS. There was a need to include this in the NIDS for its integration as part of health programming. There were also concerns that the M&E component was the most underdeveloped of the initiative because M&E experts were only engaged when the initiative had already started. It was recommended that these initiatives of the experts should have been prioritised at the very early days of the initiative.

8.6.2 Making Use of Existing Data

Aggregated data from the WebDHIS was reported to be in use. The ante-natal care first visits were used to monitor performance of the initiative. Also, the facility lists and codes were used when users subscribe into the initiative in order to analyse data per facility. Where there were network technical problems during subscription, the study obtained data to that effect. When targets were set for the PMTCT components, the HIV prevalence data was used in order to set targets for every district.

8.6.3 Using Rigorous Data Collection Methods

The study has no evidence of other different methods to collect data related to MomConnect initiatives. Data was mainly generated by events of subscription and opting out. No bias was reported.

8.6.4 Close the Knowledge Gaps

MomConnect data was available through the department's data policy and other studies. However, there were no reports of using the data for community development, which was not the focus of this study. However, there were records on interoperability of data with Statistics South Africa and the Department of Home Affairs for birth registrations. This study's focus was not to explore whether such gaps were actually followed up.

8.6.5 Use Quality Real-Time or Timely Data

At national level, data was used for planning during task team meetings. The MCWH directorate was reported to be asking for data whenever conducting provincial support visits. The data obtained, included subscription statistics, compliments and complaints. However, the compliments were reported to be three times more than the complaints. There were issues

raised by facilities regarding the complaints that come through the MomConnect initiative, but the advice from the Department of Health was that complaints were priorities to be sent to the local and district healthcare facilities for resolution within 21 days in accordance with the complaints policy. The compliments were only sent later to the facilities due to the amount and level of urgency.

8.6.6 Present Data in Easily Interpretable Formats

Data for the MomConnect initiative was available in different formats. There were standard reports from the WebDHIS and dashboards. The reports could also be generated in different formats for dissemination purposes. Moreover, there were no records or reports on difficulties in interpreting the data.

8.6.7 Creating a Data Usage Culture

It was clear from the research that the use of data was prioritised in the initiative. However, there was no recorded information on how that culture was created among the team.

8.6.8 Being Holistic About Data Collection and Analysis

MomConnect data was mainly from the subscriptions and active users opting out of data, as well as helpdesk data. Continuous reporting included all these data sources, and there were reviews and analysis reports.

8.6.9 Identifying and Using Open Data and Interoperability Standards

There were known standards endorsed by the Department of Health that were reported.

8.6.10 Collecting and Using Data Responsibly

There were records for the use of health level (HL7) and other international standards, which coheres with propositions by authors such as Aranda-Jan et al. (2014) and Skinner et al. (2018). HL7 refers to a set of international standards for transfer of clinical and administrative data between software applications used by various healthcare providers.

8.7 Principle 6: Open Standards, Data, Source and Innovation

Use Open Standards, Open Data, Open Source, and Open Innovation
An open approach to digital development can help to increase collaboration in the digital development community and avoid duplicating work that has already been done.

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Figure 8-6: Screenshot of PDD (Open Standards, Data, Source, and Innovation)

8.7.1 Define and Communicate Meaning of 'Being Open'

There were no records regarding the definition of 'being open'. The study also did not explicitly examine this opacity of definition. However, participants did mention that using open standards was ideal for the initiative. This was mentioned so that the Department did not need licences when changing vendors. There were also statements that using open standards has its own pros and cons that needed to be taken into consideration.

8.7.2 Adopt and Expand on Existing Open Standards

There were records of using open standards, at least on the WebDHIS.

8.7.3 Share Non-Sensitive Data to Ensure Data Privacy Needs

Data that was shared to stakeholders was mainly aggregated. There were no records of patient- specific data shared as part of MomConnect reporting. During the meetings, sensitive PMTCT MomConnect data was accorded more priority and privacy. Confidentiality was also maintained at the facility level and during subscription.

8.7.4 Using Existing Open Platforms

There was evidence of using open standards, at least on the WebDHIS.

8.7.5 Invest in Software for the Public Good

For this study, investment and software were only addressed as a cost of ownership for sustainability.

8.7.6 Develop New Software Code to be Open Source

No new developments of software were covered in this study.

8.7.7 Enable Innovation

The MomConnect Initiative environment was seen as an innovation-driven environment where suggestions and new ideas were always discussed during task team meetings.

8.8 Principle 7: Reuse and Improve

Reuse and Improve
Reusing and improving is about taking the work of the global development community further than any organization or program can do alone.

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Figure 8-7: Screenshot of Principle of Digital Development (Reuse and Improve)

8.8.1 Identify the Existing Technology Tools (Local and Global)

The existing tools were mainly USSD for patient-facing mHealth services. Over time, data texting, particularly WhatsApp was implemented.

8.8.2 Developing Modular, Interoperable Approaches

Interoperability was recorded and discussed for this initiative.

8.8.3 Collaborate

It was observed that collaboration was encouraged in this initiative.

8.9 Principle 8: Address Privacy and Security

Address Privacy & Security
Addressing privacy and security in digital development involves careful consideration of which data are collected and how data are acquired, used, stored and shared.

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Figure 8-8: Screenshot of PDD (Address Privacy & Security)

8.9.1 Define Data Ownership, Sovereignty and Access in Time

From the archived records and the interviews, it was noted that data ownership was in the purview of the National Department of Health. There were policies already concerning data management within the Department that were applicable to all programmes, including the MomConnect initiative.

8.9.2 Keeping Best Interests of Collected Data of End-Users and Individuals

There were no documented steps on how the best interests of the users would be recorded. However, the National Department of Health's policy governing patient information on other initiatives was agreed to. This study has no records of documents showing the re-development of the MomConnect initiative.

8.9.3 Perform Risk-Benefit Analysis of Processed Data

There were reomendations for proactivity on assessing risks related to data. However, no report specifically highlighted risk-benefit analysis, which is inimical to standard interoperability (Alami et al., 2019; Kahn et al., 2008).

8.9.4 Assess the Risks

The infrastructure team was in place for this function. However, there were no records or specific questions from this study that were focused on the probing of the risk assessment.

8.9.5 Understand Risk Contextualisation

Based on the composition of the team, observations showed that there was an understanding to this effect.

8.9.6 Minimise Collection of Identifiable Personal Information

Subscribers did not provide their names, but only the mobile number, ID number / passport number / date of birth, expected date of delivery date, and the facility at which they received antenatal care.

8.9.7 Catalogue and Track Personal/ Sensitive Information Captured in the Project

The information was mainly in the server. As with other initiatives of the National Department of Health, the same standards were applied.

8.9.8 Be Transparent

There were no reports on the lack of transparency regarding the data. The users also did not raise concerns regarding their data.

8.9.9 Obtain Informed Consent

The initiative was designed in such a way that users could either consent or not to use the service. The participants did not complain about consent issues because they appreciated the service, which is also reflective of user-friendly design (Ngoc et al., 2018; Tilahun, 2017).

8.9.10 Protect Data

Data protection of the initiative complied with the policies of the National Depatrtment of Health

8.10 Principle 9: Be Collaborative

Be Collaborative
Being collaborative means sharing information, insights, strategies and resources across projects, organizations and sectors, leading to increased efficiency and impact.

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Figure 8-9: Screenshot of Principle of Digital Development (Be Collaborative)

8.10.1 Understanding Work Context in the Global Development Landscape

There was evidence that the initiative was understood. The members of the task team have made presentations at national and international conferences, and have also welcomed countries who wished to benchmark from South Africa.

8.10.2 Engage Diverse Experts

There were experts from different backgrounds as part of the task team, who were also acclaimed authors and co-authors of published exegetic books on the initiative.

8.10.3 Plan Collaboration from the Beginning

Collaboration was intended from the beginning, as the records show. However, there were no indicators for monitoring it. Such monitoring deficiency could render the achievement of task team objectives ineffective (Groop et al., 2010; Skinner et al., 2018).

8.10.4 Document Work, Results, Processes and Best Practices

There was participation in digital health communities, and there was also a repository which had a public domain for sharing of information relating to the initiative.

8.10.5 Define Project's Local Contribution

The MomConnect initiative's local contribution was clear to the team, and there were continuous engagements within the larger group. However, this study's focus was not on the progress of these engagements.

8.11 Conclusion

The interpretation of the study's findings through the lens of the Principles of Digital Development simultaneously assisted in highlighting best practices and gaps that may exist in the digital practices themselves. It is noteworthy that, to a larger extent, the chapter also presented a convergent and interstitial premises for best practices and digital health practices not as hypothetical propositions. Rather, these have been presented on the basis of actual stakeholder statements documented variously in Chapter Five and Appendix Q. In this regard, a practice-oriented and pragmatic approach was applied to project the study as generating knowledge in the process of application (Groop et al., 2010; Julkunen, 2011; van der Donk and Kuijer-Siebelink, 2015).

# CHAPTER 9: PRACTICE-BASED ANALYSIS: PHASE 5 (GLOBAL DIGITAL HEALTH INDEX)

CHAPTER ONE: Rationale and Scope of the Study

CHAPTER TWO: Theoretical and Empirical Foundations and Location within Literature

CHAPTER THREE: Description of the Research Methodology

CHAPTER FOUR: Local Practice as The Case: MomConnect Innitiative

CHAPTER FIVE: Situational Inquiry and Theorising (Phase 2)

CHAPTER SIX: Stakeholder Analysis (Phase 2)

CHAPTER SEVEN: Practice Based Analysis: Phase 3 (NASSS Framework)

CHAPTER EIGHT: Practice Based Analysis: Phase 4 (Principles of Digital Development)

CHAPTER NINE: Practice Based Analysis: Phase 5 (Global Digital Health Index)

- Introduction
- Leadership and Governance
- Strategy and Investment
- Legislation, Policy and Compliance
- Workforce
- Standards and Interoperability
- Infrastructure
- Services and Applications
- Conclusion

CHAPTER TEN: Synthesis as Convergence of Findings from Phases 1 to 5: Using Strong Structuration Theory as Lens

CHAPTER ELEVEN: Practice Enhancement: An Evolving Stakeholder Centred Strategy for Mobile Health re-Engineering

CHAPTER TWELVE: Discussion of The Findings As a Mechanism to Highlight Insights From The Study

CHAPTER THIRTEEN:

9.1 Introduction

This chapter basically explores the content of the themes through the Global Digital Health Index (GDHI), as well as the quantification and scores per the index. The GDHI key indicators are relevant in this study, particularly for reference purpose in the context of the current state of the MomConnect initiative. It is also worth mentioning that, similar to the approach or *modus operandi* adopted in the previous chapter (Chapter Eight), the Global Digital Health Index practice-based analysis (phase 5) was not hypothetical, but derived from actual evidence obtained from the relevant stakeholders (participants themselves). Accordingly, both Figure 9.1 and Figure 9.2 below illustrate the GDHI methodology and key indicators in terms of which actual stakeholder practices were evaluated, as reflected in each score for each key indicator. Similar to the approach in Chapter 8 the information entailed in Figure 9-1 and Figure 9-2 derives from the Global Digital Health Index (GDHI, 2019)
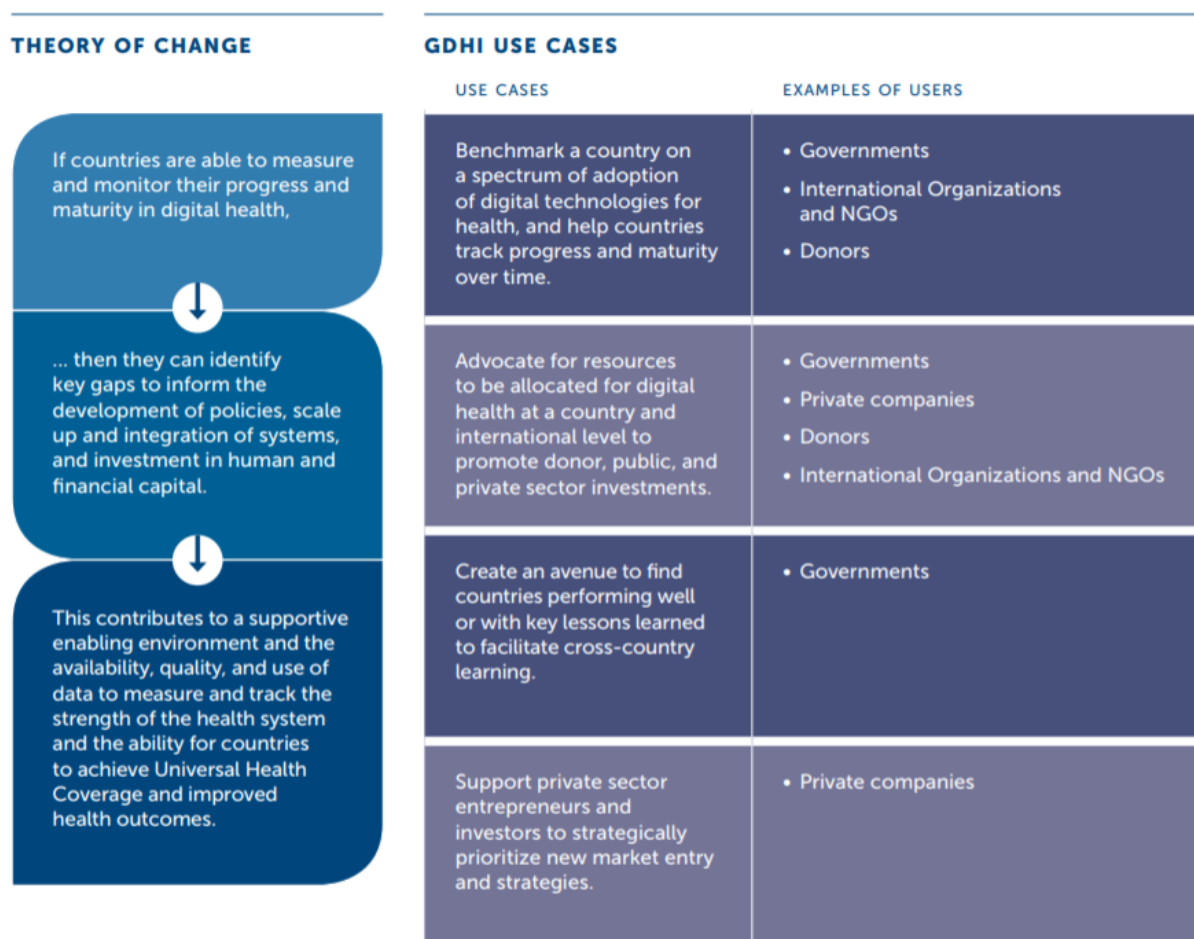
Figure 9-1: GDHI Methodology
(Source: Global Digital Health Index, 2019)

Figure 9.1 above shows the theory of change as useful for monitoring and evaluation of the progress and performance of digital health initiatives in an environment characterised by multiple stakeholders. Figure 9.2 below shows the key indicator categories of the GDHI.
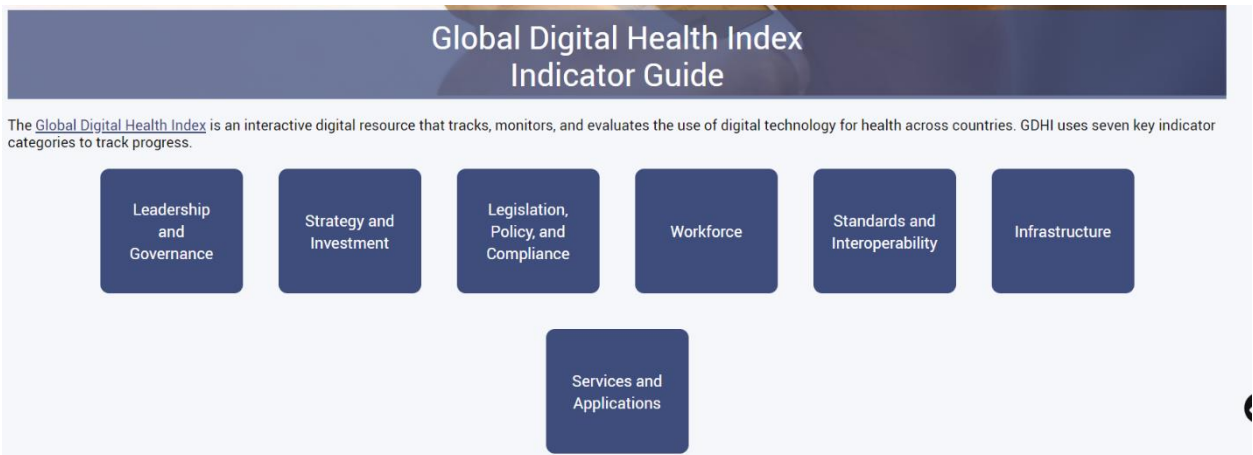
Figure 9-2: GDHI Key Indicator Categories

(Source: Global Digital Health Index, 2019)

9.2 Leadership and Governance

Figure 9-3: GDHI Indicator 1

- At least from this best demonstrated case, data did show the MomConnect Task Team as a governance structure, and functioned in consultation with other governemnt departments.
- Score: 4

Figure 9-4: GDHI Indicator 2

- The implementation of digital health was reported asreceiving the support of the Minister of Health.

- Score: 5

9.3 Strategy and Investment

Indicator 3 - National eHealth/ Digital Health Strategy or Framework
Does the country have an eHealth or digital health strategy or framework and a costed digital health plan?

1	There is no digital health strategy or framework or draft digital health strategy or framework developed, but not officially reviewed.
2	National digital health strategy or framework approved.
3	National digital health costed plan developed and approved.
4	National digital health strategy and costed plan partially implemented with resources to ensure full implementation.
5	National digital health strategy and costed plan fully implemented with planning underway for the next 3-5 year cycle.

Figure 9-5: GDHI Indicator 3

- This study did not cover the cost or budgetary information. However, both eHealth and mHealth strategies were reported as available and currently on review as part of a continuous update process.
- Score: 4

Indicator 4 - Public funding for digital health
What is the estimated percent (%) of the annual public spending on health committed to digital health?

1	No budget line item for ICT or digital health available or a budget line item for ICT exists but proportion not available.
2	Less than 1%
3	1-3%
4	3-5%
5	Greater than 5%

Figure 9-6: GDHI Indicator 4

- This study did not cover financial statements or budget details that would provide a guidance to a score for this incicator. For this study, this indicator is regarded 'Not Applicable'.
- Score: N/A

9.4 Legislation, Policy and Compliance

Indicator 5 - Legal Framework for Data Protection (Security)
Is there a law on data security (storage, transmission, use) that is relevant to digital health?

1	There is no law on data security (storage, transmission, use) that is relevant to digital health.
2	There is a law on data security (storage, transmission, use) that is relevant to digital health that has been proposed and is under review.
3	There is a law on data security (storage, transmission, use) that is relevant to digital health that has been passed, but has not yet been fully implemented.
4	There is a law on data security (storage, transmission, use) that is relevant to digital health that has been implemented, but not consistenly enforced.
5	There is a law on data security (storage, transmission, use) that is relevant to digital health that has been implemented and enforced consistently.

Figure 9-7: GDHI Indicator 5

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- There are laws in South Africa governing digital technologies. However, their implementation in mobile health is not consistently enforced, which accentuates the problem of standards and regulations regarding the use and application of mHealth in health services before, during and/or after implementation (Alami et al., 2019; Herselman et al., 2018).
- Score: 4

Figure 9-8: GDHI Indicator 6

- This study did not focus on law and health information specifically. However, from the data generated in this study, there is applicable regulation to mHealth and implementers are aware of its applicability on mHealth.
- Score: 4

Figure 9-9: GDHI Indicator 7

- South Africa has protocols for regulating or certifying devices and digital health services, although they may not be endorsed by the National Department of Health. There are available tools from different organisations that may be adopted and implemented.
- Score: 3
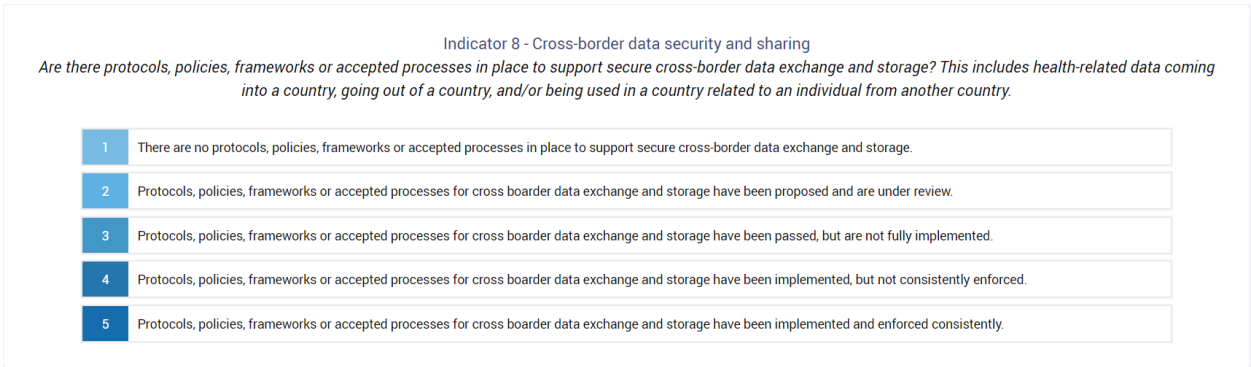
Figure 9-10: GDHI Indicator 8

- This study did not address cross-border data security and sharing. However, since MomConnect was funded, there may have been data that was sent across the border for reporting. This indicator will be regarded as 'Not Applicable'.
- Score: N/A

9.5 Workforce

An appropriately trained, knowledgeable and skilled workforce is essential for effective scalability and sustainability of a national mHealth project the size of the MomConnect initiative (Ngoc et al., 2018; Shukla and Sharma, 2016). It is against this background that curriculum-related indicators were considered.
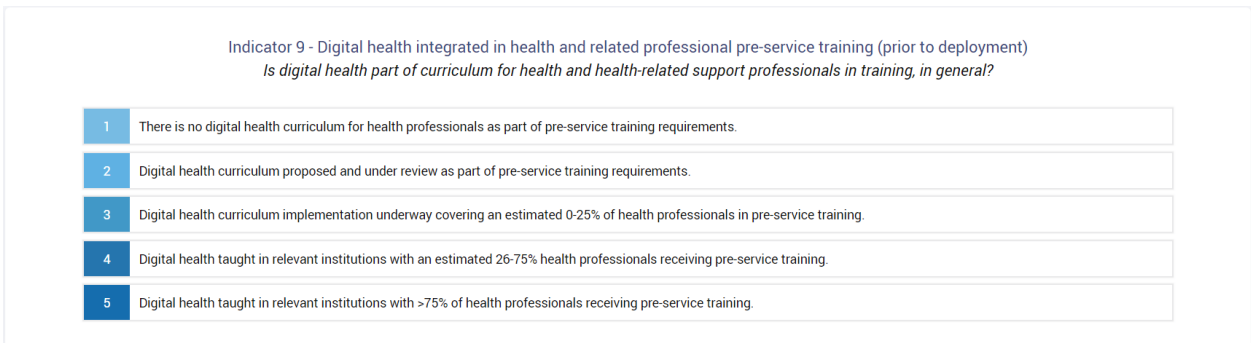
Figure 9-11: GDHI Indicator 9

- There is evidence from thegenerated themes (Chapter Five) that eHealth curriculum was proposed. However, there is no reported process of the proposed curriculum being developed or under review.
- Score: 1

Figure 9-12: GDHI Indicator 9a

- From the themes, curriculum for eHealth was proposed. However, there is no reported process of the proposed curriculum being developed or under review.
- Score: 1

Figure 9-13: GDHI Indicator 9b

- There is evidence of proposals for eHealth curriculum. However, there is no reported process of the proposed curriculum being developed or under review.
- Score: 1

Figure 9-14: GDHI Indicator 9c

- From the themes, curriculum for eHealth was proposed. However, there is no reported process of the proposed curriculum being developed or under review.
- Score: 1

Figure 9-15: GDHI Indicator 10

- From the themes, curriculum for eHealth was proposed. However, there is no reported process of the proposed curriculum being developed or under review.
- Score: 1

Figure 9-16: GDHI Indicator 10a

- From the themes, curriculum for eHealth was proposed. However, there is no reported process of the proposed curriculum being developed or under review.
- Score: 1

Figure 9-17: GDHI Indicator 10b

- From the themes, curriculum for eHealth was proposed. However, there is no reported process of the proposed curriculum being developed or under review.
- Score: 1

Figure 9-18: GDHI Indicator 10c

- This study did not address community health workers. However, based on the themes that relate to eHealth curriculum, the score may remain the same as for other health workers.
- Score: 1

Figure 9-19: GDHI Indicator 11

- Although this study did not cover formal training in digital health, South Africa does have related ehealth programmes, such as the Health Information Systems Programme, South Africa.
- Score: 4

Figure 9-20: GDHI Indicator 11a

- South Africa does have training and/or biomedical informatics.
- Score: 4

Figure 9-21: GDHI Indicator 12

- The study participants included a Director in eHealth in the public sector. Other didgital health related staff are known to be seconded to the NDoH from NGOs and independent consultants. However, there was no known specific HR policy that categorically addressed digital health within the public sector.
- Score: 3

9.6   Standards and Interoperability

Interoperability standards are an essential determinant of sustainability (Alami et al., 2019; Ngoc et al., 2018).

Figure 9-22: GDHI Indicator 13

- South Africa does have a framework. However, information regarding full implementation following industry standards was not covered by this study.
- Score: 3

Figure 9-23: GDHI Indicator 14

- There are standards, however, detailed information that woulod grand score 4 or 5 was not generated by this study
- Score 4

9.7 Infrastructure

The availability of adequate network infrastructure and related funding enhance the efficiency and sustainability of digital health and medical solutions (Kruse et al., 2019).

Figure 9-24: GDHI Indicator 15

- This study did not particularly cover network readiness, at least to a point where this indicator could be scored. Accordingly, this indicator will be regarded as 'Not Applicable'.
- Score: N/A

Figure 9-25: GDHI Indicator 16

- Based on the available MomConnect related information, the score will need to be at least 3.
- Score: 3

9.8 Services and Applications

Figure 9-26: GDHI Indicator 17

- This study did not explicitly examine the system applications.
- Score: 4

Figure 9-27: GDHI Indicator 18

- South Africa's list of facilities includes, but is not limited to GIS mapping. The WebDHIS that is used for data monitoring does have most, if not all the cited functionalities as per the indicator.
- Score: 4

Indicator 19 - Digital identity management of individuals for health

Are secure registries or a master patient index of uniquely identifiable individuals available, accessible and current for use for health-related purposes?

1	No secure registry or master patient index exists.
2	A secure registry exists, but is incomplete / partially available, used, and irregularly maintained.
3	A secure registry exists, is available and in active use and includes <25% of the relevant population.
4	A secure registry exists, is available and in active use and includes 26-75% of the relevant population.
5	A secure registry exists, is available and in active use and includes >75% of the relevant population. The data is available, used, and curated.

Figure 9-28: GDHI Indicator 19

- At least in this study, users had unique identifies. However, the intergration to the broader health stystem was not covered.
- Score: 2

Indicator 19a - Digital identity management of individuals for health

Specifically, is there a secure master patient index of uniquely identifiable individuals available, accessible and current for use for health-related purposes?

1	No secure master patient index exists.
2	A master patient index exists, but is incomplete / partially available, used, and irregularly maintained.
3	A master patient index exists, is available and in active use and includes <25% of the relevant population.
4	A master patient index exists, is available and in active use and includes 26-75% of the relevant population.
5	A master patient index exists, is available and in active use and includes >75% of the relevant population. The data is available, used, and curated.

Figure 9-29: GDHI Indicator 19a

- At least for this study and the MomConnect demonstration case, there is a k-master patient index.
- Score: 4

Indicator 19b - Digital identity management of individuals for health

Specifically, is there a secure digital birth registry of uniquely identifiable individuals available, accessible and current for use for health-related purposes?

1	No secure digital birth registry exists.
2	A secure digital birth registry exists, but is incomplete / partially available, used, and irregularly maintained.
3	A secure digital birth registry exists, is available and in active use and includes <25% of the relevant population.
4	A secure digital birth registry exists, is available and in active use and includes 26-75% of the relevant population.
5	A secure digital birth registry exists, is available and in active use and includes >75% of the relevant population. The data is available, used, and curated.

Figure 9-30: GDHI Indicator 19b

- One of the stated aims of MomConnect was the establishment of a preganancy register.
- Score: 4

Indicator 19c - Digital identity management of individuals for health

Specifically, is there a secure death registry of uniquely identifiable individuals available, accessible and current for use for health-related purposes?

1	No secure death registry exists.
2	A secure death registry exists, but is incomplete / partially available, used, and irregularly maintained.
3	A secure death registry exists, is available and in active use and includes <25% of the relevant population.
4	A secure death registry exists, is available and in active use and includes 26-75% of the relevant population.
5	A secure death registry exists, is available and in active use and includes >75% of the relevant population. The data is available, used, and curated.

Figure 9-31: GDHI Indicator 19c

- There was no register for reported deaths. However, for the purpose of MomConnect, still birth and deaths were reported by users as they optED out of the MomConnect service.
- Score: 4

Indicator 19d - Digital identity management of individuals for health

Specifically, is there a secure immunization registry of uniquely identifiable individuals available, accessible and current for use for health-related purposes?

1	No secure immunization registry exists.
2	A secure immunization registry exists, but is incomplete / partially available, used, and irregularly maintained.
3	A secure immunization registry exists, is available and in active use and includes <25% of the relevant population.
4	A secure immunization registry exists, is available and in active use and includes 26-75% of the relevant population.
5	A secure immunization registry exists, is available and in active use and includes >75% of the relevant population. The data is available, used, and curated.

Figure 9-32: GDHI Indicator 19d

- During the discusions emanating from the Task Team meetings, the 'Road to Health' card and its digital implementation were discussed, including an immunisation registry.
- Score: 4

All of the various scores reflected above, show the usefulness of the GDHI Indicator categories in digital health solutions. From the study's perspective, whereas the NASSS Framework

provided a qualitative framework for evaluating the MomConnect demonstartion case, the GDHI framework then provided a quantitative and digital approach to measuring the MomConnect demonstration case's scalability and sustainability. Table 9.1 below illustrates approximate GDHI indicator scores for mHealth, the purpose of which is to give a high-level overview based on the MomConnect best demonstrated case.

Table 9-1: Approximate GDHI Indicator scores for mHealth

GDHI Indicator Category	Approximate Scores
Leadership and Governance	5
Strategy and Investment	4
Legislation, Policy and Compliance	4
Workforce	2
Standards and Interoperability	4
Infrastructure	3
Services and Applications	4
Overall mHealth Phase	4

Table 9.1 represents the various GDHI Indicator scores in the context of their respective categories. In the category of leadership and governance, the mHealth governance needs to be institutionalised, mitigated from any risks, endorsed nationally and exercise balance in membership, including, but not limited to gender. In the category of strategy and investment, there needs to be costed planning that also considers the cost of ownership and utilty in mHealth (Iribarren et al., 2017; Kruse et al., 2019).

The legislative, policy and compliance processes need to be enforced formally, and clarity provided on how these processes will address mHealth. The development of the workforce does not only need the National Department of Health, but other departments and bodies such as the Department of Employment and Labor, universities and statutory councils in ordeer to formalise the clinical practice of mHealth as part of the broader digital health system (Noyes, Booth, Moore, Flemming, Tunçalp, and Shakibazadeh, 2019; Skinner et al., 2018). The standards and interoperability category needs progress assessment and clear implementation steps in order to track progress and set targets. This study did not cover infrastructure enough to visualise readiness. However, this is a gap that needs systematic review by the mHealth community. The services and applications category needs collaboartion between the supply chain and digital health experts to clarify gaps that may only apply to mHealth in order to achieve better outcomes (Bond et al., 2015; Marcolino et al., 2018).

9.9   Conclusion

The mHealth phase has an overall digital index score of approximately 4 (four). However, the reasercher does not claim it is representative of the broader digital context in South Africa. Some crucial factors militate against making such claims. For instance, the qualitatively obtained responses of the participants may be fraught with subjective responses (Saunders et al., 2016). Furthermore, the participants were directed at mHealth, which is not the only digital

health initiative in the country. Furthermore, particular focus was directed at best demonstrated practice of the MomConnect initiative, and not the overall disease management and health and health care enhancement initatives in the country.

For purposes of this study, an overview of the extent and magnitude of an enabling mHealth environment (the Digital Health Innovation Ecosystem) in South Africa, the Global Digital Health Index does give the desired overview. Based on its diverse findings, the study posits that all digital health initiatives could be at Phase 3 in terms of HL7 best practice implementation. However, such an assertion is based on an overview in the interpretation of the study, but, many other questions are raised, which should be a subject for further evaluation and investigation.

CHAPTER 10: SYNTHESIS AS CONVERGENCE OF FINDINGS FROM PHASES 1 TO 5: USING STRONG STRUCTURATION THEORY AS LENS

CHAPTER ONE: Rationale and Scope of the Study

CHAPTER TWO: Theoretical and Empirical Foundations and Location within Literature

CHAPTER THREE: Description of the Research Methodology

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CHAPTER FIVE: Situational Inquiry and Theorising (Phase 2)

CHAPTER SIX: Stakeholder Analysis (Phase 2)

CHAPTER SEVEN: Practice Based Analysis: Phase 3 (NASSS Framework)

CHAPTER EIGHT: Practice Based Analysis: Phase 4 (Principles of Digital Development)

CHAPTER NINE: Practice Based Analysis: Phase 5 (Global Digital Health Index)

CHAPTER TEN: Synthesis as Convergence of Findings from Phases 1 to 5: Using Strong Structuration Theory as Lens

- Introduction
- Justification for the Multiple Stakeholder and Data Collection Approach
- The Strong Saturation Theory as instrument for Convergent Analysis
- Conclusion

CHAPTER ELEVEN: Practice Enhancement: An Evolving Stakeholder Centred Strategy for Mobile Health re-Engineering

CHAPTER TWELVE: Discussion of The Findings As a Mechanism to Highlight Insights From The Study

CHAPTER THIRTEEN:

10.1 Introduction

The purpose of this chapter is to conceptualise structures and agents in the implementation of mHealth services through the strong structuration (SST) theory as a data synthesis lens (Baskerville and Myers, 2015; Bernardi, 2018). The data sources of the study consisted of different participant categories, to whom different qualitative research methods were applied during the five phases of data collection. Appendix O also complements the convergent perspective of the collected empirical data. Accordingly, a convergent analytic mode was useful for allocating both a thematically focused and methodologically coherent understanding of the study's final outcome and results (Groop et al., 2010; Vaismoradi, 2013). Table 10.1 below shows the study's five-fold data collection methods. It is worth mentioning also that these phases are interrelated, and not peripheral to each other.

Table 10-1: The five methods of data collection

Data Collection Method	Data Source
Document Review (January 2017-June 2018)	46 MomConnect Repository Documents
Stakeholder Relationship Mapping (January-December 2018)	MomConnect Task Team
Semi-Structured One-on-One Interviews (January-December 2018)	15 MomConnect Task Team Members; 9 Ministerial Advisory Committee Members; 5 Clinical Staff Members; 6 Non-clinical Staff Members.
Ethnographic Participant Observation (January-June 2018)	6 MomConnect Task Team Meetings
Focus Group Discussion (January-June 2018)	45 Pregnant women PHC facility users (5 groups of 9 members each)
Total: 5 methods	**80**

Whereas Table 10.1 above depicts the study's five-fold data collection methods, Table 10.2 below shows the results framework against which the outcomes of the convergent analysis was framed in the context of the divergent stakeholder/ participant categories.

Table 10-2: Framework of study outcomes

Participants	Main Theme	Main Category	Sub-category
Ministerial Advisory Committee on eHealth (Interviews)	Governance and Leadership	mHealth centralisation	mHealth service rationalisation
	Strategy Integration	eHealth & mHealth strategy perceptions	Strategy application feedback
	Stakeholder Involvement	Clinicians, technophobia/ capacity building; mHealth providers and consumer engagement.	
	Research and Development	Demonstrable evidence of implementation outcomes/ impact; mHealth piloting perspectives	
	Service Continuity	Sustainability	Total cost of ownership and co-utility; Cost of ownership and cost utility; Outsourcing culture
		Scalability	NDOH financial and human resources; Provincial realities regarded as mHealth barriers; Computing infrastructural issues;
		Design thinking	Lessons learnt
		Service implementation	Human and financial resources
	Ecosystem/ Environment	Organisational	Vision, policies, guidelines; Governance and Leadership; Political authority/oversight
		Ethical aspects	Privacy and Security; Data ownership
		Integration	Technical: Infrastructure & interoperability
MomConnect Task Team (Minutes)	Service Conceptualisation	Stakeholder considerations	Facility-level consultation and collaboration
		Design Process	Considerations; Research and expansion considerations
		Integration	Technical: Infrastructure and interoperability
	Rollout	National to provincial scaling-up process; Operations & Performance	
	Service Continuity	Service Continuity; Sustainability and evolution	
MomConnect Task Team (Interviews)	MomConnect as a Case Example	Member relationship mapping	
		Support for MomConnect as a case example; Differing piloting views	
	Critical Considerations	mHealth and eHealth strategy	Lifespan within NDOH/ Integration of initiative within health programming; Ethical service implementation; Uncertainty over sustainability
	Ministry of Health Prerogatives	Leadership and Management; Teamwork; Operations; Recommendations	User-centred design; Sustainability Change Management; Stakeholder Management

Participants	Main Theme	Main Category	Sub-category
Facility-Level (Clinicians, Auxiliaries and Service Users)	Service Touch Point Capacity	Stakeholders	Involvement of nurses/ clinicians (capacity building and NurseConnect); Mothers, pregnant women and care givers; Foreign nationals: challenges
		Service implementation	Content of information; Ethical considerations; MomConnect helpdesk and interactive communication with nurses; Subscription and marketing; Service rating / feedback
		Health care facility environment	
		Operations	

Table 10.2 above above is reflective of the eventual outcomes of various data analysis processes adopted to construct meaning from various participant categories representing various components and aspects in the MomConnect policy development, strategy design and implementation, and health care service users' benefit. In the end, the convergence of the various data analytic modes also reflect the inextricability of participants' environmental dynamics (e.g. vested interests and influences) and the inevitable researcher-practitioner approach adopted. Owing to the vastness of the data collected, the emergent themes were pared globally in groups rather than individually.

10.2 Justification for the Multiple Stakeholder and Data Collection Approach

Table 10.1 and Table 10.2 above collectively show the various data collection approaches, methods and sources employed in the study, which coheres with the assertions by, amongst others, Ikeziri et al. (2019) and Hwabamungua et al. (2018), that in health care research, investigating the implementation complexities of a digitally based system (such as the MomConnect initiative) should not be confined to only the technological and technical aspects. Rather, such investigations should also integrate the micro, meso and macrocosmic elements (e.g. the stakeholders, the organisational culture, the politics, as well as the managerial and clinical aspects) (Tabish and Nabil, 2013). Accordingly, a convergent analytical approach was relevant for collating the pertinent information, details and data obtained from the five different data gathering approaches.

Largely as a factor of the practitioner-researcher approach (particularly emphasised in various parts of the preceding chapters), the research approach depicted in Table 10.1 highlights the practitioner-researcher perspective as influential in shaping the study framework in respect of: chronology of the research process as clearly demarcated in two-phased stages (the period between January 2017-June 2018, and June-December 2018) respectively showing the empirical and non-empirical (e.g. document review) domains of the investigation. It is also clear

from the above table that all the research-related activities and processes are cohesively bound and characterised by two indispensable components: simultaneity and contiguity and participants and types of methods.

The notion of contiguity entails the inseparability of all relevant research variables, while simultaneity encompasses the development, occurrence or undertaking of more than a single activity or process at the same time (Creswell and Creswell, 2018; Leon et al., 2012). For instance, all January-December 2018 processes and activities are contiguous with the core January 2017-June 2018 activity. Inversely, the review of pertinent literature and relevant documents occurred throughout the research process. In this regard, these two phases are contiguous on the basis of their complementarity as well. On the other hand, all Phase 2 activities and processes happened at different times and places in real-time, yet simultaneous in the context of the broader period during which they occurred and were undertaken.

Whereas Table 10.1 above is an explication of a field-based context of the five methods of data collection, it is important to reiterate that the presentation of the very field-based data is presented differently in the study. That is, the emphasis is method-based (as opposed to field-based) and accentuates the method of analysis rather than the method of data collection, as detailed in the following chapters:

Chapter Five: **thematic analysis** for the review of MoMCTT minutes and interviews, MACeH interviews, as well as facility-level interviews and focus group discussions;

Chapter Six: **conversational and discourse analysis** of MoMCTT minutes and stakeholder mapping;

Chapter Seven: **practice-based analysis** through the NASSS Framework as a tool for interpretation of data and its relevance to research questions and objectives;

Chapter Eight: **practice-based analysis** through the Principles of Digital Development as a tool for determining the design and usability (of MomConnect) from a technological/ digital perspective;

Chapter Nine: **practice-based analysis** focusing on the usefulness of the Global Digital Health Indicator Index categories in digital health solutions.

From the perspective of the study, such a multi-model of data collection and analysis approaches justifies reference to the strong saturation theory (SST) as a tool for allocating a degree of 'convergent understanding' of the final outcomes of the collected data and its consequent findings (Goldkuhl and Sjöström, 2015; Van der Donk and Van Langen, 2018). Figure 10.2 shows the broader domain of implementation evaluation.
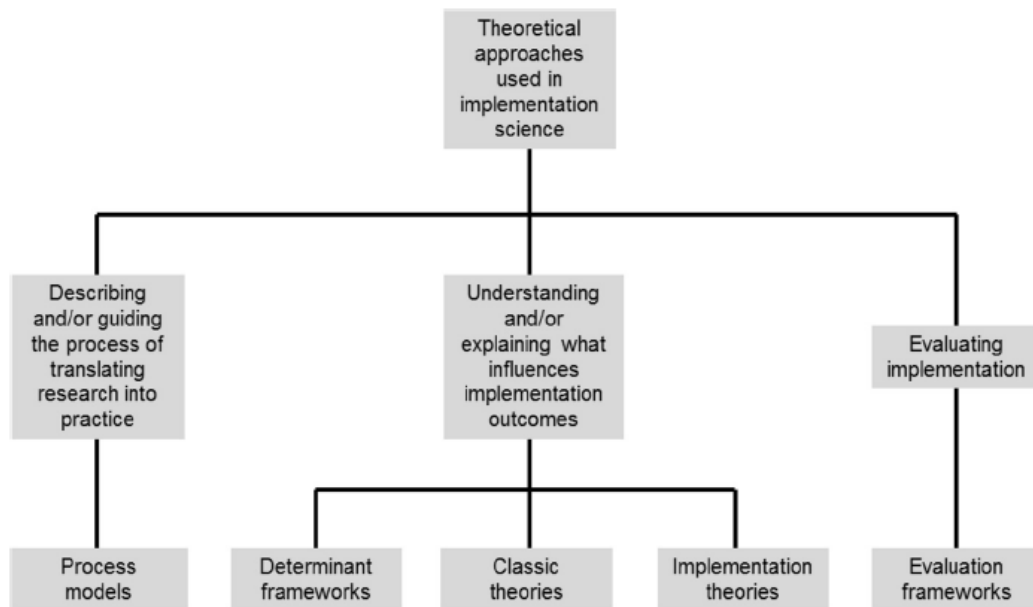
Figure 10-1: Broad context of theoretical approaches in implementation science
(Source: Nilsen: 2019:3)

In terms of the 'convergent thinking' characterising this chapter, Figure 10.1 preludes the SST, considering the study's focus on the evaluation of MomConnect implementation strategies.

10.3 The Strong Saturation Theory as Instrument for Convergent Analysis

For purposes of this study, the strong structuration theory (SST) was helpful insofar as providing a holistic framework for organisational and group communication dynamics (Baskerville and Myers, 2015; Bernardi, 2018; Greenhalgh et al., 2018; Nyström et al., 2018). Figure 10.2 below illustrates the SST's main principles.
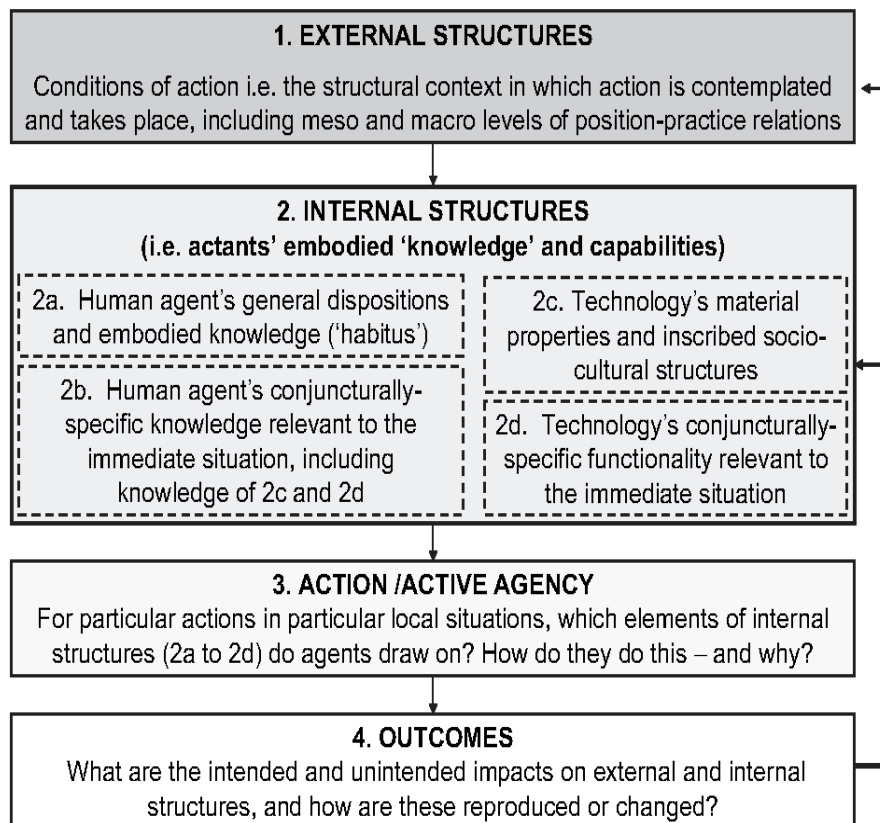
Figure 10-2: Strong structuration theory incorporating a technology dimension
(Source Greenhalgh et al., 2018:66)

In terms of Figure 10.3, the structuration theory's super-structural domain is sequentially constituted by internal and external structures; as well as actions and outcomes. In terms of this study, the theory's relevance is based on the fact that the researcher's proposed re-engineered mHealth framework is stakeholder oriented. Accordingly, external and internal conditions in the participants' environments to determine the nature (material properties) of the technological innovations to be developed and applied. Therefore, it was important to determine communication patterns between, and among the stakeholder, as this would eventually determine the desirability or otherwise of the outcome (product being developed (Greenhalgh and Stones, 2018).

In the context of the study 'external structures' would relate to the externally located collaborative networks within which MomConnect activities and implementation is expected to take place, such as the private and public organisations/ institutions, NGOs and donors/ funders. Collaboration determines the extent of the initative's relevance and implementation (Herselman et al., 2016; Kruse et al., 2019).

From an implementation perspective, the internal structures would relate with bodies such as the Ministerial Advisory Committee, the MomConnect Task Team, the National Department of Health and its provincial branches as implementers, as well as the clinical and non-clinical staff. These structures are populated by individuals with specific skills and knowledge that

would determine the pace, scale and sustainability of MomConnect (Greenhalgh et al., 2018). From an end-user perspective (Schnall et al., 2016), all the pregnant mothers and women participatng in the study also constitute human agents with specific knowledge-related inclinations based on their experiences and interaction with the MomConnect through their devices. The technological aspects of MomConnect were derived mostly from these women and mothers.

The action/ active agency factor is mostly located within the internal structures themselves, as they (more than the end-users) are best suited to make important policy decisions on any oucomes of the MomConnect project, including its human, financial and infrastructural resourcing (Ngoc et al., 2018; Proctor et al., 2013). In this study, the action/ agency factor applies thus:

- Making decisions independently and collaboratively as part of design, development, adoption and implementation of the initiative;
- Using the NDoH policies and mHealth / eHealth strategies to guide implementation as per the Minister of Health's directive;
- Mitigating for risks and using past experience and knowledge in making rational decisions in the absence of practical and/or clear endorsed framework by the government;
- Benchmarking from other mHealth initiatives and setting targets with the aim of addressing SGDs;
- Inter-sectoral and inter-stakeholder co-creation to ensure national scale;
- Proactive planning to ensure sustainability and contribution to universal coverage; and
- Documentation of processes for best practice, and operational research to improve the service.

The outcomes context applies as follows:
- Impacts on External Structures: uncertainty regarding sustainability due to changes in political leadership, sustainability after donor funding is depleted;
- Impacts on Internal Structures: lack of enough time to fully integrate the initiative into health programming at large;
- Cost of ownership and utility cost, data security and interoperability were critical factors concerning the technology;
- Retrospective M&E, dependence on consultants, USSD easy to scale, USSD challenge to sustain cost wise;
- Change national scale mHealth initiative, review mHealth/eHealth strategy, budget for mHealth, implement NurseConnect & PMTCT Connect, WhatsApp messaging;
- Centralisation of mHealth for national leadership and governance; and
- Learning and improving: Mobile Health Implementation Strategy should be the focus.

10.4 Conclusion

The SST allowed the findings to be arranged such that structures and agents could be conceptualised as a description of the best practices and implementation process. Archived data, individual interviews and focus group discussion assisted in the rearrangement of the findings in the context of SST areas of focus. Data from ethnography and stakeholder relationship mapping assisted to explain the activities between the structures and agents. The interpreted data from the NASSS Framework, Principles of Digital Development and the Global Digital Health Index also assisted in the practicalisation of the findings in terms of integrating the findings to the mHealth community. The thematic convergence approach also emphasises the correlational and interconnectedness effect between the overlapping themes and the holistic nature of implementation of stakeholder-centred mHealth services. 'Holistic' means that service design looks comprehensively at the client, provider, and health system perspectives (Salgado et al., 2017).

The holistic and multidisciplinary approach of service design enables teams to develop services that take the functional, emotional, tangible, and intangible aspects of services into account (Bentley et al., 2015; Schnall et al. 2016). The multidisciplinary approach refers to the application of different expertise in the design process, including experts in service design, product design, research, and applied public health. In this regard, the convergent data analysis and interpretation approach assisted in the conceptualisation of structures and agents in the implementation of mHealth services utilising the MomConnect initiative as a demonstration case.

CHAPTER 11: PRACTICE ENHANCEMENT: AN EVOLVING STAKEHOLDER-CENTRED STRATEGY FOR MOBILE HEALTH IMPLEMENTATION

CHAPTER ONE: Rationale and Scope of the Study

CHAPTER TWO: Theoretical and Empirical Foundations and Location within Literature

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CHAPTER FOUR: Local Practice as The Case: MomConnect Innitiative

CHAPTER FIVE: Situational Inquiry and Theorising (Phase 2)

CHAPTER SIX: Stakeholder Analysis (Phase 2)

CHAPTER SEVEN: Practice Based Analysis: Phase 3 (NASSS Framework)

CHAPTER EIGHT: Practice Based Analysis: Phase 4 (Principles of Digital Development)

CHAPTER NINE: Practice Based Analysis: Phase 5 (Global Digital Health Index)

CHAPTER TEN: Synthesis as Convergence of Findings from Phases 1 to 5: Using Strong Structuration Theory as Lens

CHAPTER ELEVEN: Practice Enhancement: An Evolving Stakeholder Centred Strategy for Mobile Health re-Engineering

- Introduction
- Background on the Need for the Strategy
- Recommended Strategiesand Actions
- Implementation Arrangement for Recommended actions
- Conclusion

CHAPTER TWELVE: Discussion of The Findings As a Mechanism to Highlight Insights From The Study

CHAPTER THIRTEEN:

11.1 Introduction

The purpose of this chapter is to present the study's findings insofar as they respond to the research question in the context of strategy development in general, and eHealth in particular. In this regard, the findings are presented in an actionable manner relevant to a practitioner-researcher oriented field situation (Almiqvist, 2017; Groop et al., 2010). Such an approach coheres with the assertion by Hwabamungua et al. (2018) that strategy research has shifted from its organisational rootedness to the practicalities of its application in places where such strategies are needed most. (Chatterjee, 2015) also mentioned that, for instance, the purpose of developing information systems methodologies is to solve problems, rather than mere expansion of knowledge. Such nexus between knowledge creation and its efficacy of artefacts is shown below in Figure 11.1. Reference to such a nexus is critically important for this study, given its practitioner-researcher methodological approach aimed at the generation of stakeholder-centred knowledge by the very stakeholders themselves (Goldkuhl and Sjöström, 2015; Groop et al., 2010).
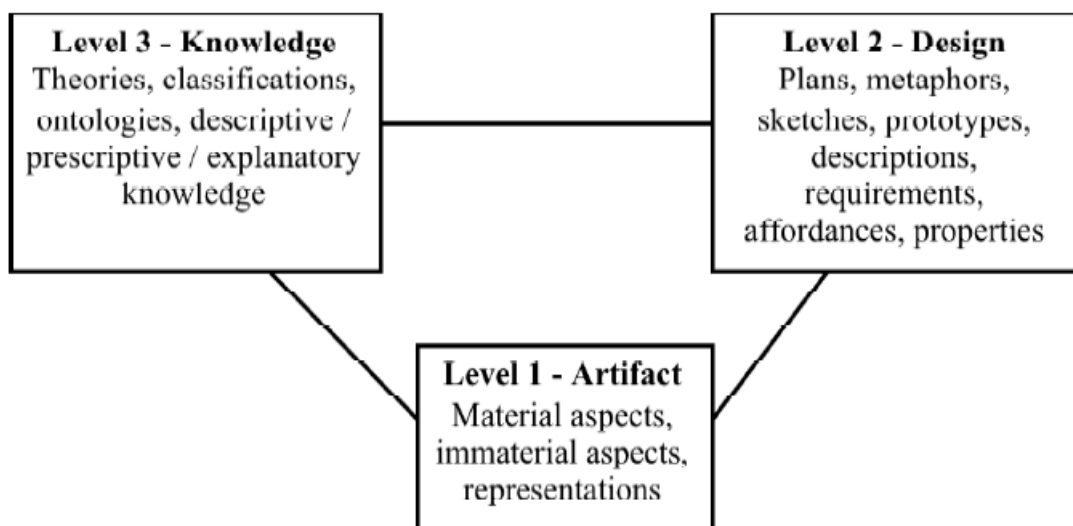
Figure 11-1: Conceptual model of knowledge artefacts
Source: Bækgaard (2015:6)

In terms of Figure 11.1 above, material and immaterial aspects are combined as knowledge representations. In the design level, the knowledge artefact is shown in the context of descriptions, models and prototypes. At the final knowledge level, the artefact is shown in the context of variables such as ontologies, categories and other forms of pertinent knowledge. Finally, the combination of various artefacts yields the ultimate outcome presented as 'knowledge' (Bækgaard, 2015).(Bækgaard, 2015)

The current chapter is demarcated into 3 (three) superstructural areas, namely: a background on the need for the strategy; the recommended strategies and actions; as well as the implementation arrangements for recommended actions.

11.2 Background on the Need for the Strategy

This study was principally aimed at contributing to the scalability and sustainability of stakeholder-centred mobile health services in South Africa. Accordingly, the ***current/ existing*** MomConnect project of the National Department of Health was referred to as a case example or demonstration case of the indispensability of ethnographically learnt experiences in the design and implementation phases of a public sector health service provision (Hwabamungua et al., 2018; Ngoc et al., 2018). The empirical data generated from the study was analysed and used as a reference point to enhance practice in the form of a strategy. From the researcher's perspective, the findings from the study cohere with other literature-based efforts within the digital health field that are aimed at the interrogation of scale and sustainability as viable strategy options for the efficacious provision of health care services, especially in the light of Goal 3 of the Sustainable Development Goals (WHO, 2014).

Most importantly, the researcher acknowledges the May 2012 *Strategy Paper on Rationalisation and Harmonisation of Information Technology (IT) Initiatives and Services in Ministries, Departments and Agencies (MDAs)* of the National Information Technology Authority Uganda (NITA-U), the Republic of Uganda. The format of this paper has been applied as a guide in the structure of this study's propositions for scalability and sustainability as crucial factors for an eHealth strategy in South Africa. The format of the afore-cited paper has assisted in the following areas:

- Prescription and justification of strategy;
- Implementation requirements;
- Strategy benefits; and
- Required actions.

11.3 Recommended Strategies and Actions

The recommended strategies and actions focus on a range of factors relating to both the micro and macro dynamics of strategy in health services as emanating from the collected data.

11.3.1 Stakeholder Management (Strategy 1)

This recommended strategy relates to implementation of the eHealth stakeholder management from the National Department of Health.

Prescription and Justification of Strategy: The purpose of this strategy is to have a central management of a matrix of stakeholders and associated roles in eHealth and information related to the work done. A regular revision and update of this matrix will help to ensure that all appropriate roles (and stakeholders) are collaborative participants in implementations (Shukla and Sharma, 2016).

Implementation Requirements: A National eHealth Coordinator at the National Department of Health is required. There should also be an open call for submission of information on implementation and implementers in consultation with other Provincial Departments of Health.

Benefits: Database that allows easier communication with the eHealth community (Ngoc et al., 2018).

Required Actions: Mapping of eHealth implementations and eHealth implementers. WHO's Digital Health Atlas (https://digitalhealthatlas.org/en/-/) is a global public good that was developed precisely for this purpose. There should be a public call for submission of information from the eHealth community, in addition to the development of a national database for eHealth stakeholders (Iyawaa et al., 2016).

11.3.2 User Centred Design (Strategy 2)

This recommended strategy relates to the description and compliance process of user- centred design processes within the digital health innovation ecosystem.

Prescription and Justification of Strategy: This process will allow for guidance in sampling and procedures for involving users in the process of user experience, and taking into account considerations that are unique to health services such as patient and clinician representations (Yang and Varshney, 2016). This strategy aligns succinctly with the first of the Principles of Digital Development (https://digitalprinciples.org/principle/design-with-the-user/)

Implementation Requirements: Guidance from the Ministerial Advisory Committee (MAC) on eHealth on the engagement of users and acceptable standards and methods for involving users. This would be a stakeholder matrix that appropriately identifies users.

Benefits: The process of user experience design will be well documented for each mHealth initiative, and will comply with prescribed process requirements.

Required Actions: Input from MAC on eHealth, as well as the involvement of statutory councils such as SANC (South African Nursing Council), HPCSA (Health Professions Council of South Africa), and SAPC (South African Pharmacy Council), hospital boards and clinic committees.

11.3.3 eHealth Governance and Leadership (Strategy 3)

This recommended strategy relates to the development of eHealth governance and leadership from the National and Provincial Departments of Health.

Prescription and Justification of Strategy: The purpose of this strategy is to ensure that the capacity of eHealth is developed from National and Provincial Departments of Health. This capacity is required to ensure that eHealth initiatives are appropriately aligned with the priorities and goals of these departments of health, with the National Department of Health

taking the lead in monitoring and ensuring the implementation of the eHealth/ mHealth strategy (Silva, 2015).

Implementation Requirements: Updated eHealth strategy incorporating mHealth. Furthermore, there should be capacity building of eHealth coordinators on eHealth and, or digital health leadership and entrepreneurship.

Benefits: eHealth leadership competence within the National or Provincial Health Department. Health professionals specialising in eHealth / Telemedicine / Medical Informatics / Nursing Informatics / Digital Health will benefit.

Required Actions: Call for development of eHealth management development programmes and eHealth research. There should be recognition of eHealth as a health professional specialty (Carlsson, Henningsson, Hrastinski and Keller, 2011). There should also be aggressive capacity building efforts to ensure eHealth coordinators have the necessary leadership, technical and entrepreneurial skills (Barron et al., 2016).

11.3.4 Infrastructure Development and Normative Standards Compliance (Strategy 4) Objective

This recommended strategy relates to guiding infrastructure developments and monitoring compliance with SA Normative Standards.

Prescription and Justification of Strategy: Guide and oversee the choice of infrastructure, for example, HL7. The process of monitoring and reporting on compliance with normative standards for every mHealth initiative is ensured. This recommendation also ensures policy-based technical standards for data exchange, transmission, messaging, security, privacy, and hardware (Mawela et al., 2017). The recommendation further ensures the prevalence of a plan for supporting mobile health infrastructure (including equipment such as computers/ tablets/ phones, supplies, software, and devices) provision and maintenance.

Implementation Requirements: Registration of mHealth initiative with the NDoH and documenting the state and condition of available infrastructure. Registry for infrastructure in use and service providers are required (Kabongo et al., 2019).

Benefits: A compliance driven process of implementation of mHealth initiatives.

Required Actions: A compliance tool designed by the NDoH, in terms of which implementers will demonstrate their current compliance and action plans to comply with infrastructure requirements.

11.3.5 Reconsideration of Privacy, Confidentiality and Security Policies (Strategy 5) Objective

This recommended strategy relates to the provision of proactive and maximum privacy and security measures for mHealth.

Prescription and Justification of Strategy: The purpose of this strategy is to ensure that there is proactive and timely review, action and reaction to privacy and security threats. In particular, review of current policies, including POPI (the Protection of Personal Information Act). Adoption and enforcement of GDPR (General Data Protection Regulation), data security (storage, transmission, use) and policies.

Implementation Requirements: Internal privacy and security of personnel.

Benefits: Cyber security and clearly described ownership of data.

Required Actions: Personnel for addressing privacy and security measures. Review of policies that are applicable to mHealth and data security measures is also needed, as well as training of a dedicated privacy and security staff (Shukla and Sharma, 2016; Wolff-Piggott et al., 2018).

11.3.6 Inclusive eHealth Policy and Regulation (Strategy 6)

This recommended strategy relates to the development of a national eHealth policy that includes mHealth.

Prescription and Justification of Strategy: There is no updated eHealth policy in eHealth and/or mHealth in South Africa.

Implementation Requirements: Collaboration between the Departments of Health, Science and Technology, and Communications for the drafting of cross-cutting policy due to the nature of eHealth (Pankomera and Van Greunen, 2018).

Benefits: A policy that is developed with the inclusion of stakeholders in mind.

Required Actions: Collaboration between government ministries and other research and development institutions on eHealth (Kabongo et al., 2019).

11.3.7 Collaborative Research and Development (Strategy 7)

This recommended strategy relates to implementation of research and development (R&D) processes that foster collaboration and evidence-based implementation of mHealth initiatives.

Prescription and Justification of Strategy: There is a lack of local mHealth rigour. This recommendation will enable funding and development of eHealth researchers, and enhance the periodical evaluation of mHealth for impact and other health measurements actions. Research and development outcomes will be implemented to enhance practice, workflows, and business needs, while also informing creation or adoption of new standard guidelines.

Implementation Requirements: Inclusion of eHealth and/or mHealth as a research focus area for the NDoH. The mHealth system should form part of health impact assessment within the NDoH, guided by research-based implementation (Pankomera and Van Greunen, 2018).

Benefits: Evidence-based implementations of eHealth/mHealth, in addition to collaboration between intellectuals, academia, industry and government agencies.

Required Actions: Involvement of the NDoH's Research Directorate in mHealth.

11.3.8 mHealth Monitoring and Evaluation Indicators (Strategy 8) Objective

This recommended strategy relates to the development of mHealth indicators as part of the Network Intrusion Detection System (NIDS).

Prescription and Justification of Strategy: The purpose of this strategy is to ensure that mHealth is monitored for performance like other health programmes. Also, to ensure standardisation of mHealth data elements across the country, developed according to the NIDS requirements (Fanta and Pretorius, 2018; Kahn et al., 2008).

Implementation Requirements: Involvement of NHISSA (National Health Information System of South Africa) in developing indicators.

Benefits: Standard monitoring of mHealth/ eHealth in South Africa, and clearly defined monitoring against targets and evaluation of goals in the area of mHealth/eHealth.

Required Actions: Incorporation of eHealth into the National Department of Health's M&E strategy.

11.3.9 eHealth as an Independent Health Programme (Strategy 9)

This recommended strategy relates to endorsement of eHealth as an independent health programme led by health professionals (Duarte and Pinhob, 2019).

Prescription and Justification of Strategy: The purpose of this strategy is to ensure that there is clear and accountable health professionals leading eHealth. This is to address the grey areas in IT, Health Technology, Data Management and Clinical health regarding ownership of eHealth in the NDoH.

Implementation Requirements: It is required that eHealth, as a health programme, should be led by health professionals. This includes mHealth, Telemedicine and other digital health innovations. Health workforce policy recognises and supports eHealth skills development.

Benefits: There is the benefit of eHealth programmes led and recognised as a health programme that addresses clinical areas, in addition to clear provincial and national eHealth/mHealth reporting lines. The development and retention of eHealth skills will be enhanced (Barron et al., 2016).

Required Actions: There should be national and provincial appointments of health professionals specialising in eHealth. These appointments should include professionals with post-basic qualifications in health informatics, eHealth and/or a combination of health and IT

that are registered with relevant professional councils. The health workforce should also be involved in eHealth policy implementation (Barron et al., 2016).

11.3.10 Consideration of Associated Economics Implications (Strategy 10) Context

This recommended strategy relates to the development and implementation of standard operating processes and procedures for evaluating the total cost of ownership of the mHealth initiative. In this regard, there is a need for a consideration of associated economic implications, including, but not limited to the total cost of ownership (Groop et al., 2010).

Prescription and Justification of Strategy: This strategy is aimed at mHealth sustainability, with the NDoH conducting evaluations to ensure mHealth compliance with specific requirements for the purpose of scaled-up and sustainable operations.

Implementation Requirements: Funding for scaling-up and sustainability is required, in conjunction with disclosure of running costs for the MomConnect initiative, including infrastructure, maintenance and human resources (Kabongo et al., 2019; Tabish and Nabil, 2013).

Benefits: For every implementation, there will be projection and evaluation of scale and sustainability. Implementation decisions will be based on the potential for both scalability and sustainability.

Required Actions: Disclosure of running costs for mHealth initiatives, as well as evaluation of post-piloting and post-scaling potential to mitigate risks.

11.4 Implementation Arrangement for Recommended Actions

The implementation arrangements for recommended actions relate to the strategy implementation timeframe, policy and governance issues, as well as institutional collaborations (Tihun, 2017; Waltz et al., 2019).

11.4.1 Strategy Implementation Timeframe

In this study, no specific strategy implementation timeframe was prescribed. Notwithstanding, the strategy implementation is dependent on the priorities and realities of the team concerned whenever its implementation is considered (PHASA, 2019).

11.4.2 Policy Issues

Implementation of the strategy needs to comply with applicable policies. Additionally, high-level ministerial adoption, endorsement and support is critical , given the urgency of the process of rationalisation (Chen, 2016; Salgado et al., 2017).

11.4.3 Governance Issues

Governance, leadership and accountability of the strategies would be more meaningful, provided such leadership accountability was first owned by the NDoH, then progressed to the provinces for implementation (Kabongo et al., 2019; Pillay and Motsoaledi, 2018).

11.4.4 Institutional Collaboration

The National Department of Health should be the lead implementer. Other government institutions such as the Department of Science and Technology, the Department of Communications; and research institutions such as the MRC, CSIR and HSRC should also be involved. The process should be as inclusive and as proactive as possible in terms of other stakeholders in the private sector and NGOs in the public sector.

11.4.5 Technical Issues

The stakeholders involved should make collaborative decisions on the technical issues, especially that the digitisation of health care service delivery involves the integration of science, technology and human sciences (Hwabamungua, 2018).

11.5 Conclusion

The implementation of stakeholder-centred reconfiguration of mHealth services should be recommended as the next milestone in South African health services delivery, given the imperatives of Goal 3 of the SDGs and the quest to facilitate access to all citizens; not only as a health care concern, but also as a fundamental human right (WHO, 2014).

Based on the study's empirical findings, this chapter presented various strategy-oriented perspectives to enhance scalability and sustainability in addition to current mHealth initiatives. It is evident from the presented perspectives that the most viable mHealth implementation options should adopt multiple stakeholder involvement and multiple ICT strategies involving other disciplines (Mehl et al., 2018; Wolff-Piggott et al., 2018). The next chapter focuses primarily on the value of the study in terms of its practical contributions to both theory and practice in mHealth.

CHAPTER 12: DISCUSSION OF THE FINDINGS AS A MECHANISM TO HIGHLIGHT INSIGHTS FROM THE STUDY

CHAPTER ONE: Rationale and Scope of the Study

CHAPTER TWO: Theoretical and Empirical Foundations and Location within Literature

CHAPTER THREE: Description of the Research Methodology

CHAPTER FOUR: Local Practice as The Case: MomConnect Innitiative

CHAPTER FIVE: Situational Inquiry and Theorising (Phase 2)

CHAPTER SIX: Stakeholder Analysis (Phase 2)

CHAPTER SEVEN: Practice Based Analysis: Phase 3 (NASSS Framework)

CHAPTER EIGHT: Practice Based Analysis: Phase 4 (Principles of Digital Development)

CHAPTER NINE: Practice Based Analysis: Phase 5 (Global Digital Health Index)

CHAPTER TEN: Synthesis as Convergence of Findings from Phases 1 to 5: Using Strong Structuration Theory as Lens

CHAPTER ELEVEN: Practice Enhancement: An Evolving Stakeholder Centred Strategy for Mobile Health re-Engineering

CHAPTER TWELVE: Discussion of The Findings As a Mechanism to Highlight Insights From The Study

- Introduction
- The Study's Response to the Research Questions
- How the Purpose and Objectives of the study were achieved
- How the Study outcomes were met
- Description of the study with regard to the Digital Health Innovation Ecosystem in South Africa
- Contributions of the study presented as Themes emerging from the Study
- Strenths of the study
- Limitations of the study
- Remarks of the Researcher on Research Journey
- Conclusion

CHAPTER THIRTEEN:

12.1 Introduction

This chapter basically provides a summary of the study's practical contribution as accruing from its phenomenological evidence base as already presented in the preceding chapters, particularly in Chapter Five. Carlsson et al. (2011) profoundly mention that a study should not only demonstrate a series of methodological procedures, but it should also reflect its practical contribution to interventions for resolving practical problems facing individuals, institutions, society and other organised entities in any environment. In this regard, the duality of the researcher-as-practitioner perspective lends both methodological practicality on the one hand, and experiential pragmatism on the other; that is, experienced reality (Julkunen, 2011; Van der Donk and Van Lanen, 2018). The notion of the researcher's experiencing of knowledge development, rather than theorising entirely about such knowledge, is presented and discussed further in Chapter Thirteen.

As articulated generally in Section 1.7 of this study, and sub-section 1.7.1 in particular, the research problem (i.e. MomConnect scalability and sustainability deficiencies) is both inevitably and interstitially linked to the research questions (Section 1.8 as a whole) and research purpose (Section 1.9 as a whole). It is against this crucial background that the current chapter (Chapter Seven) is logically premised and linked to the summarised findings in the context of the research questions, study purpose and research objectives (Saunders et al., 2016). While the research questions, purpose and objectives are an indispensable aspect of this chapter, other important aspects of this chapter relate to various thematically inclined perspectives, the identified strengths of the study, as well as recommendation for further research.

12.2 The Study's Response to the Research Questions

The study's responses to its research questions is represented below by the main research questions (RQs) and secondary research questions (SRQs) as appearing in their respective sections and sub-sections in Chapter One. It is worth mentioning that in this section of the chapter, each of the 3 (three) main research questions (RQs) is responded to in conjunction with its 4 (four) attendant secondary research questions (SRQs).

12.2.1 RQ1: Relating to Design Considerations for mHealth Scalability

RQ1: *What are the design considerations of an mHealth service implementation strategy in terms of which mobile technologies are infused in health services (scalable), from a stakeholder-centred perspective?*

12.2.1.1 SRQ1.1: Relating to design considerations for mHealth scalability

The related SRQ1.1 is: *How do stakeholders involved in the same mHealth initiative rationalise their actions and experiences in the process of implementing a health service?*

There was consensus among the participants that MomConnect was implemented correctly, and that they would not have applied it differently because they used what was available and reasonable at the time - given the resource limitations and the time during which they had to implement this project. This implementation was sensible and rational to them. The success in terms of scale and meeting subscription targets was a reassurance of success. The gaps in the strategies and the lack of capacity was mitigated by their actions. They acknowledged the gaps and gave reasons for their implementation approaches. This means that when teams reason together and have support from the highest authority, they can maximise available resources and be target driven to achieve their goals. Such an approach and state of reasoning supports the perspective by Hwabamungua et al. (2018), Proctor et al. (2013), and Wolff-Piggott et al. (2018); all of whom advocate for inclusivity and consensus among project implementers.

There has been inordinate numbers of mHealth pilot programmes in the country. When an opportunity to implement a national scale project came, the Minister of Health and most stakeholders supported it because it was a significant milestone for the mHealth community. There were challenges that were already known in the area. However, at that stage, the goal was to implement in the midst of all those challenges and learn in the process. There was a parallel process of problem solving and learning during development. This may be due to the fact that some have attempted to solve the challenges before, and the initiative was stimulating for the team to focus on as they learnt important lessons. This means that it is not necessarily key to solve all challenges prior to implementing an mHealth initiative, because some may need specific budgets when there are already known failures. Nonetheless, challenges can be addressed concurrently with implementation (Kruse et al., 2019; Pankomera and Van Greunen, 2018).

12.2.1.2 SRQ1.2: Relating to potential contextual influences on mHealth scalability

The related SRQ1.2 is: *What contextual factors could potentially influence scalability and sustainability of mHealth services as part of a digital health innovation ecosystem?*

According to Herselman et al. (2018), 'context' in a digital health innovation is characterised mainly by environmental, ethical, political, legal and social factors, as well as stakeholders. In both these factors and stakeholders, technology is the interstitial factor. While there may be direct and/ or indirect commonalities, the characterisation of 'context' by Fanta and Pretorius (2018) premises on technology (e.g. eHealth), the economy (financial capacity), society, and the environment as represented by private, public and non-governmental organisations).

In respect of both RQ1.2 and SRQ1.2, the majority of participants intimated that the inclusion of stakeholder from different backgrounds formed part of the mHealth community in order to establish a natural coalition. Scale requires broader involvement, because every stakeholder can either build or break the 'scale chain' if not properly informed. The participants averred that their teams understood that their success also depended on the entire community that would be directly or indirectly affected by the MomConnect initiative. Teamwork enhances better and effective communication, which improves performance and project sustainability (Davis et al., 2016; Nyemba-Mudenda, 2013).

There was virtually overwhelming consensus amongst the participants that the increased use of smart phones, compared to basic phones, simultaneously increased the technological options and choices of health care users and practitioners. However, the choice of USSD was mostly based on the fact that all types of phones can receive information, and this was supposed to be a free service. It was not clear whether the use of data would be provided for free, and how standards and regulations such as HL7 were considered in discussions. The latter statement is based on the assertion by Fanta and Pretorius (2018) and Ngoc et al. (2018), that the compatibility of mobile devices to various eHealth operations and offerings also advanced both the scalability and sustainability factors on the part of both the strategy and society.

Health programmes are a backbone of the mHealth service (Ossebaard and Van Gemert-Pijnen, 2016). Mobile technology usually supports a specific number of health programmes; thus, it is critical to involve clinicians to ensure that the initiative is not entirely about technology but enhances the health services by technological means as well (Barron et al., 2016; Power et al., 2019). Once clinicians find the technology to be enhancing their work and not cumbersome, they begin to support the initiative overwhelmingly (Pankomera and Van Greunen, 2018). If it contributes to their job performance, it is even better. This means the initiative must be clearly articulated and easily identify which health programmes it supports, and motivation for that support. Since government services are goal oriented, the mobile technology must be substantiated by related SDGs (Ossebaard and Van Gemert-Pijnen, 2016). It must be clear that this technology does not just enhance a service, but contributes to reaching specific goals. Such goal-orientedness assist in involving other departments or organisations that are linked to same SDGs, for collaboration in operations, funding and or research (Nyström et al., 2018).

Funding for both eHealth and mHealth is critical . The government must have its own funding mechanisms and not depend entirely on funders (Pankomera and Van Greunen, 2018). Funding and cost are also instrumental contextual factors of scale and sustainability, although the two terms are different but complementary (Fanta and Pretorius, 2018). For the MomConnect initiative, the majority of participants lamented the general funding of public

sector initiatives, which then results in stagnation of such projects despite their innovative potential. For instance, they commented on the use of SMS to facilitate availability to most users despite current trends calling for data use. They mentioned unequivocally that they have to 'change tack' because to the users, predominantly women, the cost of data was generally prohibitive. When a service is free, it seems to be well accepted. PHC services are free in South Africa, and patients expect free eHealth services as well. As much as they may have smart phones, they still prefer free SMSs than using data, for which they would have to pay themselves.

From the above state of affairs, it would appear that the business notion of 'the customer is always the king' was immaterial in this context, and was instead superseded by the *caveat exemptor* variant in terms of which "the [consumer] alone is responsible if dissatisfied" (The Pocket Oxford Dictionary of Current English, 2002).

Political power and support was instrumental in the scale and sustainability of the project. Participants expressed on their experiences and lessons learnt from other countries who had the same vision as South Africa and similar initiatives. Disappointingly, their presentations to 'highest authority' (political leaders) were not fully supported. For a national initiative such as the re-engineered implementation of the public health care service sector, it is key to have *ex cathedra* support and 'buy-in' from the highest political echelons (Kruse et al., 2019).

The participants also expressed that having the Minister of Health briefing political teams and senior managers contributed to the success of the initiative. When the team went to the field, they were already 'walking on levelled ground'. The support from higher power does not only aid the implementing team itself, but even extends to the areas where the implementation will be done. If the minister only told the team of this goal and never briefed managers himself, it would be difficult for a team which does not even have contracts to convince the provinces about the need for the MomConnect initiative. However, if minister went to the provinces as well, which made it easier for the team to do the work afterwards in collaboration with the different provinces.

12.2.1.3 SRQ1.3: Relating to critical strategy implementation and rationalisation factors

The related SRQ1.3 is: *What critical factors need to be considered for a re-engineered strategy that aims to implement and rationalise suitable mHealth services?*

Rationalisation is based on the logic or reasoning associated with the enhancement of health services to reach wider audiences, and such logic could derive from either the performance (success or failure) of the envisaged service (Pankomera and Van Greunen, 2018). Such logic emanates from the extant 'pilotitis' of most health care innovations observed in many developing economies. In this regard, the avoidance of duplication was mentioned by

participants as critical. Other programmes could actually add onto the existing mHealth initiative than start other mHealth initiatives.

Participants raised their concern with eHealth governance from the National Department of Health. It was known that there were a number of past and present similar mHealth initiatives in the country, but were mainly pilots. However, it was difficult to access such data because there was no central location where such information could be obtained. Different implementers had to be approached separately in order to obtain this information, which accentuates the criticality of the central management of mHealth, as it would assist in reducing duplication of efforts and enhance benchmarking (Pankomera and Van Greunen, 2018).

The participants also cited that pilots should be confined to areas that have not been piloted before. Also, there seems to be rich, but not shared piloting data. The NDoH needed to retrospectively call for data submission in order to make sense of the data and progress of the country in this regard. Whenever a new initiative is introduced, a proper change management process should follow (Overkamp and Holmlid, 2016). This was mentioned as a gap in this initiative and recommended for a re-engineering strategy (Wallis et al., 2017). In itself, change management correspondingly requires stakeholder management, which should be a critical responsibility of central government (Ikeziri et al., 2019). In this regard, mHealth human resources would be needed more for both scale and sustainability in respect of staff required for full-time work on Departmental initiatives (Pankomera and Van Greunen, 2018).

It was also emphasised that research and development processes were not conducted during the strategy design, as there was no evidence or data to substantiate a national scale of the MomConnect initiative. It was only at the minister's insistence that the systematic evidence gathering process was undertaken. Such a scenario is corroborated by Tomlinson et al. (2013), who aver that no significant large-scale, well-designed efficacy and effectiveness mHealth trials have been executed as yet in sub-Saharan Africa. However, participants did mention that ANC statistics were only reviewed because the initiative was more focused on ANC.

As a factor of rationalisation, the participants mentioned the importance of government taking the leadership role in privacy and security measures relating to mobile technological devices used for reducing space and time between the patient/ user and the health care provider or practitioner (Pankomera and Van Greunen, 2018). Most participants urged for the centralisation of mHealth governance or control of mHealth initiatives by the National Department of Health. This was due to a number of initiatives that take place throughout the country in which the Department was mostly uninvolved. This was mentioned to motivate for some form of database or register which would inform on what was happening in the area of mHealth throughout the country. This would also allow a closer look at the issues of both scalability and sustainability from beginning to implementation of the mHealth initiative. This is

also regarded as a transparent process of minimising duplication, so that different implementers could know what others were doing and jointly build on what was already in existence and learn from their experiences (Duarte and Pinhob, 2019).

12.2.1.4 SRQ1.4: Relating to contemporary issues influencing mHealth re-engineering

The related SRQ1.4 is*: What contemporary issues of an mHealth service influence its re-engineering?*

Cronk and Bartram, (2018) and Wolff-Piggott et al. (2018) emphasised the critical role of facility-level personnel. In this regard, the concerns of clinicians, particularly nurses working at the facilities, was mentioned by participants as one of the issues concerning mHealth re-engineering and implementation. The nurses emphasised that the initiative should be as easy as possible in order to enhance its subscription and the changes it may bring at the facility level where the active implementation takes place. They also reflected on their workloads due to staff shortage and long patient queues. Therefore, the initiative had to be uncomplicated and take little time to use; otherwise, it would not be prioritised by users. Wolff-Piggott et al. (2018) contend that grassroots considerations should be prioritised by any mHealth service.

Furthermore, nurses working at the helpdesk were concerned with the process of linking patients to care. They expressed the need to see the patients' blood test results. However, the helpdesk system only provided interactive communication, but not clinical information that would allow them to give full clinical advice. Consequently, they could only refer patients to clinical staff. Clinicians insisted on sufficient additional information that makes it possible for them to assist patients. Clinicians needed specific information about patients in order to assist them. They recommended the issue of unique patient identifiers linked to systems such as tier.net to be considered in order that clinicians should not feel excluded from providing mHealth services as a result of a disconnection between the service and patients records.

The nurses reported that they were not privy to the content of the messages sent to patients. Some had to subscribe themselves as patients in order to access the content. This is a user centred design gap, which should not have even occurred if the system was properly designed to facilitate early detection of any design malfunctioning (Schnall et al., 2016). The clinicians also ought to know what the NDoH is communicating to patients. Initiatives should focus on both clinicians and patients in terms of dissemination of information.

There was also concerns raised about MomConnect's design to focus mostly on ANC. Midwives expressed the need for the labour process to be incorporated as well. Furthermore, they expressed the need for the initiative to make clinical sense beyond SMSs being complemented predominantly with guidelines. The initiative seemed to be supportive of the services at PHC level, but limited on labour/ delivery, which mostly happens at a hospital.

There was also the call for consideration of referrals between the different levels of care and how clinical protocols work. Some programmes may not link in terms of health systems, but information provided may need to be linked regardless of the non-interoperability of systems (Grover and Lyytinen, 2015; Hultgren and Goldkuhl, 2013). This calls for consideration of consulting different clusters in mHealth so that such clinical gaps may be addressed. In this regard, the natural environment or context of the health care facility is not fully explored and capacitated (Fanta and Pretorius, 2018).

The perspectives of nurses should not be devalued. Nurses are the highest population of clinicians. Most PHC facilities are generally headed and staffed by nurses only on the clinical side. This group of professionals must be involved and considered in developing mHealth initiatives due to their impact on scale and sustainability (Goldkuhl, 2011). For instance, NIMART (Nurse-Initiated Management of Antiretroviral Treatment) ensured that initiation of ARVs are available to almost everyone through nurses. If only initiated by doctors, it would be difficult considering the shortage of doctors. The involvement of nurses contributed to both the scale and sustainability.

Another contemporary mHealth issue is the general piloting fatigue, due to the fact that pilots never scale, and different mHealth initiatives seem to pilot the same health aspect, which is tantamount to duplication of work or efforts by different implementers (Ngoc et al., 2018). It was recommended that pilot should be specific as to what they are piloting because the importance of mHealth now seems to be evident. However, pilots seem to endure for as long as funds are available for that purpose.

12.2.2 RQ2: Relating to Rationalisation of mHealth Stakeholder Involvement

RQ2: *How should a suitable mHealth service strategy be designed and implemented to rationalise the involvement of relevant stakeholders and integrate development and implementation processes of an mHealth facilitated service?*

12.2.2.1 SRQ2.1: Relating to rationalisation of mHealth stakeholder involvement

The related SRQ2.1 is: *How do stakeholders involved in the same mHealth initiative rationalise their actions and experiences in the process of re-engineering and implementing a health service?*

Existing relationships should be utilised for the enhancement of existing networks and growing them to include stakeholders that may be excluded (Furusa and Coleman, 2018). The prevalence of silo implementations has created some communication gaps, which have diminished the prominence of an mHealth community. Existing relationships ought to be used in order to bring everyone together as part of a governance process (Yang and Varshney, 2016).

The participants urged that stakeholders from different backgrounds should be involved in order to minimise the mHealth gaps caused by working in silos. There was agreement amongst participants to approach potential data integrations between different departments such as the Department of Science and Technology. The consulted MomConnect Task Team minutes and conversations with the Ministerial Advisory Committee showed that all participants/ members were involved (in varying degrees) in the design phase of the MomConnect initiative. However, the implementers in the field were not, according to the participants. More than half of the participants were there from the beginning of the MomConnect initiative. Stakeholders were keen to be involved given that this was a national project as opposed to small mHealth projects that are always implemented in silos.

12.2.2.2 SRQ2.2: Relating to methods to involve relevant stakeholders in mHealth strategy design

The related SRQ2.2 is: *Which appropriate methods could be applied to involve relevant stakeholders in the design of an mHealth service as a re-engineering concept for implementation and rationalisation?*

Consultation and collaboration among stakeholders was cited as instrumental to the inculcation of the need for ownership of the project. At the highest decision-making level, the Ministry of Health needs to ensure that all relevant stakeholders are involved in different aspects of the MomConnect initiatives regardless of the sectors they represent. At the strategic level, it is also imperative for the National Department of Health to be in full control and ensure the 'silo syndrome' is obviated (Ikeziri et al., 2019; Wallis et al., 2017). Also, there must be a team that will monitor targets and implementation processes within the NDoH.

There was a clear ownership of this initiative by the NDoH, which engendered trust among stakeholders. The MomConnect Task Team collaborated in a manner that allowed participation, and where clarification or further research was needed, a member was allocated responsibility with timeframe to bring feedback to the team. The team did acknowledge that a culture of teamwork had a positive impact on this initiative.

12.2.2.3 SRQ2.3: Relating to key scalability factors during mHealth development

The related SRQ2.3 is: *Which key scalability factors should be considered in the implementation of an mHealth service during its development?*

Factors for scalability considerations should include previous initiatives and centralisation of mHealth (and related eHealth services) at NDoH due to the silo implementations happening at different provinces and lack of a centralised data hub for these initiatives (Serrano et al., 2020). More information could be learnt from this data. However, due to the lack of access to such data, there is no way to analyse the data even retrospectively on the mHealth initiatives conducted in the country.

For data management, one of the indicators that was monitored in MomConnect was the first ANC visit within 20 weeks. It became difficult to assess how mHealth enabled women to register for ANC early. By the time the women subscribed to MomConnect, they had been through an arduous process, with the facility staff raising concerns for their time spent on helping the pregnant mothers through the registration process on their mobile devices.

There should be specific focus on the inclusion of non-South Africans that use the services in the country. South Africa is experiencing the reality of foreign nationals using the PHC system, some of whom do not have proper documentation and do not understand local languages. This was very key in the issue of patient unique identifiers, which could compromise the privacy and security of those patients because privacy would be breached whenever an interpreter is needed at facility level.

A viable business model in mHealth was recommended as a key consideration, which could be the precursor to change management and expansion of the MomConnect initiative throughout the country (Fanta and Pretorius, 2018). Additionally, the staff in the health sector needs to understand the importance of mHealth, including its benefits. Their 'buy in' is helpful, since facility level staff are the main catalysts for expansion and scalability (Marcolino et al., 2018; Furusa, and Coleman, 2018).

12.2.2.4 SRQ2.4: Relating to key sustainability factors during mHealth development

The related SRQ2.4 is: *Which key sustainability factors should be considered in the implementation of an mHealth facilitated service during its development?*

Cost of ownership: Due consideration should be given for the long-term survival of mHealth projects, as opposed to their scale or size (Fanta and Pretorius, 2018). The cost of sustaining the entire initiative should consider costs for infrastructure, operations, maintenance, employment of implementers and other employees to mention a few. The MomConnect initiative should be considered a health investment, rather than an expenditure, and the associated business model should be reconfigured accordingly (Fanta and Pretorius, 2018:136; Ngoc et al., 2018:3). The latter (reconfigured business model) is helpful in reducing short-term grants from (local and international) donors to ensure sustainability.

As much as it is opposed by others (e.g. Fantana and Pretorius , 2018), scholars such as Aranda-Jan et al. (2014, Kruse et al. (2019) and Tomlinson et al. (2013) support the proposition for continuous fundraising and budgeting, because sustainability would not be dependent on 'earmarked' or 'ring-fenced' funds injected at a particular time. Consequently, the initiative would be well positioned to fund itself on a continuous basis. The technology driven dissemination of SMSes, for instance, requires data that must be paid for from the NDoH budgets as the distributor of the data (Lien and Jiang, 2017).

As much as it makes scientific sense, the reliance on piloted digital disease management projects should be reduced because the momentum for sustainability becomes stagnated (Ossebaard and Van Gemert-Pijnen, 2016; Waltz et al., 2019). In this regard, target driven performance should be endorsed and applied as a mechanism to reduce pilot testing. For instance, the MomConnect subscriptions could be compared according to provinces, which would help in fast-tracking those whose subscription level were the lowest.

The effect of political changes in government should be considered as well (Serrano et al., 2020). This is a threat to sustainability, especially in the South African context, given that there are changes in political power in every five-year cycle. In this regard, the risks of having new management with different priorities should be mitigated.

12.2.3 RQ3: Relating to DHIE Realities in mHealth Service Provision

RQ3: *What can be learnt from the realities of a local mHealth-enabled health service based on the relationships, collaborations and processes of a specific situation*?

12.2.3.1 SRQ3.1: Relating to best demonstrated practices in digital development practices

The related *SRQ3.1* is*: How can the best demonstrated practices be described in the context of digital development principles?*

Interpretation of the data through the Principles of Digital Development assisted in highlighting the findings that may be regarded as best practice and also gaps that may exist in practice. Chapter Seven provided detailed feedback on the following nine principles: Design with the User; Understand the Existing Ecosystem; Design for Scale; Build for Sustainability; Be data Driven; Use Open Standards; Open Data, Open Source, and be collaborative (Ko, Dunn, Lahoud, Nusem, Straker, Wrigley, 2019).

12.2.3.2 SRQ3.2: Relating to lessons learnt from the South African digital health innovation ecosystem

The related *SRQ3.2* is*: What can be learnt from the mHealth environment within the Digital Health Innovation Ecosystem in South Africa?*

An overview of the mHealth environment was assessed through the Global Digital Health Index in the following 7 (seven) categories in Chapter Nine: Leadership and Governance; Strategy and Investment; Legislation, Policy and Compliance; Workforce, Standards and Interoperability; Infrastructure and Services and Applications. This assessment was based on findings of the study, and only limited to the demonstration case, the MomConnect initiative. The Global Digital Health Index does give the desired overview. If all digital health initiatives were implemented as per data in this study, South Africa could probable be at Phase 3 of the global index.

The Ministerial Advisory Committee on eHealth is a relatively new national body on eHealth matters, and has a lot of challenges to address, with mHealth just one of them. Furthermore, not all provinces have an eHealth Directorate in their Health Departments, which makes it difficult for provinces to coordinate mHealth amongst other eHealth issues. Therefore, decentralisation and coordination are still an imperative (Wolff-Piggott et al., 2018). In this regard, localisation of strategic implementation would lead to the early assessment and identification of service problems and risks without having to wait for national government's eventual interventions (Serrano et al., 2020).

From the participants' responses, it is clear that the current strategic direction of the MomConnect initiative suggest that Clinical Directorates are now needed at facility level, where eHealth Coordinators with health care background would ensure coordination from the provinces and integration to health programming (Furusa and Coleman, 2018). More so, the MomConnect office was hosted in the office of the Deputy Director-General within the National Department of Health, and not within the Maternal Child and Women's Care MCHW directorate. Regardless of its scale, the initiative was also implemented in silos within the Department, and other clusters were not involved. The need to involve other clusters was raised. However, it was thought to be linked to the nature of the initiative as being a ministerial project. In that regard, a number of standard processes and procedures were not followed since the key was to implement as soon as possible. The project manager was a medical doctor who specialised in public health (epidemiology). The HIS directorate does not have such skills. It is clear that clinicians should lead eHealth (Noyes et al., 2019).

Lessons learnt from the facility environment are that continuous MomConnect reorientation is needed, because clinical staff rotates on a continuous basis and continuity and stability of implementation could be compromised. For instance, when this study was undertaken, most of the nurses learnt about MomConnect only when they moved to the antenatal care duty section.

12.2.3.3 SRQ3.3: Relating to learnt lessons in respect of development, adoption, scale and sustainability

The related *SRQ3.3* is*: What measurements can be learnt on the demonstration case through development, adoption, scale and sustainability?*

By means of the NASSS Framework, the following seven domain-specific measurements were learnt: the condition or nature of illness; the technology; the value proposition; the adopter system; the organisation; the wider context; embedding; and adaptation over time. The specific scores and motivations are outlined in Chapter Nine.

From the NASSS Framework scores, it was learnt that the domains of condition/illness, the technology, the organisation, embedding and adaptation over time were achievable than the value proposition and the adopter system, which still have complicated areas to address. No measurement was scored as 'complex'. Power et al. (2019) assert that the achievability of implementation processes enhance localisation efforts, which lessens duplication of effort and more chances of success for development, adoption, scalability and sustainability.

As a demonstration case, the MomConnect initiative shows that there were lessons to be learnt from the apparent and continuous challenges in the public sector, characterised by a modernisation deficit, digitisation, and meeting the ever-increasing demands for services in an environment of resource constraints (Discovery Society, 2018; Pankomera and Greunen, 2018). The technology environment needs continuous and proactive measures in place because of the rapid external changes. The MomConnect Task Team has managed this by having monthly meetings, amongst others. Furthermore, the life span of consultants (sufficient for scaling-up) should be shortened in preference of strengthening internal mHealth capacity for sustainability (Wallis et al., 2017).

12.2.3.4 SRQ3.4: Relating to mHealth services implementation structures and agents

The related *SRQ3.4* is*: Which structures and agents can be conceptualised in the implementation of mHealth services?*

The strong structuration theory (SST) has assisted in the conceptualisation of structures, namely: The Ministry of health (political leadership); the National Department of Health (public service administrator); regulations, policies and strategies. The agents were all stakeholders, namely: the users (health service providers and health service consumers); the MomConnect Task Team, the Ministerial Advisory Committee on eHealth; and the funders and implementing partners at every stage of the project, or as per tasks at every milestone. For the purpose of implementation and making decisions, it was mainly the MomConnect Task Team. The team was entrusted with the nation-wide implementation of the mHealth initiative where structures were bypassed during the implementation process. There had to be reliable co-creation and rationalisation decisions (Wallis et al., 2017).

From the stakeholder relationship mapping, it was found that stakeholders knew each other's strengths, which was key to a structured approach to their expected deliverables. The extent of their interpersonal relationships is a key factor of 'structure', without which the organisational sense of being itself and its culture were likely to implode (Hilton and Hilton, 2017; Matthew-Maich et al., 2016).

12.3 How the Purpose and Objectives of the Study Were Achieved

As articulated in Section 1.9 of this study, the main purpose or primary objective of the study was:

To design an mHealth Implementation Strategy based on best demonstrated practices (considerations and methods) and learnt experiences from the perspectives of the Digital Health Innovation Ecosystem stakeholders in South Africa.

On the basis of the reviewed literature (for theoretical and secondary data) and the indispensable ethnographically oriented empirical (primary) data, a 10 (ten) point mobile health implementation framework was produced by this study as an attempt to utilise the findings as an enhancement of practice in the field of strategy development and implementation (Gurupur and Wan, 2017). Most importantly, the stakeholder-steeped results also emphasise the pragmatism by means of which the practitioner-researcher perspective enabled a process of constructing meaningful multiple realities **with** the participants; rather than **for** the participants (*Groop* et al., 2010; Julkunen, 2011; van der Donk and Kuijer-Siebelink, 2015) The proposed strategy implementation areas are:

(1) Implementation of stakeholder management on eHealth from the national department of health, (2) Description and compliance process of user centred design process within the digital health innovation ecosystem, (3)The development of eHealth governance and leadership from the national and provincial department of Health, (4) Guiding Infrastructure Developments and Monitoring compliance with SA Normative Standards, (5)The provision of proactive and maximum privacy and security measures for mHealth, (6) Development of eHealth policy that includes mHealth at national Level, (7) Implementation of Research and development processes that foster collaboration and evidence based implementation of mHealth initiatives, (8) The development of mHealth indicators as parts of the NIDS, (9) Endorsement of eHealth as an independent health program lead by health professionals and (10) Development and implementation of standard operating process for evaluating total cost of ownership for mHealth initiative.

12.4 How the Study Outcomes Were Met

12.4.1 Primary Outcome 1: An mHealth Implementation Strategy Based on Best Demonstrated Practices and Learnt Stakeholder Experiences

The proposed strategy framework areas are practical and relevantly translates the findings of the study such that it can be implemented as it is, or more items could be added by interested parties for purpose of mHealth or other related digital health innovations. It is based on the perspectives of different stakeholders who were involved directly or indirectly in mHealth in South Africa. This stakeholder-centred strategy design is neither imaginary nor abstract or

academic, but based on the real-life experiences and realities of all consulted participant constituencies (Power et al., 2019).

12.4.2 Secondary Outcomes

From the accumulated body of evidence obtained from the different categories of stakeholders, responses to Research Question 1: *Knowledge and design considerations of an mHealth service implementation strategy in terms of which mobile technologies are infused in health services (scalable), from a stakeholder-centred perspective*, were derived from the main overall responses to Secondary Research Questions (SRQ1.1 to SRQ1.4), summarised below. It is worth mentioning that some of the responses indicating the achievement of objectives do overlap; for instance, funding and collaboration. The overall convergently arranged responses yielded:

- Proper utilisation of resources in order to reduce the costs of ownership;
- Reducing pilot-testing and funder dependency;
- Inclusion of multiple stakeholders for collaboration;
- Smart phones increased technological viability and options;
- Involvement of clinicians to infuse a health service perspective, not only technological device-centredness;
- Political 'buy-in' at the highest level;
- Accommodating rationalisation;
- Benchmarking with other mHealth projects; and
- Accommodating foreign nationals and their privacy and security.

From the accumulated body of evidence obtained from the different categories of stakeholders, responses to Research Question 2: *Propose how a suitable m-health service implementation strategy should be designed that involve relevant stakeholders to integrate implementation with the development process of a mHealth facilitated service*, were derived from the main overall responses to Secondary Research Questions (SRQ2.1 to SRQ2.4), summarised below. It is worth mentioning that some of the responses indicating the achievement of objectives do overlap; for instance, funding and collaboration. The overall convergently arranged responses yielded:

- Utilising existing relationships should be utilised for enhancement of existing networks;
- Involvement of stakeholders from different backgrounds to minimise mHealth gaps caused by working in silos;
- Inculcation of a culture of project ownership among stakeholders (including designers and developers) and users;
- For research and development, previous initiatives should be systematically considered;

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- Data management considerations for end-users; and

- Considerations of clinicians as co-creators and not 'wasting' their time.

From the accumulated body of evidence obtained from the different categories of stakeholders, responses to Research Question 3: *Exploration and description of lessons learnt about the realities of the digital health innovation ecosystem in providing mHealth services based on the relationships, collaborations and processes in the public health services*, were derived from the main overall responses to Secondary Research Questions (SRQ3.1 to SRQ3.4), summarised below. It is worth mentioning that some of the responses indicating the achievement of objectives do overlap; for instance, funding and collaboration. The overall convergently arranged responses yielded:

- Utilisation of the Principles of Digital Development to integrate best practice and address practice gaps;

- Utilisation of the Global Digital Health Index to assess and understand the mHealth environment;

- Utilisation of the NASSS Framework to measure the success and sustainability (or otherwise) of the proposed mHealth implementation strategy;

- Utilisation of the Strong Structuration Theory to conceptualise structures;

- Identifying relevant structures and technological systems;

- Reconfiguration of existing structures for effective performance; and

- Facility-level lessons such as continuous staff reorientation on mHealth should be implemented;

12.5 Description of the study with regard to the Digital Health Innovation Ecosystem in South Africa

A Digital Health Innovation Ecosystem (DHIS) for South Africa was utilised as a model for highlighting the association or inter-relatedness of the findings of this study to the entire ecosystem of the environment in which the health care sector functions (Herselman et al., 2016). An indication of such association or inter-relatedness is critical for a variety of reasons. At a conceptual level, it advanced the narrowing of theory and practice in the sphere of DHIS: that is, also portraying the nexus between the reality (lived experiences) of the multiple stakeholders and the mixed-methods approach by which data was obtained and convergently analysed (Creswell and Creswell, 2018; Doocy et al., 2017; Edmonds and Kennedy, 2017; Katuu, 2018). Figure 12.1 below indicates the main components of the DHIS.
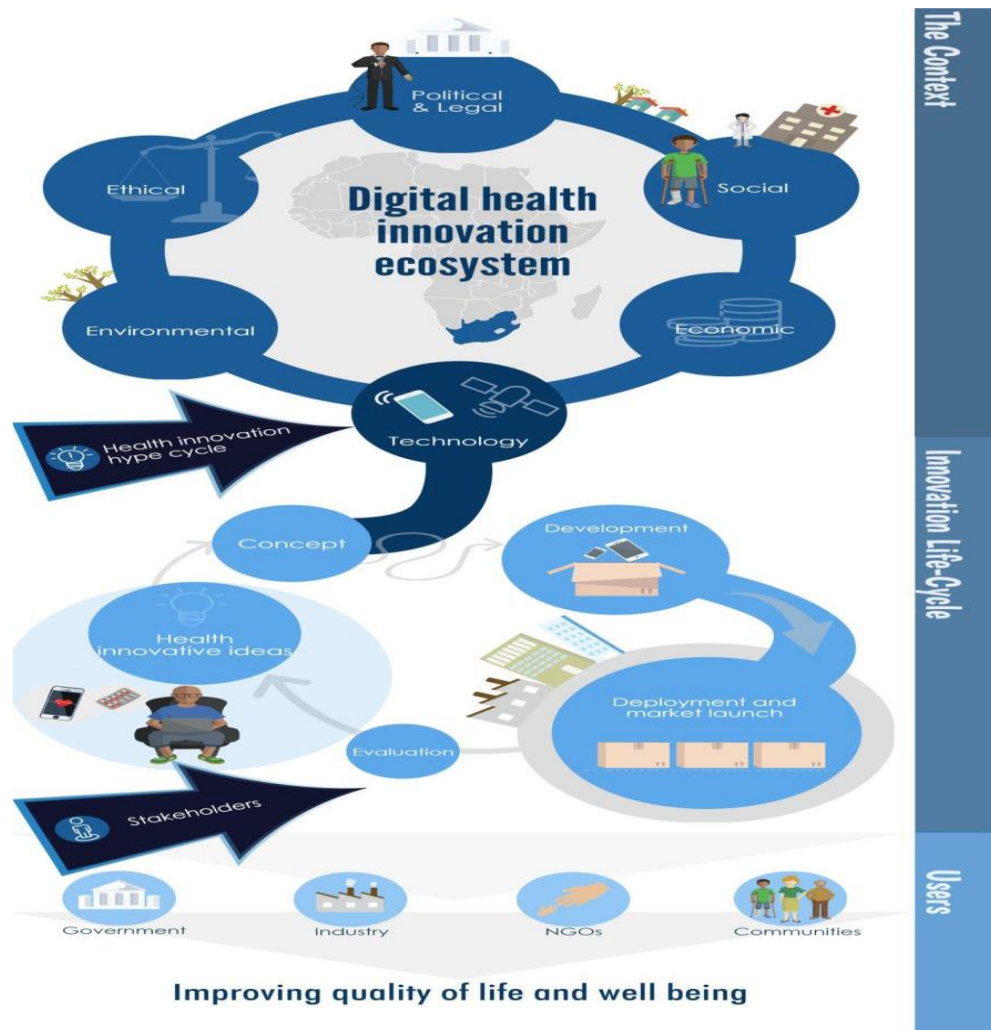
Figure 12-1: A Digital Health Innovation Ecosystem for South Africa
(Source: Herselman et al., 2016:6)

Figure 12.1 above depicts the main DHIS components as: the context, the innovation life cycle, and the users.

12.5.1 The Context

Digital health solutions constitute one of the main elements of the DHIS.

12.5.1.1 Digital health solutions that are sensitive to local economic, social, cultural, environmental and organisational factors:

12.5.1.2 Align ICT policy and government programs

Such alignment should be linked with telecommunications regulations and develop a framework for data protection and privacy. In this study, data security and privacy is one of the themes that emerged frequently from the findings. It is becoming clearer that other departments, such as the Department of Communications (which is linked to telecommunications networks), the Department of Science and Technology, and other

organisations with similar interests (e.g. CSIR) should collaborate in this regard (Hilton and Hilton, 2017).

12.5.1.3 Inappropriate and unaffordable systems will not work

In such cases, consideration should be given to socio-technical requirements where appropriate technologies are chosen to resource constrained environments (context, culture, politics) and environmental constraints (low literacy, older technologies). The choice of USSD code, which is compatible with every phone, was influenced by affordability (for the patients, as a free service) and appropriateness for scale. On the other hand, affordability (for service provider) was also considered as migration from SMS to data.

12.5.2 Digital Health Solutions Adapted to Augment the Broader Localised Digital Health Capabilities

12.5.2.1 Data security and building coalitions

These coalitions might include government, other health implementers, technology providers, mobile network operators and others (Nyemba-Mudenda, 2013:40). The findings of the study included coalitions that contribute to data security. The findings also considered the fast-paced technology environment in relation to proactive coalitions.

12.5.2.2 Align with interoperability standards for mobile health

Such alignment should be based on the recent mobile health strategy and reflect on the South African Department of Health's eHealth strategy. The findings indicated there was a need to review and update the existing mobile health strategy. It was also noted that the current two mobile health and eHealth strategies were to be incorporated into one eHealth strategy. There was also a suggestion to rather name the new strategy a Digital Health Strategy than eHealth.

12.5.2.3 Governance

Investment in infrastructure is crucial, similar to rigorous decision-making facilitated by data timing, systematic risk assessment where there is strategy and leadership (Meyers et al., 2017; Pillay and Motsoaledi, 2018). The findings reiterated the need for effective and consistent governance, especially from the National Department of Health. The rationalisation strategy for mobile health, which is the outcome of this study, may contribute as well.

12.5.2.4 Consider technical requirements for scalability

Such consideration should include client device neutrality. The technical requirements for scale were considered from the research findings. However, MomConnect sustainability was a major concern in this study.

12.5.2.5 Allow for agnostic technology access

Such allowance relates to support for information, service delivery and media convergence for digital content and services accessibility and delivery to end-users, regardless of the access technologies used by the end-user. Users, especially at facility level, were in possession of smart phones. However, they indicated preference of SMS over data messaging to access the service itself. This was due to the fact that such service is provided free of charge. However, participants also indicated the need to access the information in cases where they deleted the SMSs. In this regard, they were open to use their own data to access the information.

12.5.3 Innovation Life-Cycle

Local development of digital health solutions were premised on the fact that innovation opportunities and their uptake were not always organic and were often a facilitated process. The demonstration case, MomConnect, does show the need for a facilitated digital health innovation process. The MomConnect Task Team may be regarded, amongst others, as one of the facilitators in the specific initiative. Applying foresight methodologies may propose a useful approach to construct shared understanding on future possibilities (Herselman et al., 2016). There was shared understanding amongst the stakeholders. The proposed rationalisation strategy does take this application into account. Local competencies and skills are essential and should be developed, incorporated and supported (Kruse et al., 2019). In this study, it does show that South Africa has local competencies. However, when closely assessed, the public sector does not have internal competencies within itself.

12.5.3.1 Economic sustainability requirements

Economic sustainability requirements have to be considered. The issue of sustainability is real and is mostly linked to the total cost of ownership. The findings further revealed the need for government to have eHealth budgets even at provincial levels. Creative engagement platforms can help lower the barriers of entrepreneurship (Carlsson et al., 2011). The engagement platforms were not focus areas of the study. However, implementation of the rationalisation strategy may open opportunities for these engagements.

12.5.3.2 A self-directed innovation ecosystem

Allowing innovation to take place in an organic manner based on common interests of various stakeholders, can allow for novel outcomes (Pankomera and Van Greunen, 2018). The stakeholder-centred approach of this study allowed for the expression of the common interests of various stakeholders. The MomConnect demonstration case as well showed that during development and implantation, there was room for common interests. Bridgers and curators help shape the ecosystem. Curators may be described as focusing on sustaining and enriching the quality of the innovation for reuse or adaption by bridgers to other disciplines (Ko et al.,

2019). Bridgers are described as socially well connected stakeholders, with a broad knowledgebase, and are able to link various aspects of the innovation in spontaneous and unusual ways with other stakeholders or innovations (Benson, 2019; (Ko et al., 2019).

12.5.3.3 The users/ Stakeholders

An innovation ecosystem is based on the common interest of all actors in a quadruple helix (government, industry, users or community, and universities) (Sabet et al., 2017). From this study, the MomConnect Task Team and the MAC on eHealth was very much representative of the different sectors. However, the journey of bringing stakeholders in digital health together is still long. Resources (allocation, management, availability), people, partners and technology need to work in a flexible system where there is a culture of innovation (Barron et al., 2016; Waltz et al., 2019). The strategies may contribute to this. It will be difficult to foster an innovation culture outside of strategies which do not explicitly guide this type of culture. For solutions to work in a digital health space, the technologies and people will have to be able to adapt to changes and to focus on a mind-set where capabilities are important to think differently, and where opportunities exist for co-creation (Ikeziri, et al., 2019; Katuu, 2018). Change management was one of the findings that was suggested and recommended, for the success of digital health.

12.6   Contributions of the Study Presented as Themes Emerging from the Study

12.6.1   Knowledge/ Epistemological Themes Emerging from the Study

Knowledge themes are those that may contribute to the body of knowledge and/or academia (Ossebaard and Van Gemert-Pijnen, 2016).

12.6.1.1 The facility as a setting

The local healthcare facility was the most cited area in terms of how its operations would be affected by new implementation of the initiative. The facility is where the patients come in contact with the clinicians, it is also the site of patients' MomConnect subscription. As much as the clinicians' and patients' opinions would be considered as part of the user centred design, the facility operations have to be considered as the setting at which implementation takes place. The workload endured by nurses was one of the critical factors considered. However, the structure also had to be considered in terms of its provision of waiting rooms and/or the consulting room.

12.6.1.2 mHealth is cross-cutting in terms of governments ministries

mHealth, as part of eHealth and mobile technologies, has cross-cutting relationship with other departments such as the Department of Science and Technology and the Department of Telecommunications. These departments may have different mHealth policy priorities in terms

of its technological and clinical domains. Consideration for this relationship became pivotal when issues of sustainability were discussed (Shukla and Sharma, 2016).

12.6.1.3 Political power as highest authority was a motivator for decisions made

There are known strategic research processes, but these were by-passed because the instruction was from the highest political authority. Even researchers felt that their opinions would not matter because of the political and high-profile nature of the MomConnect initiative (Katuu, 2018).

12.6.1.4 The use of mHealth by patients to obtain critical information

Such information was directed to national health, where the NDoH may need to act immediately. The service rendered through mobile technology is from the PHC facilities, the sub-district, district and provincial levels may be by-passed due to the convenience of the technology. However, this also has an effect on national policy and operations.

12.6.1.5 Scale is driven by meeting targets, and sustainability by sustaining the targets achieved

The implementation team was more focused on scale than sustainability in the very beginning of the MomConnect initiative, it was performance driven based on the targets. Once there was sufficient achievement on the targets, the sustainability became critical. Factors which were not critical in the beginning became critical later, such as registering MomConnect as an independent body, contracts for stakeholders, clash of interests among stakeholders should they be on the board of the new body, legal advice was sought, fundraising was also considered amongst others. An mHealth solution targeted at patients only, may be a risk for clinicians.

The task team had to be proactive and design NurseConnect supported by clinicians, mainly nurses. This was due to the fact that patients would be more informed and expect a certain level of service about which they were not sensitised at its inception. Some of the nurses subscribed themselves as patients because they were keen to know the nature of information the patients were receiving.

There are two types of silo implementation in mHealth, external and internal. The external could be described in the context of mHealth services being implemented without involving certain stakeholders who may be of interest; such as the many pilots whose outcomes were not submitted to the NDoH. The internal is one in which stakeholders are involved, but excludes overlapping internal structures such as other HIS and other health programmes. An example in this regard is MomConnect, which excludes health programmes such as EPI, HIS directorate within the National Department of Health.

Furthermore, there are stakeholders who may not be able to represent themselves, with the effect that their voices may not be heard. For instance, the undocumented foreign nationals may not come forth and articulate their needs because they are illegal in the country. However, they have a right to clinical services. The issues of language barriers and ID numbers as identifiers were also alluded to. In such instances, the question may arise (fairly or unfairly): Why should the team plan for illegal expatriates?

12.6.1.6 mHealth as more of a clinical programme than a technology implementation

eHealth coordinators are regarded as health professionals, and should report to a Clinical Directorate for the enhancement of different health programmes through mobile technology. For instance, the MomConnect project manager was a medical specialist in public health epidemiology. It was not recorded why such an appointee was not an IT practitioner or engineering professional appointed for this role. This is attributable to the view that mHealth is focused more on clinical than technological terms.

12.6.1.7 Generation of mHealth funds for mHealth

The generation of such funds should also include the service generating its own funds than relying wholly on government or external funders (Aranda-Jan et al., 2014; Fantana and Pretorius, 2018). One of the suggested models for raising funds for sustainability was to explore MomConnect data to be used by other organisations for research at a cost. The success of mHealth service implementation is fundamentally defined by scale, more than any other factors. There was consensus amongst task team members that the initiative was well implemented, regardless of the gaps and the targets they met. Most participants also expressed that given the time and circumstances, they would definitely re-do what they were doing, and in a similar manner.

12.6.1.8 Patients' need for reassurance

Patients need reassurance that messages received were from a trusted sender, in this case, the Department of Health under whose fiat the MomConnect initiative is implemented. In much the same way that a message from a bank would need some integrity and verification check, the women also raised the concern that MomConnect messages come with a long number. Therefore, it was most preferable and ideal that the word 'MomConnect' should accompany the messages being sent in order that the message is not mistaken for an advertisement. There were also instances where patients mistakenly thought their messages were from the nurses at the clinics, and they would then visit the clinic under the impression that they were SMSed by the nurse for a check-up or something related to MomConnect registration.

12.6.2 Practice Themes Emerging from the Study

Practice themes are those that may enhance practice in a particular field or industry (Barron et al., 2016; Overkamp & Holmlid, 2016). Among other emerging practice themes, the knowledge generated during the implementation of mHealth services may contribute to bridging the gap between documentation of best practice and knowledge on the users when other stakeholders leave the implementing team. There was a parallel process of creating a MomConnect repository. This required all task team members sending copies of all documents in their possession, including minutes, for central storage and future reference. This would also assist consultants to access relevant NDoH records in the course of performing the duties for which their consultancy was sought.

A parallel process of addressing mHealth issues during implementation is possible, as opposed to waiting for all issues to be addressed before implementation occurs. Stakeholders knew of the mHealth gaps since they worked in that environment. However, the opportunity of reaching a milestone of implementing a national mHealth service was a key motivator. Activities such as MandE, the retraining of nurses, and operational research were performed concurrently with implementation for scaling.

By virtue of its practitioner-researcher methodological orientation, the study has necessarily accentuated the pivotal and indispensable role of multi-professional healthcare and IT professionals in digital health innovations (design and implementation). Such a grassroots approach is conducive for avoidance of duplication of digital health services and products; thus, rendering better interoperability of digital health initiatives such as MomConntect (Kabongo et al., 2019; Ngoc et al., 2018). It is the well-considered view of the study that such collaborated involvement is seminal and effectively integrates clinical practice to end-user needs, which is indeed desirable in further preventing a state of perpetual 'pilotitis' and wastage of funds.

12.6.2.1 Patient-facing mHealth service

Patient-facing PHC service is still dependent on fixed physical facilities for complete subscription. Accordingly, patients have to come to a facility for subscription, after which they then receive the requisite registration information such as EDD. Notwithstanding, it is still critically important to explore other ways by which patients could receive mHealth services at home before they went to the primary health care facility.

12.6.2.2 Lack of documented best practices

Lack of documented best practices necessitated stakeholder suggestions and unanimous agreements. In a case where there is no evidence and best practice to refer to, stakeholders rely on their own experience to rationalise decisions (Hwabamungu et al., 2018; Salgado et

al., 2017; Wolff-Piggott et al., 2018). The lack of clear step-by-step guidance for both mHealth and eHealth strategy has also led to task team members' reliance on team suggestions and judgement.

12.6.2.3 There is selection bias in mHealth meetings

Most people who are averse to technology (e.g. older nurses) are not engaged in service design. However, they do impact on implementation and scale because they are also based in the facilities.

12.6.2.4 The first and new MACeH

The first Ministerial Advisory Committee on eHealth in South Africa is a step towards coalition and eHealth centralisation (Hwabamungua et al., 2018). This committee represents almost all nine provinces, research and academic institutes, as well as the NGO sector.

12.6.3 Theory Themes that Emerged from the Study

Theory themes are those themes that may contribute to the study's theoretical grounding (Kuziemsky et al., 2009). The theory of constraints (ToC) (ToT) served as a tool to evaluate the entire process of development and implementation of mHealth service, including its current trends and future projections for a re-engineered version of mHealth. The ToC assisted in obtaining data on what was planned, what actually happened, and what is considered as ideal regardless of the planned and actual events.

In this study, the ToC provided the conceptual guidance/ parameters for the researcher's development of the ten mobile health re-engineering strategy implementation framework areas as a pragmatic attempt to utilise the findings as an enhancement of practice (Gurupur and Wan, 2017; Ikeziri et al., 2019; Tabish & Nabil, 2013). The ten framework areas are clearly articulated in Section 12.3 (p. 236) of this study and demonstrate the extent of the study's achievement of the objective (of proposing an mHealth implementation strategy based on best demonstrated practices and learnt stakeholder experiences). By virtue of its emphasis on, amongst others, establishing the simplicity framework within which limiting organisational and technology-induced factors could be removed in implementation of stakeholder-centred mobile health initiatives (Groop et al., 2010), the ToC provided insights for the identification of organisational constraints to sustainability and scalability of the MomConnect initiative. Therefore, it was on the basis of such constraint identification that the ten strategy implementation framework areas were developed to identify limiting factors to organisations (e.g. the NDOH as MomConnect custodian) achieving their goals and increasing their throughput (Groop et al., 2010; Tabish and Nabil 2013).

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This study assisted in understanding of the stakeholder theory as an inquiry principle from a group of stakeholders involved in a service (Marcolino et al., 2018). This theory was applied as a principle to consult and evaluate stakeholder needs from their end-user perspectives and for the success of the mHealth. The rationalisation theory assisted in understanding reasons for a group of stakeholders, who are aware of policies within the health sector, to ignore, overwrite and/or go against such policy when faced with decisions in the field; and also provision of reasons (rationalisation) for such resistance. The theory further enabled the proposition of suggestions for changes in policy to de-rationalise resistance or opposition.

The strong structuration theory (SST) can be used as a tool to synthesise data for the conceptualisation of structures, agents and feedback in the enhancement of nursing, health care and technology practice (Bernardi, 2018; Greenhalgh et al., 2018). Through the SST, clarity was obtained concerning the actions and motivations of agents in bypassing structures. In all interactions, agents acknowledged the barriers caused by structures and gave feedback in order to inform improvement of the structures. The use of knowledge, skills and experience to execute a task regardless of limitation caused by structures, illuminated on how structures can be modified in order to apply knowledge, experience and skills that agents gain over time.

Service design research also contributes to the design of a strategy (Coleman et al., 2017). Additionally, service design research has provided solid mapping of development and implementation of mHealth services that could be translated into a strategy based, on the data that the theory of constraints has generated (Chen, 2016).

12.6.4 Applied Knowledge Themes that Emerged from the Study

Applied knowledge themes are those themes that may contribute to what is already known (Tappen, 2016). What is already known in the field of mHealth either from peer reviewed literature, grey literature and from practice, does influence decision making in the provision of services. There is a need for collaboration between academia and those in the field for purposes of strengthening mHealth rigour. Change in policy is a process that may take long, and the digital environment may not wait for the formal process. This is the difference between the private and public sectors (Iribarren et al., 2017). In respect of applied knowledge, the study has alluded in various sections to the role and value of the practitioner-researcher perspective in terms of which ten strategy implementation framework areas were developed by the researcher as the seminal outcome of this study.

12.6.5 Methodology Themes that Emerged from the Study

Methodology themes are those themes that may contribute to the use of research methods and justifications thereof (Baniasadi et al., 2018; Goldkuhl and Sjöström, 2015). Using multiple data collection methods assisted with the validation and authentication of the findings and

provided in-depth understanding of practice in the field (Goldkuhl and Sjöström, 2015). Furthermore, the ethnographic process within health care was experienced as a replay of the data from archived minutes, interviews and focus group discussions - especially as the last method of data collection.

Regarding the use of data, the MomConnect Task Team minutes provided a clear map of how the mHealth service was implemented. Such clarity also assisted in understanding of the prevailing constraints and concomitant action taken to resolve them. From this experience, the archived data was important for further understanding of stakeholders' collaboration, interpersonal relationships, and their rationalised decisions.

The ethnographic process made sense of the actions of agents and the arrangement of structures. Through interactions, reasoning and collaboration, was understood why undocumented insight possessed by agents was key in the success of the initiative. The limitation caused by structures was also observed, as well as the manner in which agents inform structures formally and informally in order to harmonise their interaction.

Stakeholder relationship mapping shows how agents use their own deliverables and performance in order to assess the nature of a relationship in the context of other agents and the applicable technology. Stakeholder relationships were weighed according to their inter-dependent needs in the completion of their own deliverables.

12.6.5.1 The use of a demonstration case

The MomConnect initiative was used in this study as a demonstration case, and not as a case study. Accordingly, while the research methods may not be dissimilar to a case study, the research setting of the current study and related methods made it easier for the researcher to access the identified and sampled participants to relate their experiences. Most importantly, their decision-making and rationale was a critical factor in relation to the demonstration case. Additionally, the demonstrative aspect also made it easier to give related examples of other mHealth initiatives and experiences. This factor was crucial in the differentiation with a typical case study, whose research environment would constitute the essential background against which examples are cited (Yin, 2016). Based on the peculiarities of the study and its five-fold data collection trajectory, the study makes a unique contribution to the body of knowledge by the perennial assertiveness of the researcher as practitioner in the generation of knowledge. This contribution is addressed further in Chapter Thirteen as the researcher's own reflective thoughts and contribution of the study.

12.7 Strengths of the Study

The key strength of this study lies in its systematic application of review methods to a field in which such methods have been rarely applied. As such, the researcher was able to transcend possible barriers associated with a cross-analysis of data residing within multiple stakeholder categories in a public sector setting (Nyström et al., 2018; Serrano et al., 2020). In addition to the strength of a convergent cross-analysis, the study critically focused on the delivery end more than the development and/ or design. Such an orientation resonates with the MomConnect's most profound aspect, that is: scalability and sustainability, although the latter is viewed as more of the focal issue than the former (scalability). By focusing on sustainability, the researcher considered that the end-users and beneficiaries of MomConnect, the pregnant mothers using ANC and MWCH services, were the group on whom the nexus between technology and health care services was most testable.

12.8 Recommendations for Further Research

More studies need to be undertaken, focusing particularly on the incorporation of mobile technologies in health care aspects such as service design and programming, digital health as a support mechanism for universal coverage, economic evaluation of mHealth, retrospective analysis on mHealth initiatives and capacity building for clinicians in information and communication technologies as a tool to enhance service delivery (Grover and Lyytinen, 2015). Such focus has the capacity to contribute to mHealth research, especially for the benefit of the majority of underserved communities in developing countries (Chigona et al., 2012; Iribarren et al., 2017; Ngoc et al., 2018; WHO, 2011).

12.9 Limitations of the Study

The study did not consider the financial context and implications of implementing a re-engineered eHealth strategy. This study is entirely qualitative, and its findings may not necessarily be generalisable. In addition, the MomConnect demonstration case focuses on maternal, child and women's health, which may limit perspectives that are applicable to other health programmes in mHealth services. At the time of conducting this study, only MomConnect had been rolled-out on a national scale in South Africa in the context of the National Department of Health's implementation framework. There may be other contexts not addressed in this study.

12.10 Conclusion

This study has laid a foundation for inquiry in public sector mHealth. The lived experiences of the professionals, practitioners and end-users are provided and discussed as obtained from actual observations, verbal statements and written accounts such as minutes or records of meetings. It is the considered view of the researcher that it is the actual ***words*** and

experiences of the practitioners and professionals in mobile health that will inform and educate the sector/ industry and academics in the universities about the practice realities and challenges being experienced. As products of the self-same universities that prepared their postgraduate students for the field, as researchers, the academic institutions ought to be reciprocated on feedback pertaining to these students' research based experiences in the field without the resort to autobiographies and their attendant limited audiences.

CHAPTER 13: CONTRIBUTION AND REFLECTION

CHAPTER ONE: Rationale and Scope of the Study

CHAPTER TWO: Theoretical and Empirical Foundations and Location within Literature

CHAPTER THREE: Description of the Research Methodology

CHAPTER FOUR: Local Practice as The Case: MomConnect Innitiative

CHAPTER FIVE: Situational Inquiry and Theorising (Phase 2)

CHAPTER SIX: Stakeholder Analysis (Phase 2)

CHAPTER SEVEN: Practice Based Analysis: Phase 3 (NASSS Framework)

CHAPTER EIGHT: Practice Based Analysis: Phase 4 (Principles of Digital Development)

CHAPTER NINE: Practice Based Analysis: Phase 5 (Global Digital Health Index)

CHAPTER TEN: Synthesis as Convergence of Findings from Phases 1 to 5: Using Strong Structuration Theory as Lens

CHAPTER ELEVEN: Practice Enhancement: An Evolving Stakeholder Centred Strategy for Mobile Health re-Engineering

CHAPTER TWELVE: Discussion of The Findings As a Mechanism to Highlight Insights From The Study

CHAPTER THIRTEEN:

- Introduction
- Background to the Research Journey
- My Attendance of MomConnect Task Team Meetings
- Reflections on Contributions of the Study
- Remarks of the Researcher on Research Journey
- Conclusion

"Practice research means research into some practice(s) with the purpose to improve such and similar practices" (Goldkuhl and Sjöström, 2015:5).

"…it is increasingly important to find out what the writing challenges and practices are for postgraduate students, not only by focusing on their research texts but also by critically engaging with written feedback given to these students as they struggle to engage with the academic discourse of the institution" (Chamberlain, 2016:18).

"My role as both researcher and fellow student gives me an advantageous 'insider's' vantage point from which to foreground my fellow students' voices which might not otherwise be heard" (Vyncke, 2012:7).

13.1 Introduction

The uniqueness of this chapter compels a brief revisitation of the structure of this thesis as a whole in terms of the organisation of its chapters. The fundamental purpose of the current chapter is to provide a synoptic perspective of the researcher regarding ***his own*** reflections on the study's ***contribution*** and the salience of his ***experiences*** during the research journey, a journey of many destinations. Accordingly, the uniqueness premises precisely on the collective effect of both the contribution of the study and the researcher's reflected experiences. In this regard, reference to the structure of the thesis (see p. xvi) situates the current chapter into a noticeable and emphatically differentiated mode of conversation/ discourse. In the previous twelve chapters, three critical research variables or units of analysis are ubiquitously evident, namely: the research participants (multiple stakeholder categories) as the primary data ***sources***, the multiple data collection ***methods***, and the eclectic data analysis modes that are not the same in each chapter.

For purposes of the present discussion, it is worth mentioning writ large that in the self-same chapters, the explicit view or researcher's 'authorial voice' (Vyncke, 2012) is somewhat 'muted'. That is to say, the researcher is present insofar as he adopts and periodically makes reference to the practitioner-researcher methodological approach that so pivotally characterises the nature of this study. In that regard, the presence of the researcher in all twelve preceding chapters was essentially premised on the methodological and academically defined prescripts or conventions of practice research and its lexical or conceptual variants; that is, pragmatism, practitioner-research, reflective practice, research in practice, and so on (Goldkuhl & Lagsten, 2012; Goldkuhl & Sjöström, 2015). In fact, Goldkuhl and Lagsten (2012) categorically differentiates the relational form (theoreticity) and substance (practice) of practice research on account of prepositional relations, for instance: research ***about*** practice premises on theorising about practices; research ***for*** practice focuses on the creation of valuable knowledge for practices; research ***in*** practice is situated in the close study of practices with the benefit of unconstrained access to pertinent or 'privileged' information and data; and research ***with*** practice addresses collaborated inquiry with practitioners or professionals; while research ***from*** practice premises on knowledge construction on account of developments in the practices/profession or field of study.

13.2 Background to the Research Journey

For purposes of the current chapter, the background to the research journey specifically relates to the ***educational*** and ***professiona***l factors that influenced or shaped both the interest in, and trajectory of the study. These afore-cited factors are of paramount significance, since they are necessarily the actual precursors to the research methodological approach that is pivotal to this study from its commencement and conclusion. As mentioned earlier, the researcher does not appear in the first person in all of the twelve preceding chapters, which does not in any way suggest any unreflective engagement on his part in those chapters. However, the mere essentialisation of the researcher's reflection or reflective thoughts in this chapter directs that ***'the researcher'*** (which suggests neutrality or scientific objectivity) is then personified in the first person ***'I'*** (which demonstrates personal and experienced engagement and perspective). Therefore, I contend that the shift from 'the researcher' (which appears 122 times throughout this study) to 'I' in the current chapter is ***not*** superficial, but poignantly encapsulates ideological, intellectual, academic, disciplinary, professional and other related perspectives on the part of both myself and my academic supervisors.

I contend further that my supervisors' guidance and advice concerning the approach to this chapter signifies two important aspects. Firstly, it highlights the supervisors' realisation and acknowledgement of the role and importance of my own 'exclusive' thoughts and reflection, notwithstanding that I have already done so in varying degrees throughout the preceding chapters, not without some methodological or academic restrictions. It is to their academic and intellectual credit and expertise that I am offered the opportunity to provide my own reflective thoughts within the confines of allowable space in this chapter. Rarely does such an opportunity get presented to postgraduate students by their academic supervisor/s, it may be construed 'unacademic' in some instances (Chamberlain, 2016; Vyncke, 2012).

Secondly, it is my further contention that both my educational background and professional training and experience (see page xxix in this study) informed my academic supervisors' intellectual predisposition and expert realisation that a study of this nature would - in addition to the practitioner-researcher methodological and knowledge generation perspective – benefit from an infusion of my personal perspective/s derived from observed and learnt ***experiences*** during this journey that metamorphosed from practitioner to researcher-practitioner to researcher, with the importance of application in practice. The latter approach/es entail/s the practical and real-time juxtaposition and interchangeability of roles as researcher, practitioner, PhD student (and possibly back to researcher again) in an intensive educational activity (i.e. research) especially designed for practitioners as 'student researchers' (Nyström et al., 2018). As a practitioner, my selection of research topic, its rational and scope were all factors that were motivated by my work-related challenges and the general problem of pilotitis that was discussed in most, if not all digital health engagements.

It is my considered view that, it is the words and experiences of the practitioners and professionals in mobile health (such as myself) that will inform and educate the industry and academics in the universities about the realities and challenges being experienced. As products of the self-same universities that prepared their postgraduate students for the field, as researchers, the academic institutions ought to be reciprocated on feedback pertaining to these students' research-based experiences in the field without the resort to autobiographies and their limited audiences. The current (hierarchical) form of predominantly Western higher education academic systems and their canonically-steeped intellectual cultures and conventions of knowledge generation, dissemination and community engagement tend to be viewed as promoting elitism epistemological hegemony or 'superiority' of some disciplines or field of study (and their methods) over others (Vyncke, 2012). Such perceptions are an affront to epistemological diversity.

13.2.1 My Attendance of MomConnect Task Team Meetings

My attendance of the MomConnect Task Team's monthly multitasking meetings warrants particular mentioning. By virtue of its composition and mandate, it is this task team that served as the interstitial domain between MomConnect's policy and implementation environments. In addition, clarity is provided on the chronological sense of the study, as well as the 'insider' advantage that stood the practitioner-researcher methodological orientation in good stead and advantage. I was part of these meetings since I was involved in the MomConnect initiatives in various capacities. When I formally undertook the research, I subsequently attended six meetings between January 2018 and June 2018 (one meeting per month). So, I was part of those meetings as a full-time staff member of the National Department of Health, as a seconded representative by various NGOs, and as a researcher or PhD candidate/ student researcher. For purposes of avoiding repetition, a full spectrum of my involvement in the MomConnect through the NDOH is presented from pages 158-160 of this study, in addition to my synoptically presented professional or work-/ practice-related experience. Subsequent to NDOH ethical clearance, I was privy to 46 archived records and reports of meetings that I reviewed as part of gathering data relating to government's MomConnect initiative.

13.3 Reflections on Contributions of the Study

My reflections on the study's contributions are mainly demonstrative of my experiences during the research journey. The previous chapter (Chapter Twelve) mainly presented and discussed the main findings of the study, with emphasis on their relevance to the key research objectives and their attendant research questions (Baniasadi et al., 2018; Brink et al., 2013; Tilahun, 2017). It is my view that the preceding chapter necessarily constitutes an informed prelude to the core of the current chapter's reflected thoughts. For instance, Section 12.2 and Section 12.4 jointly reflect my critical engagement in establishing the findings as a natural consequence and development flowing undistorted from both the research questions and objectives (Brink

et al., 2013; Bradbury-Jones et al., 2014). On the other hand, Section 12.7 emphatically locates the cross-analytic or convergent mode of data analysis as one of the indispensable enablers in unravelling the multi-modal data collection approaches.

13.3.1 Remarks of the Researcher on Research Journey

The research journey has been stimulating and also limiting. The latter premises mainly on the nature of expectations in a doctoral project to demonstrate the application of theory/ philosophical paradigms to practical situations. It was my declared intention to bring out knowledge that lies 'incubated' or in figurative pilotitis in the heads of professionals working in the mHealth sector, also bearing in mind that they were not necessarily academics. They are academic experts whose experience could augment to the body of knowledge outside of the academic libraries.

The basic contribution of this study is not in the value arguing against any theories or previous studies, but to add to broader understanding of the field. In one of my conversations with fellow students during a doctoral colloquium, they mentioned that my work (research) looked more like that of a consultant than exegetic academic work. Notwithstanding such criticism (stemming from the inherent academicization of any form of university-approved research undertaking, it is my resolute aim through this dissertation to ensure that its empirical findings inspire other 'unacademic' researchers to make their contribution to the body of knowledge. Fitting the findings into existing mHealth theories was a challenge, it was desirable that the empirical evidence should retain its raw and original state as presented respectively in Chapter Five and Appendix Q. It was stimulating to gather and understand what is available in the minds of the participating stakeholders and utilising that to inform the academics. My own experiences (particularly engagements with the MomConnect Task Team and facility-level implementers and users) were invaluable in my interactions with professionals in the field through critical activity, in terms of which human experience is not suppressed, and is also not allowed to dominate the generality of being human (Reason, 1988).

The MomConnect initiative is a product of the National Department of Health's national digital health strategy (NDHS) intended to meet health targets and simultaneously maintaining its scalability and sustainability momentum (Leon et al., 2012; Peter et al., 2018. The selection of my research topic was inspired by the desire for 'something' that 'made sense' to someone in practice and be relevant to academia at the same time. Merging the two, the academic and the practice propensity presented a challenge, given the somewhat rigid research methodological protocols. The selection of the research methodology had had to be predominantly narrative (qualitative) because it was clear what the research problem is. I was seized with the desire to obtain the first-hand accounts of all stakeholders. This was not without some issues, which required my optimum self-monitoring amidst the various roles I had assumed up to that point in time. For instance, during certain stages of the interviews, some

of my colleagues (whom I had to treat strictly as research participants) would say, " … but you know what the problem is … " in response to my questions. It is in such specific instances that the researcher-practitioner-researcher cycle prominently played itself out and resorted to retorting: "I am now doing research, and not at work. So, please explain to me …". When it came to stakeholder analysis, it was interesting to notice how stakeholders viewed their relationship among themselves and the NDoH as the main stakeholder. Their reactions and responses oscillated from absurdity (professional antagonisms) to the absolutely heartfelt respect for each other.

I was most comfortable with all the practice-based aspects of the study because they related to practice, what I do, what I know and how I think as a practitioner. Although I had never used the NASSS framework in my practice, I found it to be a very relevant measuring instrument to what I know as best practice in my field as mHealth practitioner. I have used the PDD (Principles for Digital Development) in my actual work-related projects, and I had never previously read a peer reviewed article about the application of the NASSS framework. It is now a matter of interest how I will use and apply a real-world tool such as the NASSS to make practical sense of my research findings. In this regard, knowledge generated from the study will be confidently applied as a non-conflictual and indivisible product of non-theoretical stakeholder-driven (real-world/ practical) and some relevant theoretical constructs (Bull et al., 2016:406).

It was a great feeling for me that I had addressed all research questions, but the most interesting part was finding a solution based on both practice and research – an indication that these two perspectives were complementary rather than contradictory. In that regard, I was neither too practical nor too theoretical. I was real, as the problem is real. From a practitioner perspective, it was liberating that I could conceptualise the field problem in such a way that it could be answered by means of different data collection tools and methods. Above all, my most enduring reflective thought as both practitioner and researcher premises on the extent to which the study helped me to 'find' my identity. Before anything else, I was a practitioner, and research was a project to enhance the resolution of a practice-related problem and to advance the full academic requirements for a doctoral qualification. However, after this research, I still had to go back and practice in my field as I had also become 'nostalgic' due to thinking of my colleagues throughout my research journey.

13.4 Conclusion

The career in medical informatics is not linear, at least for me. It is mostly determined by one's experience and repertoire of skills. There are different titles, and I had different titles in my career history. However, I regard myself as Medical Informatician who transitioned from being a clinician, as prescribed by the primary registration requirements of the Health Professions Council in South Africa. My Master's degree was conferred with specialisation in Medical

Informatics. However, as a result of the knowledge/experience and qualifications dichotomy, one has to constantly focus on required experience by employers than on one's academic qualifications to check suitability whenever there are job opportunities. Table 13.1 below exemplifies how my personal repertoire of skills and qualifications would 'comply' with conventional job applications.

Table 13-1: Exemplification of employment suitability

Attribute	Requirement
Knowledge	The journey of this research has made me to find myself as a professional – Medical Informatician. I have had the opportunity to collaborate with different experts, clinicians, software developers, project manners, health program managers and create knowledge based on their evidence, experience and traditions.
Skills	I have had the opportunity to examine complex information systems in collaboration with different stakeholders in order to implement digital health initiatives.
Competencies	My competence in terms of applying ICT- based solutions to healthcare was enhanced. I have had a unique opportunity and experience in the field of ICT for Health.
Types of Information	I have had exposure to different kinds of information both as a practitioner and researcher.
Medical Culture	I did not struggle with culture fit, because I have always worked in such an environment. I have had the opportunity to contribute to strategy and policy development.
Erudition and unique qualifications	Since I started my career as a clinician and postgraduate in Medical Informatics at Master's level, this background has enabled me to be a facilitator in such a multidisciplinary environment due to the versatility of my academic background.

Table 13.1 above demonstrates how my current professional and academic background and experience would fit in the current regime of job applications. I was able to develop the tabulated information with the use of Vinarova & Mihova (2010) comparative analysis table of the profession of Medical Informatician. The rationale of the above table is to demonstrate the practice-related relevance of Medical Informatics as a field steeped more in practice than in the abstract world of theory (Letts, 2013).

Epilogue:

"Postgraduate students come with a range of academic experiences and language ability. The culture and norms of the diverse student populations add to the pressure of supervisors coping with the diversifying genres of research writing" Chamberlain, 2016:4).

" … professional contexts are the sites of study; there are blurred boundaries between inquiry and practice; community and collaboration are important constructs; and they act to make new knowledge public and have this new knowledge led to improved practice (Letts, 2013:478).

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APPENDIX A: CPUT ETHICAL CLEARANCE

Cape Peninsula
University of Technology

P.O. Box 652 • Cape Town 8000 South Africa •Tel: +27 21 469 1012 • Fax +27 21 469 1002
80 Roeland Street, Vredehoek, Cape Town 8001
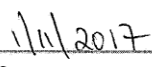
Office of the Research Ethics Committee	Faculty of Informatics and Design

Ethics approval was granted to Idon Nkhenso Sibuyi student number 216301092 on 1

November 2017 for research activities related to the PhD in Informatics at the Faculty of

Informatics and Design, Cape Peninsula University of Technology.

Title of dissertation/thesis:	Implementation of mobile health technology as an enhancement tool for health services in South Africa: a stakeholder centered exploration

Comments

  a) Research activities are restricted to those detailed in the research proposal.
  b) Formal consent will need to be obtained from the National Department of Health.

[signature]	1\11\2017
Signed: Faculty Research Ethics Committee	Date

APPENDIX B: RESEARCHER'S REQUEST LETTER TO NATIONAL DEPARTMENT OF HEALTH

Director: Health Research   21 November 2017

National Department of Health, South Africa

Private Bag X828

PRETORIA

0001

Dear Tshilidzi Muthivhi

Consent to Conduct a Study for Academic Purposes: MomConnect Initiative

I am a postgraduate student enrolled for a Doctoral degree in Informatics at the Cape Peninsula University of Technology (CPUT). As part of my job, I am involved in the HIV component of the MomConnect Initiative known as MomConnect PMTCT. I am a health professional registered in independent practice by Health Professions Council of South Africa (HPCSA) as an Optometrist.

I humbly request consent of the National Department of Health in South Africa to conduct the study titled "Implementation of Mobile Health Technology as an Enhancement Tool for Health Services in South Africa".

The objective of the study is to design a stakeholder-centered mHealth service implementation strategy as part of an ecosystem for digital and personal connected health initiatives that enhance health and well-being services. There are two levels in which study may contribute to the body of knowledge and NDoH, namely, the national scale up of mHealth initiatives and sustainability thereof; and the implementation, design, and evaluation of the eHealth Strategy as intended by the establishment of the Ministerial Advisory Committee on eHealth.

Data will be collected by means of questionnaires for stakeholder mapping, interviews with the key informants, document review in MomConnect repository and focus group discussions with users (pregnant women and mothers) at facilities. Data will be analysed by means of content and thematic analysis for qualitative part and software for quantitative part. The sampling for this study is judgemental.

Key informants for the study will be as follows:

- Staff who were involved (directly or indirectly) in the MomConnect Initiative from the NDoH, Provinces, District, Sub-district and Facilities (Through interviews).
- MomConnect Repository (Through document Review).
- MomConnect Task Team Members (Through both interviews and questionnaire).
- Pregnant Women & Mothers (Through Focus Group Discussions at facility level).

The focus of the study is on health as a service (from a service design perspective) and mHealth from patient facing service perspective, especially to empower patients to take care of themselves and able to engage with the health services from outside the health facility. This study is purely on service implementation and does not include any clinical outcomes, behavior change or impact evaluation of MomConnect.

I am attaching the following to this letter:

- Ethical Clearance from the University (CPUT)
- The Research Proposal

1

- Data Collection Tools
- Participant Information Sheet & Informed Consent

I am looking forward to a formal consent to conduct this study

Regards,

....

Idon Nkhenso Sibuyi

CPUT Student Number: 216301092

PO Box 2151, Rant-En-Dal, 1751

Mobile: +2783 338 9132

Fax-to-Mail: 086 776 4235

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APPENDIX C: RESEARCHER'S REQUEST LETTER TO GAUTENG PROVINCE AND CITY OF JOHANNESBURG DEPARTMENTS OF HEALTH

27 November 2017

To: Director of Health Research

Gauteng Department of Health, South Africa	AND	City of Johannesburg, South Africa
Private Bag X85		PO Box 1049
MARSHALTOWN		JOHANNESBURG
2107		2000

Sir

Consent to Conduct a Study for Academic Purposes at Johannesburg Health District (Region F): MomConnect Initiative

I am a postgraduate student enrolled for a Doctoral degree in Informatics at the Cape Peninsula University of Technology (CPUT). As part of my job, I am involved in the HIV component of the MomConnect initiative known as MomConnect PMTCT at National Department of Health. I am a health professional registered in independent practice by Health Professions Council of South Africa (HPCSA) as an Optometrist.

I humbly request consent of the Gauteng Department of Health in South Africa to conduct the study titled "Implementation of Mobile Health Technology as an Enhancement Tool for Health Services in South Africa". The research question, objective and outcome of the study are as follows:

- Research question: What are the design considerations of an m-health service implementation strategy where mobile technologies are infused in healthcare services (scalable and sustainable), from a stakeholder-centered perspective.
- Research Objective: To design a stakeholder-centered mHealth service implementation strategy as part of an ecosystem for digital and personal connected health projects that enhance health and well-being service.
- Primary outcome: An mHealth implementation strategy that prioritieses scale-up, sustainability, best practice, practical processes, integration, benchmarking, ethical considerations and stakeholders-centered service design perspective that may inform and be relevant to other digital and personal connected health services given the health Sustainable Development Goals in South Africa.

There are two levels in which study may contribute to the body of knowledge and NDoH, namely, the national scale up of mHealth initiatives and sustainability thereof; and the implementation, design, and evaluation of the eHealth Strategy as intended by the establishment of the Ministerial Advisory Committee on eHealth.

From Gauteng Department of Health, the study will be conducted at four sites located in inner-city Johannesburg, in the Johannesburg Health District within sub-district F. These sites include the Shandukani Maternal and Child Health Centre (Midwife Obstetric Unit), located in

- Hillbrow Community Health Centre.

1

and the following 3 primary health care (PHC) referring facilities:

- Yeoville Clinic,
- Jeppestown Clinic, and
- 80 Albert Street Clinic.

Data will be analysed by means of content and thematic analysis for qualitative part and software for quantitative part. The sampling for this study is judgmental.

Key informants for the study will be as follows:

- Pregnant women & mothers above the age of 18 (Through Focus Group Discussions at facility level).

The focus of the study is on health as a service (from a service design perspective) and mHealth from patient facing service perspective, especially to empower patients to take care of themselves and able to engage with the health services from outside the health facility. This study is purely on service implementation and does not include any clinical outcomes, behavior change or impact evaluation of MomConnect.

I am attaching the following to this letter:

- Ethical Clearance from the University (CPUT)
- The Research Proposal
- Data Collection Tools
- Participant Information Sheet & Informed Consent
- List of participants and time needed for data collection

I am looking forward to a formal consent to conduct this study

Regards,

....

Idon Nkhenso Sibuyi

CPUT Student Number: 216301092

PO Box 2151, Rant-En-Dal, 1751

Mobile: +2783 338 9132

Fax-to-Mail: 086 776 4235

Email: insibuyioptometrist@gmail.com

2

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APPENDIX D: APPROVAL LETTER FROM NATIONAL DEPARTMENT OF HEALTH

DIRECTOR GENERAL
HEALTH
REPUBLIC OF SOUTH AFRICA

PRETORIA
Private Bag X828, PRETORIA, 0001, 27th Floor, Room 2710, Civitas Building, Cnr Thabo Sehume & Struben Street, PRETORIA, 0001 Tel: 012 395 8000, Fax: 012 395 8422
CAPE TOWN
P.O. Box 3875, CAPE TOWN, 8000, 8th Floor, Room 817, 103 Parliament Towers, Plein Street, CAPE TOWN, 8000 Tel: 021 461 2040, Fax: 021 461 6864

Mr Idon Nkhenso Sibuyi
P.O. Box 2151
Rant-En-Dal
KRUGERSDORP
1751

Dear Mr Sibuyi

PERMISSION TO INTERVIEW OFFICIALS OF THE NATIONAL DEPARTMENT OF HEALTH ON IMPLEMENTATION OF MOBILE HEALTH TECHNOLOGY

Your application letter dated 31 November 2017 refers

1. RESOLUTION AND APPROVAL
It was recently resolved by the Directorate: Health Research in consultation with the affected Units within the National Department of Health (NDoH) that; the request for permission to conduct the study according to the following Protocol be approved:-

Study title: Implementation of Mobile Health Technology as an Enhancement Tool for Health Services in South Africa: A Stakeholder-Centered Exploration.

1.1 BEFORE THE COMMENCEMENT OF THE STUDY
Pease note: Copies of written Research Ethics Committee approval to be submitted to the NDoH before study commences

2. AUTHORISATION
Authorisation is hereby granted to interview the following officials within the NDoH
- Members of the Ministerial Advisory Committee on eHealth
- Deputy Director-General: HIV/AIDS, TB and Maternal Child and Women Health;
- Technical Assistant of the NDoH
- Project Manager of MomConnect
- Chief Director: Child and Youth Health
- Chief Director: Health Information, Research, Monitoring and Evaluation
- Director: Maternal and Neonatal Health
- Director: Strategic Planning

- Director: National Health Information Systems
- Deputy Director: National Health Information Systems
- Deputy Director: MomConnect Helpdesk
- PMTCT Coordinator
- MomConnect Helpdesk Coordinator

3. PLEASE FORWARD

It is a requirement that a copy of this letter be forwarded to all the relevant NDoH officials, including the approving Research Ethics Committee(s).

4. THIS AUTHORISATION IS SUBJECT TO THE FOLLOWING PROVISOS

(a) The NDoH shall be notified of any decision to discontinue the research study. The reason for such cancellation shall be stated.

(b) The Research study shall be conducted in accordance with the Protocol submitted to the NDoH. Any Amendment(s) to the Protocol, shall first be submitted to the NDoH.

5. PROGRESS REPORT

Submission and presentation of the final report of the study with recommendations to the NDoH is required.

6. INFORMED CONSENT

It is the NDoH requirement that in all research projects the 'Principle of Informed Consent' should be adhered to. This applies to research study volunteers and participants.

Yours sincerely

MS MP MATSOSO
DIRECTOR-GENERAL: HEALTH
DATE:

APPENDIX E: APPROVAL LETTER FROM GAUTENG PROVINCE AND CITY OF JOHANNESBURG DEPARTMENTS OF HEALTH

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

Jo'burg
a world class African city

JOHANNESBURG HEALTH DISTRICT

Faculty Of Health Sciences
Health And Wellness Sciences Research Ethics Committee
Cape Peninsula University of Technology
Cape Town, South Africa
nsibuyioptometrist@gmail.com

DRC Ref: 2017-12-003

NHRD Ref no: GP_201712_006

Enquiries: Dr EM Ohaju
Tel: 011 694 3888 Cell: 076 8831659
Email: Elizabeth.Ohaju@gauteng.gov.za

Hillbrow CHC: Administration Building
Cr Smith Str. & Klein Street
Private Bag X21, Johannesburg
South Africa, 2017

Dear: MR Idon Nkhenso Sibuyi

Re: *IMPLEMENTATION OF MOBILE HEALTH TECHNOLOGY AS AN ENHANCEMENT TOOL FOR HEALTH SERVICES IN SOUTH AFRICA: A STAKEHOLDER-CENTERED EXPLORATION*

Your application dated **2017/12/04** refers.

The District Research Committee has reviewed your application. This letter serves as an in-principle approval to access the Districts Health facilities (mentioned below) for the above project subject to following conditions:

- The facility to be visited: **80 ALBERT STREET CLINIC, HILLBROW CHC, JEPPE CLINIC, YEOVILLE CLINIC**

- This facility will be visited from **25/01/2018 to 25/01/2019**

- The research can only commence after you submit an ethics clearance certificate from a recognized institution. -

- You will report to the Facility Manager before initiating the study.

Region	Regional Health Manager	Contact No.	Cell phone
ABEF	Ms Matlala	011 440 1231	082 307 0267
F (LA)	Oupa Montsioa	011 681 8130	082 467 9423

- Participants' rights and confidentiality will be maintained all the time.
- No resources (Financial, material and human resources) from the above facilities will be used for the study. Neither the District nor the facility will incur any additional cost for this study.
- The study will comply with **Publicly Financed Research and Development Act, 2008 (Act 51 of 2008) and its related Regulations.**

- You will submit a copy (electronic and hard copy) of your final report. In addition, you will submit a six-monthly progress report to the District Research Committee.
- Your supervisor and Cape Peninsula University of Technology will ensure that these reports are being submitted timeously to the District Research Committee.
- The District must be acknowledged in all the reports/publications generated from the research and a copy of these reports/publications must be submitted to the District Research Committee.

We reserve our right to withdraw our approval, if you breach any of the conditions mentioned above.

Please feel free to contact us, if you have any further queries. On behalf of the District Research Committee, we would like to thank you for choosing our District to conduct such an important study.

Regards,

Dr EM Ohaju
Chairperson: District Research Committee
Johannesburg Health District
Date 8/02/2018

Mrs M. Morewane
Chief Director
Johannesburg Health District
Date: 09/02/2018

APPENDIX F: AMENDMENT OF RESEARCH TOPIC

01 April 2019

Mr IN Sibuyi
PO Box 2151
Rant-en-Dal
1751

Dear Mr Sibuyi
Re: Approval of Amended Research Title
Student Name: Idon Nkhenso Sibuyi
Student Number: 216301092
Degree: DTech Informatics

Research topic amendment has been approved as follows:	
From	**To**
Implementation of Mobile Health Technology as an enhancement tool for Health Services in South Africa: A stakeholder-centred exploration	**A Stakeholder-Centred Mobile Health Implementation Inquiry within the Digital Health Innovation Ecosystem in South Africa: A Practitioner-Researcher's Perspective**

The amended title must appear on the front page of thesis document.
Regards,

Supervisor   Faculty Research Ethics Committee

APPENDIX G: PARTICIPANTS' INFORMATION SHEET AND INFORMED CONSENT – NATIONAL LEVEL

Title of the Study: Implementation of Mobile Health Technology as an Enhancement Tool for Health Services in South Africa: A Stakeholder-Centred Exploration
Student Name: Idon Nkhenso Sibuyi
Degree: D Tech Informatics

PARTICIPANT INFORMATION SHEET AND INFORMED CONSENT

PART 1: Participation Information Sheet
I, Idon Nkhenso Sibuyi, a postgraduate student enrolled for a Doctor of Technology degree in Informatics (with special interest in Health Informatics) at the Cape Peninsula University of Technology, am doing a research on mHealth service implementation as per title above. The study is aimed at exploring your experiences and roles as a stakeholder in implementing mHealth service, particularly the MomConnect, as a case example in which you have been involved in directly and/or indirectly.

Participant Selection:
- You are selected through judgement sampling i.e. due to your job description, knowledge and expertise, organisation's involvement and/or participation (direct / indirect) in MomConnect service implementation.

Invitation to Participate:
- You are humbly invited to participate in this study.

The Study Involves The Following:
Tick what is relevant to the specific participant:
- Semi-structured interview:

You will be interviewed at a time that is convenient to yourself. Interviews may be conducted face to face, telephonically or via Skype. Interviews will take around 30 to 45 minutes. Interviews will be recorded electronically. However, you may choose not to be recorded electronically.
- Stakeholder Mapping Exercise :

You will be given a form that you need to complete regarding your experiences in working with different stakeholders in MomConnect. You will complete this mini-questionnaire at your convenient time return back to researcher either by hand or electronically. Completion of the questionnaire will take approximately 30 minutes.
- Focus Group Discussion:

Focus group discussions will be done at the facility. You will be with other participants in the same room. The researcher will be facilitating this discussion. You are free to remain silent should you not feel like saying anything. Other participants in the group will hear your views and experiences as you share.

Risk:
- There is no risk in participating in this study

Benefit / Outcome of the Study:

- The study will produce a mHealth service implementation strategy, to be named: Digital-, Responsive-, Electronic-, Appropriate-, Mobile- Health = dream Health Service Implementation Strategy. Furthermore in will contribute to the mHealth body of knowledge and research.

Information/Findings on the Study:
- The participant will be given pertinent of the study while involved in the study and after the study. The findings will be shared with the National Department of Health.

Voluntary Participation:
- Your participation in this study is entirely voluntary. You may agree or refuse participation in this study, the choice you make will have no bearing on your job or any work-related evaluations or reports. You may even withdraw from the study at any stage.

Reimbursements:
- No expenses are due to you for participating in this study. No reimbursements will be made to the participants during and/or after the study.

Confidentiality:
- No personal Information will be shared about the participant in this study. All information will be treated, recorded and reported anonymously. Personal Information may only be disclosed is strictly required by law.

Contact details for further information / reporting of study related adverse events:
- Researcher / Doctoral Student: Idon-Nkhenso Sibuyi at mobile phone +27(0)83 338 9132 or email insibuyioptometrist@gmail.com
- Supervisor: Prof Retha de la Harper at email delaharper@cput.ac.za
- Co-Supervisor: Prof Peter Nyasulu at email peter.nyasulu@wits.ac.za

PART 2: Informed Consent

I have read and/or been read-to, the foregoing information and I have had an opportunity to ask any questions about it. Any questions I have been asked I have answered to my satisfaction. I consent voluntarily to be a participant in this study.

Name of Participant: …………………………………………………………………………………………………

Organisation: ……

Sector: NGO / Government / Private / Independent Consultant / Other ……………………………...

Designation: ……………………………………………………………………………………………………….

Highest Level of Education: ……………………………………………………………………………………

Sex: Male / Female: ……………………………………………………………………………………………..

Background: Clinical / IT/ Engineering/Other…………………………………………………………….

Race: ……

Signature: ………

Witness: (If interview done telephonically or Skype) …………………………………………………………

APPENDIX H: PARTICIPANT INFORMATION SHEET AND INFORMED CONSENT – FACILITY LEVEL

Title of the Study: Implementation of Mobile Health Technology as an Enhancement Tool for Health Services in South Africa: A Stakeholder-Centred Exploration
Student Name: Idon Nkhenso Sibuyi
Degree: D Tech Informatics

PARTICIPANT INFORMATION SHEET AND INFORMED CONSENT

PART 1: Participation Information Sheet

I, Idon Nkhenso Sibuyi, a postgraduate student enrolled for a Doctor of Technology degree in Informatics (with special interest in Health Informatics) at the Cape Peninsula University of Technology, am doing a research on mHealth service implementation as per title above. The study is aimed at exploring your experiences and roles as a stakeholder in implementing mHealth service, particularly the MomConnect, as a case example in which you have been involved in directly and/or indirectly.

Participant Selection:
- You are selected through judgement sampling i.e. based at a PHC facility, you are directly / indirectly involved in MomConnect, a woman subscribed to MomConnect, a nurse or other staff member involved in MomConnect or organisation's involvement and/or participation (direct / indirect) in MomConnect service implementation.

Invitation to Participate:
- You are humbly invited to participate in this study

The Study Involves The Following:
Tick what is relevant to the specific participant:
- Semi-structured interview: (Staff at a facility involved in MomConnect)

☐

You will be interviewed at a time that is convenient to yourself. Interviews may be conducted face to face, telephonically or via Skype. Interviews will take around 30 minutes. Interviews will be recorded electronically. However, you may choose not to be recorded electronically.

- Focus Group Discussion: (Women utilizing MomConnect Service)

☐

Focus group discussions will be done at the facility. You will be with other participants in the same room. The researcher will be facilitating this discussion. You are free to remain silent should you not feel like saying anything. Other participants in the group will hear your views and experiences as you share.

Risk:
- There is no risk in participating in this study

Benefit / Outcome of the Study:
- The study will produce a mHealth service implementation strategy, to be named: Digital-, Responsive-, Electronic-, Appropriate-, Mobile- Health = dream Health Service Implementation Strategy. Furthermore in will contribute to the mHealth body of knowledge and research.

Information/Findings on the Study:

- The participant will be given pertinent of the study while involved in the study and after the study. The findings will be shared with the National Department of Health and Gauteng Department of Health.

Voluntary Participation:

- Your participation in this study is entirely voluntary. You may agree or refuse participation in this study, the choice you make will have no bearing on your job or any work-related evaluations or reports. You may even withdraw from the study at any stage.

Reimbursements:

- No expenses are due to you for participating in this study. No reimbursements will be made to the participants during and/or after the study.

Confidentiality:

- No personal Information will be shared about the participant in this study. All information will be treated, recorded and reported anonymously. Personal Information may only be disclosed is strictly required by law.

Contact details for further information / reporting of study related adverse events:

- Researcher / Doctoral Student: Idon-Nkhenso Sibuyi at mobile phone +27(0)83 338 9132 or email insibuyioptometrist@gmail.com
- Supervisor: Prof Retha de la Harper at email delaharper@cput.ac.za
- Co-Supervisor: Prof Peter Nyasulu at email peter.nyasulu@wits.ac.za

PART 2: Informed Consent

I have read and/or been read-to, the foregoing information and I have had an opportunity to ask any questions about it. Any questions I have been asked I have answered to my satisfaction. I consent voluntarily to be a participant in this study.

STAFF @ FACILITY:

Name of Participant: ………

Organisation: ………

Sector: NGO / Government / Private / Independent Consultant / Other ……………………………….

Designation: ……….

Highest Level of Education: ……………………………………………………………………………………………….

Sex: Male / Female: ……..

Background: Clinical / IT/ Engineering/Other………………………………………………………………………

Race: ……..

Signature: ……

Witness: (If interview done telephonically or Skype) ……………………………………………………………

PREGNANT WOMEN / MOTHERS @ FACILITY:

Name of Participant: ……

Services visiting facility for (ANC / EPI etc)……………………………………………………………………….

Period on MomConnect: ……………………………………………………………………………………………………

Highest Level of Education: ……….

Type of phone used: Basic / Smart Phone ……………………………………………………………………………….

Own Phone / Share Phone ……………………………………………………………………………………………………….

Preferred text messaging: SMS / WhatsApp / Other …………………………………………………………………

Age: ……….

Race: ……….

Signature: …………………………………………………………

APPENDIX I: INTERVIEW GUIDE FOR MOMCONNECT TASK TEAM MEMBERS

MomConnect Task Team Interview: Current a Past Members

1. INTRODUCTION

1.1. Date of interview: 1.2. Name:

1.3. Organisation: 1.4. Years of experience in eHealth
    initiatives:

1.5. Role in the organisation:

1.6. In what capacity/capacities have you been involved with National Department of Health's eHealth and/or mHealth?

1.7. Please describe your involvement in mHealth projects within the National Department of Health?

1.7.1. If you were involved in other eHealth projects, please name the project and indicate whether it is/was a pilot or national scaled initiative.

1.8. Has this been as part of your job or voluntary?

2. HISTORY

2.1. When did you become involved with MomConnect?

2.2. Please think through the months since your involvement started, and indicate the main events that you were involved in? (I*f needed to prompt: May 2013 - Meeting that led to MomConnect Task Team; March 2014 – Test system goes live; Aug 2014 - Launch of MomConnect; Aug 2015 – First anniversary*)

3. STRATEGY: eHealth/mHealth

3.2. What are your views on the current mHealth Strategy in South Africa? (Probe)

3.3. In your opinion how does the strategy address the key issues in mHealth ?

3.4. If it had to be reviewed what, in your opinion, should be added or removed?

3.5. Have you applied the implementation plan section in the strategy in any of your project? If your answer is yes, then how did you apply the implementation plan and why did you do it in that manner?

3.5. In your opinion what can be improved/sustained regarding implementation?

4. DESIGN CONSIDERATIONS

4.1. What was the most critical considerations during design in the following areas: 1) Identification of Stakeholders, 2) Costs, 3) Price, 4) Appearance, 5) End-use, 6) Maintenance/Customer Care, 6) Prestige Value, 7) Monitoring, Evaluation, Research and Development, 8) Environmental considerations (Organisational Limitations) and 9) Legal and Ethical considerations.

4.2. In your involvement, how was scalability and sustainability of MomConnect addressed? Were scalability and sustainability seen as critical? On what basis are you saying this?

4.4. Was there a Benchmarking process? Why?

5. STAKEHOLDERS

5.1. Who would you say have been the individuals and organisations that have been most influential in the design, development, implementation and evaluation of the MomConnect programme? Why were they in a position to influence the design, development, implementation and evaluation of the MomConnect programme?

5.2. How were the following managed during collaboration: co-creation, co-design, co-implementation etc.

5.3. Whenever a stakeholder leaves the project how was the project affected? How was the issue of knowledge, insights and experience loss dealt with when a stakeholder leaves the?

5.4. Were you given an opportunity to contribute to the sustainability and scalability of MomConnect? How?

5.5. How did the process around MomConnect dealt with the inclusion of all those who could contribute?

6. IMPLEMENTATION, SCALABILITY AND SUSTAINABILITY

6.1. Describe how MomConnect was implemented.

6.3. Overall, What were the strengths and weaknesses of the implementation?

6.4. Has the focus of MomConnect changed in later phases or was it consistent with its original goal?

6.5. Is the implementation process a once off activity or continuous? Why?

6.6. As this was a national scale initiative, what was critical compared to small scale initiative? Why?

6.6. Overall, how sustainable is MomConnect? Why do you think this is the case?

7. CLOSING

7.1. If we were starting MomConnect (Or another national scale mHealth service) again, what would you suggest should be done differently?

7.2. Is there anything else haven't covered yet?

APPENDIX J: INTERVIEW GUIDE FOR MINISTERIAL ADVISORY COMMITTEE ON EHEALTH

Key Informants Interview: MAC of eHealth and NDoH Officials

---

1. INTRODUCTION

1.1. Date of interview:

1.2. Name:

1.3. Organisation:

1.4. In what capacity/capacities have you been involved with National Department of Health's eHealth and/or mHealth?

1.5. Have you been involved in MomConnect? Or other mHealth projects within the National Department of Health?

1.5.1. If other projects, name the project and whether it was a pilot or national scaled initiative.

1.6. At which level of implementation were you involved? National, Provincial, District, Sub-District and/or Facility? What are the key considerations that need to be considered for each of these levels?

1.7. Has this been as part of your job or voluntary?

2. STRATEGY: eHealth/mHealth

2.2. What can you say about the current mHealth Strategy implementation in South Africa (Probe)

2.3. Is the strategy addressing the key issues in mHealth ?

2.4. If it had to be reviewed what, in your opinion, should be added or removed?

2.5. Have you applied the implementation plan section in the strategy in any of your work? Why?

2.5. What can be improved/sustained regarding implementation? Are there any gaps?

3. BEYOND SCALE SUSTAINABILITY: eHealth/mHealth

3.1. How might **mHealth implementation strategy** need to change to enable financial sustainability?

3.2. How might funding or **business model** need to change to ensure financial sustainability?

3.3. What new **legal, policy or regulatory** issues might need to be considered and how might legal agreements need to change?

3.4. Are there **partner relationships** in place to enable scale and sustainability, or are new partnerships required?

3.5. Is there a there a sufficient **human capacity** to make these strategic changes, or do you need to retrain or hire staff with different skills and experiences?

3.6. How might your approach to **roll out**, including everything from technical support and customer care to marketing and distribution, need to change?

3.7. How might **mHealth solution design** need to change to enable replication or diversification of programme offering?

APPENDIX K: FOCUS GROUP DISCUSSION GUIDE FOR PATIENTS AND STAFF AT FACILITY LEVEL

1. INTRODUCTION
1.1 What is your role in MomConnect in the facility?

2. HISTORY AND DAILY ROUTINE
2.1. When did you first hear about MomConnect? How?

2.2. Were you trained in MomConnect or other mHealth initiatives?

2.3. How does MomConnect impact your daily routine? Is it an additional activity?

2.4. How did you find the process of subscribing into MomConnect? How can it be improved?

3. ASSESSMENT
3.1. Were you involved in MomConnect before it was implemented?

3.2. What do you think you could have contributed to MomConnect if you were involved in the beginning or in continuous improvement of the MomConnect?

3.3. What can you recommend for implementation of mHealth or other technologies to be done at facility level?

4. THE CONTENT
4.1. Do you know the type of messages the women are receiving?

4.2. Are you getting any feedback on the messages from the women? Explain?

4.3. Do you find any value in MomConnect?

4.4. Do you utilise the MomConnect data in service planning? How?

5. CLOSING
5.1. If we were starting MomConnect again, how should it be done differently?

Focus Group Discussion Guideline: For Users of Facility Health Care Service Users/ Patients

1. INTRODUCTION
1.1. Date of FGD:

1.2. Facility:

1.3. FGD Number:

1.4. Total Number of Participants:

2. HISTORY
2.1. When did you first hear about MomConnect? How?

2.2. Was the programme introduced as a new component of the service you have been getting or something completely new?

2.2. How did you find the process of subscribing into MomConnect? How can it be improved?

3. ASSESSMENT

3.1. Were you involved in MomConnect before it was implemented?

3.2. What do you think you could have contributed to MomConnect if you were involved in the beginning or in continuous improvement of the MomConnect?

3.3. Did you hear about MomConnect in the facility or at home – which is best?

3.4. Do you know about the MomConnect Helpdesk?

4. THE CONTENT

4.1. Do you find the messages useful? Why?

4.2. How do you feel when you receive the messages?

4.3. How do you feel when you interact with a helpdesk nurse?

4.4. Except your facility and helpdesk who else have you ever dealt with regarding MomConnect? Why?

4.4. Do you find any value in MomConnect?

4.5. Did you ever opt-out? Why?

5. CLOSING

5.1. If we were starting MomConnect again, how should it be done differently?

5.2. Is there anything else important that you have learnt through MomConnect that we haven't covered yet?

APPENDIX L: STAKEHOLDER RELATIONSHIP MAPPING TOOL FOR MOMCONNECT TASK TEAM MEMBERS

MomConnect Task Team Mapping: Current and Past Members (Anonymous)

1.

1.1. Date of Mapping Exercise:

2. Issue (s) at stake:

Kindly note that the issues at hand for this exercise are the following, based on your experiences and/or perspectives on MomConnect as a case example:

- National scaled implementation; and
- Sustainability

3. Stakeholders Relationship Perspectives

3.1. Put the name of your organisation in the centre of the circle below

3.2. Put the names of other stakeholders that you have worked with along the circle but outside the circle line
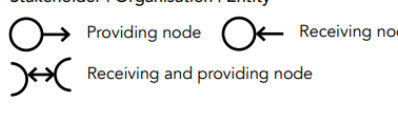
3.3. Indicate the type of a relationship you had/have with the stakeholder next to it (*As per figure M1*)

3.4. Indicate nature of relationship (*As per figure M2*)

3.5. What type of relationship do you have (*As per figure M3*)

3.6. Indicate the power in which the stakeholder had during implementation (From 1 – 5, *1 = very low, 2= low, 3 = medium, 4 = high, 5 = very high*)

3.7. Give us any information regarding stakeholders involved in MomConnect which you think we have not covered in this exercise. (*You may write in words on the space provided below*)

Figure M1:	Figure M2	Figure M3
Stakeholder | Organisation | Entity — Providing node, Receiving node, Receiving and providing node	The Nature of Relationships — *(add the relevant symbol to your relationship line to indicate the nature of the relationship)* — Strong connection perceived; Tense or conflicting connection perceived; Weak or informal connection perceived; Interrupted connection perceived; Broken connection perceived; Inconsistent connection perceived; Cordial or emerging connection perceived; Temporary connection	Pick the colour that defines the type of relationship you are mapping. There are five (5) relationship types — **Resources** (Red); **Information** (Blue); **Funding** (Green); **Advocacy** (Purple); *a new relationship type defined.*

4. Stakeholder Contribution Perspectives:

✓ List name of stakeholder/organisation, then tick applicable boxes

Name of Stakeholder (Including your organisation)	Participation in Sustainability		Participation in Service Design Process						
	Lead	*Support*	Analysis	Design			Development	Implementation	Evaluation
				Conceptualisation	*Specification*	*Prototyping*			

APPENDIX M: ETHNOGRAPHY GUIDELINE FOR MOMCONNECT TASK TEAM MEETING

Interaction	
Participation,	
Active members,	
Feedback	
Culture	
How they interact - ?	
What exactly are they doing?	
Language used, jargon	
Notes of overheard conversations	
Layout of the space	
Rationale	
The unspeakable	
Evidence	

APPENDIX N: NASS PROGRAMME IMPLEMENTATION GUIDELINES

	Domain/ Question	Simple	Complicated	Complex
Domain 1: The condition or illness				
Q	1A. What is the nature of the condition or illness?	Well-characterized, well-understood, predictable	Not fully characterized, understood, or predictable	Poorly characterized, poorly understood, unpredictable, or high risk
A			*X*	
	Maternal Child and Women's Health programme. Providing support for pregnant women, mothers and care givers from pregnancy up to the age of two of the children. (In cases where there is still birth and/or miscarriage, the mHealth support will cease accordingly)			
Q	1B. What are the relevant sociocultural	Unlikely to affect care significantly	Must be factored into care plan and service model	Pose significant challenges to care

Domain/ Question		Simple	Complicated	Complex
	factors and comorbidities?			planning and service provision
A			*X*	
	The sociocultural factors, include, traditional beliefs, inability and unwillingness to pay for service, lack of users representation, location of facilities,			
Domain 2: The technology				
Q	2A. What are the key features of the technology?	Off-the-shelf or already installed, freestanding, dependable	Not yet developed or fully interoperable; not 100% dependable	Requires close embedding in complex technical systems; significant dependability issues
A		*X*		
	The use of low denominator technology, USSD in particular, insured scale and less training on the users.			
Q	2B. What kind of knowledge does the technology bring into play?	Directly and transparently measures [changes in] the condition	Partially and indirectly measures [changes in] the condition	Link between data generated and [changes in] the condition is currently unpredictable or contested
A		*X*		
	The knowledge brought by the technology to the users was communicated in the language of a lay person, regardless of being clinical, and was based on gestational stage which made it more personal to the users.			
Q	2C. What knowledge and/or support is required to use the technology?	None or a simple set of instruction	Detailed instruction and training needed, perhaps with ongoing helpdesk support	Effective use of technology requires advanced training and/or support to adjust to new identity or organisational role
A		*X*		
	No need for support was raised by the users particularly for the use of the technology; however, the content brought by the technology there was a helpdesk where clinical nurse practitioners were available to provide support by SMS and telephone to the users.			
Q	2D. What is the technology supply model?	Generic, plug and play, or COTS[a] solutions requiring minimal customization; easily substitutable if	COTS solutions requiring significant customization or bespoke solutions; substitution	Solutions requiring significant organisational reconfiguration or medium- to large scale-bespoke solutions; highly vulnerable to supplier withdrawal

	Domain/ Question	Simple	Complicated	Complex
		supplier withdraws	difficult if supplier withdraws	
A		*X*		
	Generic. A basic phone could be used.			
Domain 3: The value proposition				
Q	3A. What is the developer's business case for the technology (supply-side value)?	Clear business case with strong chance of return on investment	Business case underdeveloped; potential risk to investors	Business case implausible; significant risk to investors
A			*X*	
Q	3B. What is its desirability, efficacy, safety, and cost effectiveness (demand-side value)?	Technology is desirable for patients, effective, safe, and cost effective	Technology's desirability, efficacy, safety, or cost effectiveness is unknown or contested	Significant possibility that technology is undesirable, unsafe, ineffective, or unaffordable
A		*X*		
	The technology was cost effective for the users, however, for the service provider it was more expensive to send SMSs than to use data through WhatsApp where users would use their own data.			
Domain 4: The adopter system				
Q	4A. What changes in staff roles, practices, and identities are implied?	None	Existing staff must learn new skills and/or new staff be appointed	Threat to professional identity, values, or scope of practice; risk of job loss
A			*X*	
	At National level new staff had to be appointed to manage the initiate and man the helpdesk. At provinces and districts staff had to add a new KPA of coordinating MomConnect Initiative. At facility level, the counsellors had to inform the users about the initiative and give instructions on subscription.			
Q	4B. What is expected of the patient (and/or immediate caregiver)—and is this achievable by, and acceptable to, them?	Nothing *X*	Routine tasks, e.g. log on, enter data, converse	Complex tasks, e.g. initiate changes in therapy, make judgments, organise
A	*There were no expectations, except having a basic phone as your own or anyone from your household.*			

	Domain/ Question	Simple	Complicated	Complex
Q	4C. What is assumed about the extended network of lay caregivers?	None	Assumes a caregiver will be available when needed	Assumes a network of caregivers with ability to coordinate their input
A		*X*		
	No expectations			
Domain 5: The organisation				
Q	5A. What is the organisation's capacity to innovate?	Well-led organisation with slack resources and good managerial relations; risk taking encouraged	Limited slack resources; suboptimal leadership and managerial relations; risk taking not encouraged	Severe resource pressures (e.g. frozen posts); weak leadership and managerial relations; risk taking may be punished
A		*X*		
	The MomConnect task team was well-led, although it is not necessarily a National Department of Health's official staff.			
Q	5B. How ready is the organisation for this technology-supported change?	High tension for change, good innovation-system fit, widespread support *X*	Little tension for change; moderate innovation-system fit; some powerful opponents	No tension for change; poor innovation-system fit; many opponents, some with wrecking power
A	*The National Department was ready for the technology*			
Q	5C. How easy will the adoption and funding decision be?	Single organisation with sufficient resources; anticipated cost savings; no new infrastructure or recurrent costs required	Multiple organisations with partnership relationship; cost-benefit balance favourable or neutral; new infrastructure (e.g. staff roles, training, kit) can mostly be found from repurposing	Multiple organisations with no formal links and/or conflicting agendas; funding depends on cost savings across system; costs and benefits unclear; new infrastructure conflicts with existing; significant budget implications
A			*X*	
	Adoption was easy, however, funding was a threat to sustainability.			
Q	5D. What changes will be needed in team interactions and routines?	No new team routines or care pathways needed	New team routines or care pathways that	New team routines or care pathways that conflict with established ones

	Domain/ Question	Simple	Complicated	Complex
			align readily with established ones ***X***	
A	*There is a need for both clinical and digital spheres to interact.*			
Q	5E. What work is involved in implementation and who will do it?	Established shared vision; few simple tasks, uncontested and easily monitored	Some work needed to build shared vision, engage staff, enact new practices, and monitor impact	Significant work needed to build shared vision, engage staff, enact new practices, and monitor impact
A			***X***	
	The implementation needed buy bin from provinces, staff engagement which was done by the minister. Monitoring of impact needed, but at the time of data collection there was no impact evaluation done.			
Domain 6: The wider context				
Q	6A. What is the political, economic, regulatory, professional (e.g. medicolegal), and sociocultural context for programme rollout?	Financial and regulatory requirements already in place nationally; professional bodies and civil society supportive	Financial and regulatory requirements being negotiated nationally; professional and lay stakeholders not yet committed	Financial and regulatory requirements raise tricky legal or other challenges; professional bodies and lay stakeholders unsupportive or opposed
A		***X***		
	The content of the mHealth service had to be aligned to the clinical guidelines of the National Department t of Health.			
Domain 7: Embedding and adaptation over time				
Q	7A. How much scope is there for adapting and coevolving the technology and the service over time?	Strong scope for adapting and embedding the technology as local need or context changes	Potential for adapting and coevolving the technology and service is limited or uncertain	Significant barriers to further adaptation and/or coevolution of the technology or service
A		***X***		
	The initiative has evolved over time, including adding new component such as PMTCT MomConnect and			
Q	7B. How resilient is the organisation to handling critical events and adapting to unforeseen eventualities?	Sense making, collective reflection, and adaptive action are ongoing and encouraged	Sense making, collective reflection, and adaptive action are difficult and	Sense making, collective reflection, and adaptive action are discouraged in a rigid, inflexible implementation model

Domain/ Question	Simple	Complicated	Complex
		viewed as low priority	
A	*X*		
	The National Department of Health is a resilient considering its high level of authority and handles critical events and may adapt to unforeseen eventualities.		

APPENDIX O: MACRO-LEVEL QUESTIONS IN RELATION TO AN UNFOLDING PROGRAMME MAPPING THE NETWORK IN FOCUS: (QUESTION 10.3)

10.3.1 What is the **prevailing political, economic, technological and institutional context** within which the technology is being introduced locally or nationally?

**Themes from Minutes*

^*Themes from MomConnect Task Team*

^^*Themes from MAC on eHealth*

^^^ *Themes from Facility Level*

Strong Structuration Theory Area of Focus	Phase 1: Thematic Order: (Cluster : Theme; Sub-theme)	Phase 2: NASSS Framework Order: (Domain: Category. Category Explanation)	Phase 3: Principles of Digital Development Order: (Principle)	Phase 4: Global Digital Health Index Order: (GDHI Indicator Category: Approximate Scores)	Synthesis Order: (Narrative)
Political	• Service Conceptualisation: Stake holders; Consultation and Collaboration* • Ecosystem: Organisational; Political* • Roll out: The scaling process: National to Provinces* • MomConnect As a Case Example by Task Team Members: Perspectives, Top-Down Communication / Power Issues^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Privileges for MomConnect^	*Domain 6 – The Wider Context:* A combination of both 'simple' and 'complicated' category. Because: (1) Financial and regulatory requirements being negotiated nationally; (2) professional bodies and civil society supportive *Domain 5: The organisation* 'Simple' Category. 5B. High tension for change, good innovation-system fit, widespread support	• Design With the User • Understand the Existing Ecosystem • Build for Sustainability • Address Privacy and Security • Be Collaborative	• Legislation, Policy and Compliance: 4 • Strategy and Investment: 4 • Leadership and Governance: 5	The initiative was described as an order from the minister and a political high-profile project. The political nature of the initiative resulted in top down communication, high political interest, support by health minister, review of mHealth strategy, omission of piloting, uncertainty regarding sustainability due to changes in political leadership and lack of enough time to fully integrate the initiative into health programming at large. There was no political directive regarding foreign nationals

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	• MomConnect As a Case Example by Task Team Members: Stakeholders, Selection^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, mHealth and eHealth Strategy^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Uncertainty regarding Sustainability (Including culture of the team, consistency over time and evolution of the Initiative)^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Different Views on the Necessity for Piloting^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Integration of Initiative within Health	*Domain 5: The organisation* 5A. 'Simple' Category. Well-led organisation with slack resources and good managerial relations; risk taking encouraged *Domain 3: The value proposition* 3B. 'Simple' Category. Technology is desirable for patients, effective, safe, and cost effective			utilising mHealth services, there were barriers such as language and lack of identity numbers for subscription.

Strong Structuration Theory Area of Focus	Phase 1: Thematic Order: (Cluster : Theme; Sub-theme)	Phase 2: NASSS Framework Order: (Domain: Category. Category Explanation)	Phase 3: Principles of Digital Development Order: (Principle)	Phase 4: Global Digital Health Index Order: (GDHI Indicator Category: Approximate Scores)	Synthesis Order: (Narrative)
	Programming^ • MomConnect As a Case Example by Task Team Members: The Ministry of Health, Responses that were about the National Department of Health^ • MomConnect As a Case Example by Task Team Members: Recommendations, Includes, but not limited to, User Centred Design, Sustainability, Privacy and Security, Change Management and Stakeholder Management^ • Governance and Leadership: Centralisation of mHealth, Rationalisation and Harmonisation of mHealth Services^^ • Governance and Leadership: Stakeholders, Engaging with and between mHealth Providers and Consumers^^ • Ecosystem: Sustainable Development Goals: NHI^^				

Strong Structuration Theory Area of Focus	Phase 1: Thematic Order: (Cluster : Theme; Sub-theme)	Phase 2: NASSS Framework Order: (Domain: Category. Category Explanation)	Phase 3: Principles of Digital Development Order: (Principle)	Phase 4: Global Digital Health Index Order: (GDHI Indicator Category: Approximate Scores)	Synthesis Order: (Narrative)
	• Ecosystem: The MAC members background: Demography^^ • Service Touch Point: Facility Level: Stakeholders, Foreign Nationals as users of mHealth, and barriers associated^^^				
Economic	• Ecosystem: Organisational; Governance and Leadership* • Service Continuity: Service Continuity, including Sustainability and Evolution* • Service Conceptualisation: Design Process; Considerations* • MomConnect As a Case Example by Task Team Members: Stakeholders, Life Span within the NDoH^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, mHealth and eHealth Strategy^ • MomConnect As a Case	*Domain 6 – The Wider Context:* A combination of both 'simple' and 'complicated' category. Because: (1) Financial and regulatory requirements being negotiated nationally; (2) professional bodies and civil society supportive *Domain 5 - The organisation* 'Complicated' category. Some work needed to build shared vision, engage staff, enact new practices, and monitor impact	• Design With the User • Understand the Existing Ecosystem • Build for Sustainability • Reuse and Improve • Be Collaborative • Design for Scale • Be Data Driven	• Workforce: 2 • Strategy and Investment: 4 • Leadership and Governance: 5 • Legislation, Policy and Compliance: 4 • Services and Applications: 4 • Infrastructure: 3	The initiative was financially executed on external funding from donor(s), issues such as continuous funding after the donor leaves project, Cost of Ownership and Utility Cost emerged. The economic related factors included the dependence of external sources such as consultants and funding which have limited span within the national department of health, mHealth strategy not practical enough to implement with economic sustainable measures, human resources factors, cost of ownership, cost utility,

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Strong Structuration Theory Area of Focus	Phase 1: Thematic Order: (Cluster : Theme; Sub-theme)	Phase 2: NASSS Framework Order: (Domain: Category. Category Explanation)	Phase 3: Principles of Digital Development Order: (Principle)	Phase 4: Global Digital Health Index Order: (GDHI Indicator Category: Approximate Scores)	Synthesis Order: (Narrative)
	Example by Task Team Members: Critical Considerations, Uncertainty regarding Sustainability (Including culture of the team, consistency over time and evolution of the Initiative)^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Cost for mHealth Service Consumer versus Cost for mHealth Service Provider^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Research and Development (Including the Design Process, Evidence-based initiative, tech environment, Compliance with Normative Standards, Inclusions of clinicians^ • MomConnect As a Case Example by Task Team Members: The Ministry of	*Domain 7- Embedding and adaptation over time* 'Simple' category. Sense making, collective reflection, and adaptive action are ongoing and encouraged *Domain 7- Embedding and adaptation over time* 'Simple' category. Strong scope for adapting and embedding the technology as local need or context changes *Domain 5: The organisation* 5C. Complicated Category. Multiple organisations with partnership relationship; cost-benefit balance favourable or neutral; new infrastructure (e.g.	• Use Open Standards, Open Data, Open Source, and Open Innovation • Address Privacy and Security		and sustainability of the initiative by its owner (the NDoH) with minimal external dependence. The recommendations from the Ministerial Advisory Committee on eHealth included impact and outcomes driven mHealth, which should also enhance the services to meet sustainable development goals and contribute to universal coverage.

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	Health, Responses that were about the National Department of Health^ • MomConnect As a Case Example by Task Team Members: Operations, Operations: M&E, DHIS, HR, Link to Care and Implementation Process^ • MomConnect As a Case Example by Task Team Members: Recommendations, Includes, but not limited to, User Centred Design, Sustainability, Privacy and Security, Change Management and Stakeholder Management^ • Governance and Leadership: Centralisation of mHealth, Rationalisation and Harmonisation of mHealth Services^^ • Governance and Leadership: Strategy, Perceptions on both the eHealth and mHealth Strategies	staff roles, training, kit) can mostly be found from repurposing *Domain 5: The organisation* 'Simple' Category. 5B. High tension for change, good innovation-system fit, widespread support *Domain 5: The organisation* 5A. 'Simple' Category. Well-led organisation with slack resources and good managerial relations; risk taking encouraged *Domain 4: The adopter system* 4A. 'Complicated' Category. Existing staff must learn new skills and/or new staff be appointed *Domain 3: The value proposition* 3B. 'Simple'			

Strong Structuration Theory Area of Focus	Phase 1: Thematic Order: (Cluster : Theme; Sub-theme)	Phase 2: NASSS Framework Order: (Domain: Category. Category Explanation)	Phase 3: Principles of Digital Development Order: (Principle)	Phase 4: Global Digital Health Index Order: (GDHI Indicator Category: Approximate Scores)	Synthesis Order: (Narrative)
	• Governance and Leadership: Strategy, Feedback on applying the strategies^^ • Governance and Leadership: Stakeholders, Engaging with and between mHealth Providers and Consumers^^ • Research & Development: Evidence Based Implementation, with emphasis on impact and Outcomes^^ • Continuity of Service: Sustainability, Total Cost of Ownership and Cost Utility^^ • Continuity of Service: Sustainability, The ongoing culture of outsourcing, including Funding and Consultants^^ • Continuity of Service: Scale, NDoH: Both Human and Financial Resources^^ • Continuity of Service: Scale, Provincial Realities that are regarded as	Category. Technology is desirable for patients, effective, safe, and cost effective *Domain 3: The value proposition* 3A. 'Complicated' Category. Business case underdeveloped; potential risk to investors *Domain 1: The condition or illness* 1B. 'Complicated' Category. Must be factored into care plan and service model			

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	barriers in mHealth^^ • Continuity of Service: Design Thinking, South Africa Learning from Itself: MomConnect as a demonstration case^^ • Continuity of Service: Service Implementation^^ • Ecosystem: Sustainable Development Goals: NHI^^ • Recommendations: Recommendations from the MAC on eHealth^^				
Technologic al	• Service Conceptualisation: Design Process; Considerations* • Ecosystem: Privacy and Security; Data Ownership* • Ecosystem: Privacy and Security; The service* • Ecosystem: Integration; Technical: Infrastructure and Interoperability* • Service Conceptualisation: Design Process; Considerations* • Service Conceptualisation:	*Domain 6 – The Wider Context:* A combination of both 'simple' and 'complicated' category. Because: (1) Financial and regulatory requirements being negotiated nationally; (2) professional bodies and civil society supportive *Domain 7- Embedding and adaptation over time*	• Design With the User • Understand the Existing Ecosystem • Build for Sustainability • Address Privacy and Security • Be Collaborative	• Leadership and Governance: 5 • Strategy and Investment: 4 • Legislation, Policy and Compliance: 4 • Workforce: 2 • Standards and Interoperability: 4	The choice of technology was based on one that will be easy to scale, which is the reason for low denominator technology chosen, USSD, in particular. Issues relating to ethics, data ownership, data security and interoperability were critical factors around the technology. The mHealth strategy was reported to need further review and update in order to give clear step by step implementation guidelines, there were

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	Design Process; Expansion* • Service Conceptualisation: Design Process; Expansion: Research* • MomConnect As a Case Example by Task Team Members: Critical Considerations, mHealth and eHealth Strategy^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Consideration of Ethics in Service Implementation (Including data security and ownership, content sent to mHealth Consumers)^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Different Views on the Necessity for Piloting^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Research	'Simple' category. Strong scope for adapting and embedding the technology as local need or context changes *Domain 7- Embedding and adaptation over time* 'Simple' category. Sense making, collective reflection, and adaptive action are ongoing and encouraged *Domain 7- Embedding and adaptation over time* 'Simple' category. Strong scope for adapting and embedding the technology as local need or context changes *Domain 5 - The organisation 5D.*	• Design for Scale • Be Data Driven • Use Open Standards, Open Data, Open Source, and Open Innovation • Reuse and Improve	• Infrastructure: 3 • Services and Applications: 4	different perceptions on piloting the technology based on the time at hand, what is already known about mHealth in South Africa and the simplicity that came with USSD implementation. The research and development was not sufficient which also limited the involvement of nurses and change management as part of mHealth implementation. A need for centralisation of mHealth with will result in a Rationalisation and Harmonisation of mHealth Services as part Governance and Leadership was raised. Capacity building for health professionals in the use of ICT in health service delivery, planning and management. Addressing grey areas regarding the strategic location of mHealth and eHealth within the health sector to a point where eHealth gains recognition as

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	& Development (Including the Design Process, Evidence-based initiative, tech environment, Compliance with Normative Standards, Inclusions of clinicians^ • MomConnect As a Case Example by Task Team Members: Stakeholders, Involvement of nurses^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, mHealth and eHealth Strategy^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Consideration of Ethics in Service Implementation (Including data security and ownership, content sent to mHealth Consumers)^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Cost for	'Complicated' Category. New team routines or care pathways that align readily with established ones *Domain 5: The organisation* 5C. Complicated Category. Multiple organisations with partnership relationship; cost-benefit balance favourable or neutral; new infrastructure (e.g. staff roles, training, kit) can mostly be found from repurposing *Domain 5: The organisation* 'Simple' Category. 5B. High tension for change, good innovation-system fit, widespread support *Domain 5: The organisation* 5A. 'Simple' Category. Well-			a health programme and managed by clinicians with support from ICT directorate. There is a need to have repository or other documentation techniques that will allow best practices to be learnt and shared. Proactive governance and leadership that will ensure compliance and regulation of the fast-paced technology environment. Perspectives and recommendations from facility, reiterated need for continuous engagement, content of the messages, expansion of the initiative to include nurses, utilization of the helpdesk and a positive mHealth service rating was also observed.

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	mHealth Service Consumer versus Cost for mHealth Service Provider^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Different Views on the Necessity for Piloting^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Research & Development (Including the Design Process, Evidence-based initiative, tech environment, Compliance with Normative Standards, Inclusions of clinicians^ • MomConnect As a Case Example by Task Team Members: The Ministry of Health, Responses that were about the National Department of Health^ • MomConnect As a Case Example by Task Team Members: Operations,	led organisation with slack resources and good managerial relations; risk taking encouraged *Domain 4: The adopter system* 4A. 'Complicated' Category. Existing staff must learn new skills and/or new staff be appointed *Domain 3: The value proposition* 3B. 'Simple' Category. Technology is desirable for patients, effective, safe, and cost effective *Domain 2 - The technology* 2D. 'Simple' Category. Generic, 'plug and play', or COTS[a] solutions requiring minimal customization; easily *Domain 2: The*			

Strong Structuration Theory Area of Focus	Phase 1: Thematic Order: (Cluster : Theme; Sub-theme)	Phase 2: NASSS Framework Order: (Domain: Category. Category Explanation)	Phase 3: Principles of Digital Development Order: (Principle)	Phase 4: Global Digital Health Index Order: (GDHI Indicator Category: Approximate Scores)	Synthesis Order: (Narrative)
	Operations: M&E, DHIS, HR, Link to Care and Implementation Process^ • MomConnect As a Case Example by Task Team Members: Recommendations, Includes, but not limited to, User Centred Design, Sustainability, Privacy and Security, Change Management and Stakeholder Management^ • Governance and Leadership: Centralisation of mHealth, Rationalisation and Harmonisation of mHealth Services^^ • Governance and Leadership: Strategy, Perceptions on both the eHealth and mHealth Strategies^^ • Governance and Leadership: Strategy, Feedback on applying the strategies^^ • Governance and Leadership: Stakeholders,	*technology* 2A. 'Simple' Category. Off-the-shelf or already installed, freestanding, dependable *Domain 1: The condition or illness* 1B. 'Complicated' Category. Must be factored into care plan and service model			

Strong Structuration Theory Area of Focus	Phase 1: Thematic Order: (Cluster : Theme; Sub-theme)	Phase 2: NASSS Framework Order: (Domain: Category. Category Explanation)	Phase 3: Principles of Digital Development Order: (Principle)	Phase 4: Global Digital Health Index Order: (GDHI Indicator Category: Approximate Scores)	Synthesis Order: (Narrative)
	Clinicians, Technophobia / Capacity Building, As Users^^ • Governance and Leadership: Stakeholders, Engaging with and between mHealth Providers and Consumers^^ • Research & Development: Evidence Based Implementation, with emphasis on impact and Outcomes^^ • Research & Development: Perspectives on the piloting of mHealth^^ • Continuity of Service: Sustainability, Total Cost of Ownership and Cost Utility^^ • Continuity of Service: Sustainability, The ongoing culture of outsourcing, including Funding and Consultants^^ • Continuity of Service: Scale, NDoH: Both Human and Financial Resources^^ • Continuity of Service:				

Strong Structuration Theory Area of Focus	Phase 1: Thematic Order: (Cluster : Theme; Sub-theme)	Phase 2: NASSS Framework Order: (Domain: Category. Category Explanation)	Phase 3: Principles of Digital Development Order: (Principle)	Phase 4: Global Digital Health Index Order: (GDHI Indicator Category: Approximate Scores)	Synthesis Order: (Narrative)
	Design Thinking, South Africa Learning from Itself: MomConnect as a demonstration case^^ • Continuity of Service: Design Thinking, Issues relating to Computing Infrastructure^^ • Continuity of Service: Service Implementation^^ • Ecosystem: eHealth as a clinical service^^ • Ecosystem: Grey Areas amongst IT, Data Mx and eHealth^^ • Ecosystem: Fast Paced Tech Environment^^ • Ecosystem: Sustainable Development Goals: NHI^^ • Ecosystem: legal, policy or regulatory issues, Compliance^^ • Ecosystem: legal, policy or regulatory issues, Privacy and Security^^ • Ecosystem: legal, policy or regulatory issues, Data Ownership^^				

Strong Structuration Theory Area of Focus	Phase 1: Thematic Order: (Cluster : Theme; Sub-theme)	Phase 2: NASSS Framework Order: (Domain: Category. Category Explanation)	Phase 3: Principles of Digital Development Order: (Principle)	Phase 4: Global Digital Health Index Order: (GDHI Indicator Category: Approximate Scores)	Synthesis Order: (Narrative)
	• Recommendations: Recommendations from the MAC on eHealth^^ • Service Touch Point: Facility Level: Stakeholders, Mothers, Pregnant Women and where applicable, care givers^^^ • Service Touch Point: Facility Level: Stakeholders, Clinicians (Capacity Building, NurseConnect)^^^ • Service Touch Point: Facility Level: Stakeholders, Foreign Nationals as users of mHealth, and barriers associated^^^ • Service Touch Point: Facility Level: Service Implementation, Content of information as an mHealth service: Push and Pull SMSs^^^ • Service Touch Point: Facility Level: Service Implementation, Ethical				

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	considerations^^^ • Service Touch Point: Facility Level: Service Implementation, The MomConnect Helpdesk: Interactive communication with nurses^^^ • Service Touch Point: Facility Level: Service Implementation, Subscription and Marketing^^^ • Service Touch Point: Facility Level: Service Implementation, Service Rating / Feedback / Feeling^^^ • Service Touch Point: Facility Level: Facility Environment^^^ • Service Touch Point: Facility Level: Operations^^^ • Service Touch Point: Facility Level: Recommendations^^^				
Institutional	• Service Conceptualisation: Stake holders; Facility	*Domain 6 – The Wider Context:* A combination	• Design With the User	• Leadership and Governance: 5	The initiative was implemented as a

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	Level* • Ecosystem: Organisational; Vision, Policies and Guidelines* • Ecosystem: Integration; Programmatic - Maternal, Child and Women's Health* • Roll out: Operations and Performance* • Service Conceptualisation: Design Process; Expansion* • MomConnect As a Case Example by Task Team Members: Stakeholders, Life Span within the NDoH^ • MomConnect As a Case Example by Task Team Members: Stakeholders, Selection^ • MomConnect As a Case Example by Task Team Members: Stakeholders, Involvement of nurses^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, mHealth and eHealth Strategy^	of both 'simple' and 'complicated' category. Because: (1) Financial and regulatory requirements being negotiated nationally; (2) professional bodies and civil society supportive *Domain 7 - Embedding and adaptation over time* 'Simple' category. Sense making, collective reflection, and adaptive action are ongoing and encouraged *Domain 7- Embedding and adaptation over time* 'Simple' category. Sense making, collective reflection, and adaptive action are ongoing and encouraged *Domain 7- Embedding*	• Reuse and Improve • Build for Sustainability • Address Privacy and Security • Be Collaborative • Design for Scale • Be Data Driven • Use Open Standards, Open Data, Open Source, and Open Innovation • Understand the Existing Ecosystem	• Strategy and Investment: 4 • Legislation, Policy and Compliance: 4 • Workforce: 2 • Standards and Interoperability: 4 • Infrastructure: 3 • Services and Applications: 4	government owned initiative, regardless of who funds it and the implementing partners. Issues such as facility settings, integration into health system and programming, and further expansion of the initiative were critical factors around the institutionalization of the initiative. The NDoH as an institution did not have enough internal capacity to execute the initiative, the PHC service where the biggest population that uses the initiative is based was free, this resulted in consumers expecting a free service, necessitating changing from SMS to data texting would not be accepted by most users. The changes in operations of the facility were existent but manageable. Centralisation of mHealth as part of institutionalization of eHealth as a clinical programme.

Strong Structuration Theory Area of Focus	Phase 1: Thematic Order: (Cluster : Theme; Sub-theme)	Phase 2: NASSS Framework Order: (Domain: Category. Category Explanation)	Phase 3: Principles of Digital Development Order: (Principle)	Phase 4: Global Digital Health Index Order: (GDHI Indicator Category: Approximate Scores)	Synthesis Order: (Narrative)
	• MomConnect As a Case Example by Task Team Members: Critical Considerations, Consideration of Ethics in Service Implementation (Including data security and ownership, content sent to mHealth Consumers)^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Uncertainty regarding Sustainability (Including culture of the team, consistency over time and evolution of the Initiative)^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Cost for mHealth Service Consumer versus Cost for mHealth Service Provider^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Integration	*and adaptation over time* 'Simple' category. Strong scope for adapting and embedding the technology as local need or context changes *Domain 5 - The organisation* 5D. 'Complicated' Category. New team routines or care pathways that align readily with established ones *Domain 5: The organisation* 5C. Complicated Category. Multiple organisations with partnership relationship; cost-benefit balance favourable or neutral; new infrastructure (e.g. staff roles, training, kit) can mostly be found from repurposing			Capacity building and inclusion of clinical staff that are need capacitation in the use of ICT in healthcare for a co-created service. Clarification of roles between IT, Data Management, Health technology and clinical care for the implementation of eHealth as an independent clinical programme. There must be budget for eHealth. Ensure compliance with ethical, policy and other regulations related to mHealth services. The feedback from users at facility was positive regarding the initiative, issues raised by nurses was linked to the fact that the content that goes to the women was not shared with them, a need for capacity building, ethical considerations for mHealth and the MomConnect data which sometimes differed with the facility's manual collection system for own

Strong Structuration Theory Area of Focus	Phase 1: Thematic Order: (Cluster : Theme; Sub-theme)	Phase 2: NASSS Framework Order: (Domain: Category. Category Explanation)	Phase 3: Principles of Digital Development Order: (Principle)	Phase 4: Global Digital Health Index Order: (GDHI Indicator Category: Approximate Scores)	Synthesis Order: (Narrative)
	of Initiative within Health Programming^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Research & Development (Including the Design Process, Evidence-based initiative, tech environment, Compliance with Normative Standards, Inclusions of clinicians^ • MomConnect As a Case Example by Task Team Members: The Ministry of Health, Responses that were about the National Department of Health^ • MomConnect As a Case Example by Task Team Members: Operations, Operations: M&E, DHIS, HR, Link to Care and Implementation Process^ • MomConnect As a Case Example by Task Team Members: Recommendations,	*Domain 5: The organisation* 'Simple' Category. 5B. High tension for change, good innovation-system fit, widespread support *Domain 5: The organisation* 5A. 'Simple' Category. Well-led organisation with slack resources and good managerial relations; risk taking encouraged *Domain 4: The adopter system* 4A. 'Complicated' Category. Existing staff must learn new skills and/or new staff be appointed *Domain 3: The value proposition* 3B. 'Simple' Category. Technology is desirable for patients, effective, safe, and cost			performance.

Strong Structuration Theory Area of Focus	Phase 1: Thematic Order: (Cluster : Theme; Sub-theme)	Phase 2: NASSS Framework Order: (Domain: Category. Category Explanation)	Phase 3: Principles of Digital Development Order: (Principle)	Phase 4: Global Digital Health Index Order: (GDHI Indicator Category: Approximate Scores)	Synthesis Order: (Narrative)
	Includes, but not limited to, User Centred Design, Sustainability, Privacy and Security, Change Management and Stakeholder Management^ • MomConnect As a Case Example by Task Team Members: Outliars, Traditional Beliefs, the importance of telecommunications network, PEPFAR partners at districts. Need for information centre for eHealth^ • Governance and Leadership: Centralisation of mHealth, Rationalisation and Harmonisation of mHealth Services^^ • Governance and Leadership: Strategy, Perceptions on both the eHealth and mHealth Strategies^^ • Governance and Leadership: Strategy, Feedback on applying the	effective *Domain 1: The condition or illness* 1B. 'Complicated' Category. Must be factored into care plan and service model *Domain 1: The condition or illness* 1A. Not fully characterized, understood, or predictable			

Strong Structuration Theory Area of Focus	Phase 1: Thematic Order: (Cluster : Theme; Sub-theme)	Phase 2: NASSS Framework Order: (Domain: Category. Category Explanation)	Phase 3: Principles of Digital Development Order: (Principle)	Phase 4: Global Digital Health Index Order: (GDHI Indicator Category: Approximate Scores)	Synthesis Order: (Narrative)
	strategies^^ • Governance and Leadership: Stakeholders, Clinicians, Technophobia / Capacity Building, As Users^^ • Governance and Leadership: Stakeholders, Engaging with and between mHealth Providers and Consumers^^ • Research & Development: Evidence Based Implementation, with emphasis on impact and Outcomes^^ • Continuity of Service: Sustainability, Total Cost of Ownership and Cost Utility^^ • Continuity of Service: Sustainability, The ongoing culture of outsourcing, including Funding and Consultants^^ • Continuity of Service: Scale, NDoH: Both Human and Financial Resources^^ • Continuity of Service:				

Strong Structuration Theory Area of Focus	Phase 1: Thematic Order: (Cluster : Theme; Sub-theme)	Phase 2: NASSS Framework Order: (Domain: Category. Category Explanation)	Phase 3: Principles of Digital Development Order: (Principle)	Phase 4: Global Digital Health Index Order: (GDHI Indicator Category: Approximate Scores)	Synthesis Order: (Narrative)
	Scale, Provincial Realities that are regarded as barriers in mHealth^^ • Continuity of Service: Design Thinking, South Africa Learning from Itself: MomConnect as a demonstration case^^ • Continuity of Service: Service Implementation^^ • Ecosystem: eHealth as a clinical service^^ • Ecosystem: Grey Areas amongst IT, Data Mx and eHealth^^ • Ecosystem: Fast Paced Tech Environment^^ • Ecosystem: Sustainable Development Goals: NHI^^ • Ecosystem: legal, policy or regulatory issues, Compliance^^ • Ecosystem: legal, policy or regulatory issues, Privacy and Security^^ • Ecosystem: legal, policy or regulatory issues, Data Ownership^^				

Strong Structuration Theory Area of Focus	Phase 1: Thematic Order: (Cluster : Theme; Sub-theme)	Phase 2: NASSS Framework Order: (Domain: Category. Category Explanation)	Phase 3: Principles of Digital Development Order: (Principle)	Phase 4: Global Digital Health Index Order: (GDHI Indicator Category: Approximate Scores)	Synthesis Order: (Narrative)
	• Recommendations: Recommendations from the MAC on eHealth^^ • Service Touch Point: Facility Level: Stakeholders, Mothers, Pregnant Women and where applicable, care givers^^^ • Service Touch Point: Facility Level: Stakeholders, Clinicians (Capacity Building, NurseConnect)^^^ • Service Touch Point: Facility Level: Stakeholders, Foreign Nationals as users of mHealth, and barriers associated^^^ • Service Touch Point: Facility Level: Service Implementation, Content of information as an mHealth service: Push and Pull SMSs^^^ • Service Touch Point: Facility Level: Service Implementation, Ethical				

Strong Structuration Theory Area of Focus	Phase 1: Thematic Order: (Cluster : Theme; Sub-theme)	Phase 2: NASSS Framework Order: (Domain: Category. Category Explanation)	Phase 3: Principles of Digital Development Order: (Principle)	Phase 4: Global Digital Health Index Order: (GDHI Indicator Category: Approximate Scores)	Synthesis Order: (Narrative)
	considerations^^^ • Service Touch Point: Facility Level: Service Implementation, The MomConnect Helpdesk: Interactive communication with nurses^^^ • Service Touch Point: Facility Level: Service Implementation, Subscription and Marketing^^^ • Service Touch Point: Facility Level: Service Implementation, Service Rating / Feedback / Feeling^^^ • Service Touch Point: Facility Level: Facility Environment^^^ • Service Touch Point: Facility Level: Operations^^^ • Service Touch Point: Facility Level: Recommendations^^^				

10.3.2 *What is the **socio-technical network of this project** or programme? Which agents and technologies are represented, and what are their position-practices?*

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
Regulations and Policies:	• Ecosystem: Organisational; Governance and Leadership* • Ecosystem: Privacy and Security; Data Ownership* • Ecosystem: Integration; Programmatic - Maternal, Child and Women's Health • Roll out: Operations and Performance* • Service Conceptualisation: Design Process; Expansion: Research* • MomConnect As a Case Example by Task Team Members: Critical Considerations, mHealth and eHealth Strategy^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Consideration of Ethics in Service Implementation (Including data security and ownership, content sent to mHealth Consumers)^ • MomConnect As a Case	*Domain 5 - The organisation* 'Complicated' category. Some work needed to build shared vision, engage staff, enact new practices, and monitor impact *Domain 7- Embedding and adaptation over time* 'Simple' category. Sense making, collective reflection, and adaptive action are ongoing and encouraged *Domain 7- Embedding and adaptation over time* 'Simple' category. Strong scope for adapting and embedding the technology as local need or context	• Design With the User • Understand the Existing Ecosystem • Use Open Standards, Open Data, Open Source, and Open Innovation • Address Privacy <u>and</u> Security	• Leadership and Governance: 5 • Strategy and Investment: 4 • Legislation, Policy and Compliance: 4 • Workforce: 2 • Standards and Interoperability: 4 • Infrastructure: 3 • Services and Applications: 4	The regulations around mHealth implementation were regarded as critical and needed proactive governance and leadership from the national department of health. The policies and strategies around mHealth and eHealth at large needed further review and update in order to address pressing issues around mHealth. Ethical considerations in mHealth implementation should be taken to considerations and policies should be clear on this. Research and development to guide and inform costs of mHealth, including but not limited to telecommunication charges for SMSs, calls and data.

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
	Example by Task Team Members: Cost for mHealth Service Consumer versus Cost for mHealth Service Provider^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Research and Development (Including the Design Process, Evidence-based initiative, tech environment, Compliance with Normative Standards, Inclusions of clinicians^ • Governance and Leadership: Strategy, Perceptions on both the eHealth and mHealth Strategies^^ • Governance and Leadership: Strategy, Feedback on applying the strategies^^ • Recommendations: Recommendations from the MAC on eHealth^^	changes *Domain 5 - The organisation* 5D. 'Complicated' Category. New team routines or care pathways that align readily with established ones *Domain 5: The organisation* 5C. Complicated Category. Multiple organisations with partnership relationship; cost-benefit balance favourable or neutral; new infrastructure (e.g. staff roles, training, kit) can mostly be found from repurposing *Domain 5: The organisation* 'Simple' Category. 5B. High tension for change,			

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
		good innovation-system fit, widespread support *Domain 3: The value proposition* 3B. 'Simple' Category. Technology is desirable for patients, effective, safe, and cost effective *Domain 1: The condition or illness* 1B. 'Complicated' Category. Must be factored into care plan and service model *Domain 1: The condition or illness* 1A. Not fully characterized, understood, or predictable			
Maintenance and Distribution	• Service Conceptualisation: Stake holders; Consultation and Collaboration*	*Domain 7-Embedding and adaptation over time*	• Design With the User	• Leadership and Governance: 5	Continuous maintenance, collaboration and

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
Network:	• MomConnect As a Case Example by Task Team Members: The Ministry of Health, Responses that were about the National Department of Health^	'Simple' category. Sense making, collective reflection, and adaptive action are ongoing and encouraged *Domain 5 - The organisation* 5D. 'Complicated' Category. New team routines or care pathways that align readily with established ones *Domain 5: The organisation* 5C. Complicated Category. Multiple organisations with partnership relationship; cost-benefit balance favourable or neutral; new infrastructure (e.g. staff roles, training, kit) can mostly be found from repurposing	• Build for Sustainability • Be Collaborative	• Strategy and Investment: 4 • Legislation, Policy and Compliance: 4 • Workforce: 2 • Standards and Interoperability: 4 • Infrastructure: 3 • Services and Applications: 4	networking was regarded as critical, however, there was no clear framework guiding this process.

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
		Domain 5: The organisation 'Simple' Category. 5B. High tension for change, good innovation-system fit, widespread support			
		Domain 5: The organisation 5A. 'Simple' Category. Well-led organisation with slack resources and good managerial relations; risk taking encouraged			
		Domain 4: The adopter system 4A. 'Complicated' Category. Existing staff must learn new skills and/or new staff be appointed			
		Domain 3: The value proposition 3B. 'Simple' Category. Technology is desirable for			

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Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
		patients, effective, safe, and cost effective *Domain 2: The technology* 2A. 'Simple' Category. Off-the-shelf or already installed, freestanding, dependable *Domain 1: The condition or illness* 1B. 'Complicated' Category. Must be factored into care plan and service model			
Production and Supply	• Service Continuity: Service Continuity, including Sustainability and Evolution* • MomConnect As a Case Example by Task Team Members: Critical Considerations, Cost for mHealth Service Consumer versus Cost for mHealth	*Domain 7- Embedding and adaptation over time* 'Simple' category. Sense making, collective reflection, and adaptive action are ongoing and encouraged	• Design With the User • Understand the Existing Ecosystem • Design for Scale • Build for Sustainability	• Leadership and Governance: 5 • Strategy and Investment: 4 • Legislation, Policy and Compliance: 4 • Workforce: 2	The sustainability of the initiative was the most cited risk, especially after reaching scale, due to the reality of the costs of sustaining the initiative in the absence of external funding. The costs of operations behind the production of

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
	Service Provider^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Research & Development (Including the Design Process, Evidence-based initiative, tech environment, Compliance with Normative Standards, Inclusions of clinicians^ • MomConnect As a Case Example by Task Team Members: Operations, Operations: M&E, DHIS, HR, Link to Care and Implementation Process^ • Continuity of Service: Sustainability, Total Cost of Ownership and Cost Utility^^	*Domain 7- Embedding and adaptation over time* 'Simple' category. Strong scope for adapting and embedding the technology as local need or context changes *Domain 5 - The organisation* 5D. 'Complicated' Category. New team routines or care pathways that align readily with established ones *Domain 5: The organisation* 5C. Complicated Category. Multiple organisations with partnership relationship; cost-benefit balance favourable or neutral; new infrastructure (e.g.		• Standards and Interoperability: 4 • Infrastructure: 3 • Services and Applications: 4	service. The total cost of ownership and the cost utility remains key items to be prioritized.

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Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
		staff roles, training, kit) can mostly be found from repurposing *Domain 5: The organisation* 'Simple' Category. 5B. High tension for change, good innovation-system fit, widespread support *Domain 5: The organisation* 5A. 'Simple' Category. Well-led organisation with slack resources and good managerial relations; risk taking encouraged *Domain 4: The adopter system* 4A. 'Complicated' Category. Existing staff must learn new skills and/or new staff be appointed *Domain 3: The value proposition* 3B.			

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
		'Simple' Category. Technology is desirable for patients, effective, safe, and cost effective			
		Domain 3: The value proposition 3A. 'Complicated' Category. Business case underdeveloped; potential risk to investors			
		Domain 2 - The technology 2D. 'Simple' Category. Generic, 'plug and play,' or COTS[a] solutions requiring minimal customization; easily			
		Domain 2: The technology 2A. 'Simple' Category. Off-the-shelf or already installed, freestanding,			

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
		dependable *Domain 1: The condition or illness* 1B. 'Complicated' Category. Must be factored into care plan and service model *Domain 1: The condition or illness* 1A. Not fully characterized, understood, or predictable			
Users and User practices	• Service Conceptualisation: Stake holders; Consultation and Collaboration* • Service Conceptualisation: Design Process; Expansion: Research* • MomConnect As a Case Example by Task Team Members: Stakeholders, Involvement of nurses^ • MomConnect As a Case Example by Task Team Members: Critical	*Domain 5 - The organisation* 'Complicated' category. Some work needed to build shared vision, engage staff, enact new practices, and monitor impact *Domain 7- Embedding and adaptation over time*	• Understand the Existing Ecosystem • Design with the User	• Leadership and Governance: 5 • Legislation, Policy and Compliance: 4 • Services and Applications: 4	There were different types of users, users at facility and users at helpdesk. It was easier for users at helpdesk to be more involved and heard, compared to users in facility who are a bigger population, there was no reported sampling technique for facility-based users. Internally, the initiative

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Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
	Considerations, Consideration of Ethics in Service Implementation (Including data security and ownership, content sent to mHealth Consumers)^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Cost for mHealth Service Consumer versus Cost for mHealth Service Provider^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Integration of Initiative within Health Programming^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Research & Development (Including the Design Process, Evidence-based initiative, tech environment, Compliance with Normative Standards, Inclusions of clinicians^ • MomConnect As a Case	'Simple' category. Strong scope for adapting and embedding the technology as local need or context changes *Domain 5 - The organisation* 5D. 'Complicated' Category. New team routines or care pathways that align readily with established ones *Domain 5: The organisation* 'Simple' Category. 5B. High tension for change, good innovation-system fit, widespread support *Domain 4: The adopter system* 4A. 'Complicated' Category. Existing staff must learn new skills and/or new			had to be used as a health programming tool to enhance the service, which is the reason the integration of mHealth into health programming remains key. Continuous research and development will ensure up to date and participation involvement of users in continuous service improvement .

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
	Example by Task Team Members: Operations, Operations: M&E, DHIS, HR, Link to Care and Implementation Process^ • MomConnect As a Case Example by Task Team Members: Recommendations, Includes, but not limited to, User Centred Design, Sustainability, Privacy and Security, Change Management and Stakeholder Management^ • Research & Development: Perspectives on the piloting of mHealth^^ • Service Touch Point: Facility Level: Stakeholders, Mothers, Pregnant Women and where applicable, care givers^^^ • Service Touch Point: Facility Level: Stakeholders, Clinicians (Capacity Building, NurseConnect)^^^ • Service Touch Point: Facility Level:	staff be appointed *Domain 3: The value proposition* 3B. 'Simple' Category. Technology is desirable for patients, effective, safe, and cost effective *Domain 2: The technology* 2A. 'Simple' Category. Off-the-shelf or already installed, freestanding, dependable *Domain 1: The condition or illness* 1B. 'Complicated' Category. Must be factored into care plan and service model *Domain 1: The condition or illness* 1A. Not fully characterized,			

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
	Stakeholders, Foreign Nationals as users of mHealth, and barriers associated^^^	understood, or predictable			
Cultural	• Service Conceptualisation: Design Process; Expansion: Research* • MomConnect As a Case Example by Task Team Members: Outliars, Traditional Beliefs, the importance of telecommunications network, PEPFAR partners at districts. Need for information centre for eHealth^ • Service Touch Point: Facility Level: Stakeholders, Foreign Nationals as users of mHealth, and barriers associated^^^ • Service Touch Point: Facility Level: Service Implementation, Content of information as an mHealth service: Push and Pull SMSs^^^	*Domain 5 - The organisation* 'Complicated' category. Some work needed to build shared vision, engage staff, enact new practices, and monitor impact *Domain 1: The condition or illness* 1B. 'Complicated' Category. Must be factored into care plan and service model	• Understand the Existing Ecosystem • Design With the User	• Services and Applications: 4	A need for research was raised which could address cultural and related issues.

10.3.3 What are the **key relationships** (agent–agent, technology–technology, agent–technology) in the network and how are they changing over time?

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
Agent-agent:	• Service Conceptualisation: Stake holders; Consultation and Collaboration* • Roll out: The scaling process: National to Provinces* • Ecosystem: Privacy and Security; The service* • Service Conceptualisation: Design Process; Considerations* • Service Conceptualisation: Design Process; Expansion: Research* • MomConnect As a Case Example by Task Team Members: Stakeholders, Selection^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Cost for mHealth Service Consumer versus Cost for mHealth Service Provider^ • MomConnect As a Case Example by Task Team Members: Perspectives, Top-Down Communication / Power	*Domain 5 - The organisation* 'Complicated' category. Some work needed to build shared vision, engage staff, enact new practices, and monitor impact **Domain 7-** *Embedding and adaptation over time* 'Simple' category. Sense making, collective reflection, and adaptive action are ongoing and encouraged *Domain 7- Embedding and adaptation over time* 'Simple' category. Strong scope for	• Design With the User • Understand the Existing Ecosystem • Design for Scale • Build for Sustainability • Use Open Standards, Open Data, Open Source, and Open Innovation • Be Data Driven • Reuse and Improve • Be Collaborative	• Leadership and Governance: 5 • Strategy and Investment: 4 • Legislation, Policy and Compliance: 4 • Workforce: 2 • Standards and Interoperability: 4 • Infrastructure: 3 • Services and Applications: 4	The MomConnect task team may be regarded as a fit for agent to agent independent decisions because of the nature of collaborations and independent decisions that were taken regardless of the gaps in policies and strategies in order to make the initiative a success. The selection of stakeholders was based on existing networks between the stakeholders or agents. The cost also represents the relationship and decisions made between agents such as telecommunications networks organisations and the national department of health. The power issue is also an agent to agent situation, which brings in the structure or hierarchical order sensitivities. Capacity building of clinicians in the area of using ICT for health, centralisation of mHealth and clarification of roles in different directorates that contribute to mHealth for effective governance by the national department may be identified as an agent to agent link.

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
	Issues^ • Governance and Leadership: Stakeholders, Clinicians, Technophobia / Capacity Building, As Users^^ • Governance and Leadership: Stakeholders, Engaging with and between mHealth Providers and Consumers^^ • Governance and Leadership: Centralisation of mHealth, Rationalisation and Harmonisation of mHealth Services^^ • Continuity of Service: Design Thinking, South Africa Learning from Itself: MomConnect as a demonstration case^^ • Ecosystem: Grey Areas amongst IT, Data Mx and eHealth^^ • Service Touch Point: Facility Level: Service Implementation, The MomConnect Helpdesk: Interactive communication with nurses^^^	adapting and embedding the technology as local need or context changes *Domain 5 - The organisation* 5D. 'Complicated' Category. New team routines or care pathways that align readily with established ones *Domain 5: The organisation* 5C. Complicated Category. Multiple organisations with partnership relationship; cost-benefit balance favourable or neutral; new infrastructure (e.g. staff roles, training, kit) can			

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
		mostly be found from repurposing *Domain 5: The organisation* 'Simple' Category. 5B. High tension for change, good innovation-system fit, widespread support *Domain 5: The organisation* 5A. 'Simple' Category. Well-led organisation with slack resources and good managerial relations; risk taking encouraged *Domain 4: The adopter system* 4A.			

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
		'Complicated' Category. Existing staff must learn new skills and/or new staff be appointed *Domain 4: The adopter system* 4A. 'Complicated' Category. Existing staff must learn new skills and/or new staff be appointed *Domain 3: The value proposition* 3B. 'Simple' Category. Technology is desirable for patients, effective, safe, and cost effective			

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
Tech to tech:	• Ecosystem: Integration; Technical: Infrastructure and Interoperability* • Ecosystem: Privacy and Security; The service* • Service Conceptualisation: Design Process; Considerations* • Service Conceptualisation: Design Process; Expansion: Research* • MomConnect As a Case Example by Task Team Members: Critical Considerations, mHealth and eHealth Strategy^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Consideration of Ethics in Service Implementation (Including data security and ownership, content sent to mHealth Consumers)^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Research &	*Domain 5 - The organisation* 'Complicated' category. Some work needed to build shared vision, engage staff, enact new practices, and monitor impact *Domain 7- Embedding and adaptation over time* 'Simple' category. Sense making, collective reflection, and adaptive action are ongoing and encouraged *Domain 7- Embedding and adaptation over time* 'Simple' category. Strong scope for	• Understand the Existing Ecosystem • Build for Sustainability • Be Data Driven • Use Open Standards, Open Data, Open Source, and Open Innovation • Address Privacy and Security • Be Collaborative	• Leadership and Governance: 5 • Strategy and Investment: 4 • Legislation, Policy and Compliance: 4 • Standards and Interoperability: 4 • Infrastructure: 3 • Services and Applications: 4	Telecommunications network, USSD, WebDHIS (for data reporting) and CasePro (for helpdesk operations) may be regarded as a fit for technology-to-technology link. The mHealthj strategy serves as a guideline for tech-to-tech link, including data ownership and related ethics and regulations between technology touch points. Centralisation of mHealth will ensure integration and interoperability between the different technologies.

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Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
	Development (Including the Design Process, Evidence-based initiative, tech environment, Compliance with Normative Standards, Inclusions of clinicians^ • MomConnect As a Case Example by Task Team Members: Operations, Operations: M&E, DHIS, HR, Link to Care and Implementation Process^ • Governance and Leadership: Centralisation of mHealth, Rationalisation and Harmonisation of mHealth Services^^ • Governance and Leadership: Strategy, Perceptions on both the eHealth and mHealth Strategies^^ • Continuity of Service: Design Thinking, South Africa Learning from Itself: MomConnect as a demonstration case^^ • Continuity of Service: Design Thinking, Issues relating to Computing Infrastructure^^ • Ecosystem: Fast Paced Tech Environment^^	adapting and embedding the technology as local need or context changes *Domain 5: The organisation* 5C. Complicated Category. Multiple organisations with partnership relationship; cost-benefit balance favourable or neutral; new infrastructure (e.g. staff roles, training, kit) can mostly be found from repurposing *Domain 5: The organisation* 'Simple' Category. 5B. High tension for change, good			

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Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
	• Service Touch Point: Facility Level: Service Implementation, The MomConnect Helpdesk: Interactive communication with nurses^^^ • Service Touch Point: Facility Level: Service Implementation, Content of information as an mHealth service: Push and Pull SMSs^^^ • Service Touch Point: Facility Level: Service Implementation, Subscription and Marketing^^^	innovation-system fit, widespread support *Domain 5: The organisation* 5A. 'Simple' Category. Well-led organisation with slack resources and good managerial relations; risk taking encouraged *Domain 4: The adopter system* 4A. 'Complicated' Category. Existing staff must learn new skills and/or new staff be appointed *Domain 3: The value*			

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
		proposition 3B. 'Simple' Category. Technology is desirable for patients, effective, safe, and cost effective			
		Domain 2 - The technology 2D. 'Simple' Category. Generic, 'plug and play,' or COTS[a] solutions requiring minimal customization; easily			
		Domain 2: The technology 2A. 'Simple' Category. Off-the-shelf or already installed, freestanding, dependable			

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
		Domain 1: The condition or illness 1B. 'Complicated' Category. Must be factored into care plan and service model			
Agent-tech:	• Service Continuity: Service Continuity, including Sustainability and Evolution* • Ecosystem: Privacy and Security; The service* • Service Conceptualisation: Design Process; Considerations* • Service Conceptualisation: Design Process; Expansion: Research* • MomConnect As a Case Example by Task Team Members: Critical Considerations, mHealth and eHealth Strategy^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Consideration of Ethics in Service	*Domain 5 - The organisation* 'Complicated' category. Some work needed to build shared vision, engage staff, enact new practices, and monitor impact **Domain 7-** *Embedding and adaptation over time* 'Simple' category. Sense making, collective reflection, and adaptive action are ongoing and	• Understand the Existing Ecosystem • Build for Sustainability • Be Data Driven • Use Open Standards, Open Data, Open Source, and Open Innovation • Address Privacy and Security	• Leadership and Governance: 5 • Strategy and Investment: 4 • Legislation, Policy and Compliance: 4 • Workforce: 2 • Standards and Interoperability: 4 • Infrastructure: 3 • Services and Applications: 4	The use of tech to reach out to patients, the use of tech to reach out to helpdesk, and the use of data generated by the initiative by the department of health for health service delivery, planning and management best describes the agent and tech link. The strategy hides the agent and tech touch point, how data security should be managed in this regard. The centralisation of mHealth will ensure agent to tech link in order to address issues related to implementation of mHealth.

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
	Implementation (Including data security and ownership, content sent to mHealth Consumers)^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Integration of Initiative within Health^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Programming Research & Development (Including the Design Process, Evidence-based initiative, tech environment, Compliance with Normative Standards, Inclusions of clinicians^ • MomConnect As a Case Example by Task Team Members: Operations, Operations: M&E, DHIS, HR, Link to Care and Implementation Process^ • MomConnect As a Case Example by Task Team Members: Recommendations, Includes, but not limited to, User Centred Design,	encouraged *Domain 7- Embedding and adaptation over time* 'Simple' category. Strong scope for adapting and embedding the technology as local need or context changes *Domain 5 - The organisation* 5D. 'Complicated' Category. New team routines or care pathways that align readily with established ones *Domain 5: The organisation* 5C. Complicated Category. Multiple organisations with partnership	• Be Collaborative • Reuse and Improve • Design for Scale • Design With the User		

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
	Sustainability, Privacy and Security, Change Management and Stakeholder Management^ • Governance and Leadership: Centralisation of mHealth, Rationalisation and Harmonisation of mHealth Services^^ • Governance and Leadership: Strategy, Perceptions on both the eHealth and mHealth Strategies^^ • Governance and Leadership: Strategy, Feedback on applying the strategies^^ • Governance and Leadership: Stakeholders, Clinicians, Technophobia / Capacity Building, As Users^^ • Governance and Leadership: Stakeholders, Engaging with and between mHealth Providers and Consumers^^ • Research & Development: Evidence Based Implementation, with emphasis on impact and Outcomes^^ • Continuity of Service: Design Thinking, South Africa Learning from Itself:	relationship; cost-benefit balance favourable or neutral; new infrastructure (e.g. staff roles, training, kit) can mostly be found from repurposing *Domain 5: The organisation* 'Simple' Category. 5B. High tension for change, good innovation-system fit, widespread support *Domain 5: The organisation* 5A. 'Simple' Category. Well-led organisation with slack resources and good			

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
	MomConnect as a demonstration case^^ • Ecosystem: Grey Areas amongst IT, Data Mx and eHealth^^ • Ecosystem: eHealth as a clinical service^^ • Ecosystem: legal, policy or regulatory issues, Compliance^^ • Ecosystem: legal, policy or regulatory issues, Privacy and Security^^ • Ecosystem: legal, policy or regulatory issues, Data Ownership^^ • Service Touch Point: Facility Level: Service Implementation, Service Rating / Feedback / Feeling^^^ • Service Touch Point: Facility Level: Facility Environment^^^	managerial relations; risk taking encouraged *Domain 4: The adopter system* 4A. 'Complicated' Category. Existing staff must learn new skills and/or new staff be appointed *Domain 3: The value proposition* 3B. 'Simple' Category. Technology is desirable for patients, effective, safe, and cost effective *Domain 2 - The technology* 2D. 'Simple'			

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
		Category. Generic, 'plug and play,' or COTS[a] solutions requiring minimal customization; easily *Domain 2: The technology* 2A. 'Simple' Category. Off-the-shelf or already installed, freestanding, dependable *Domain 1: The condition or illness* 1B. 'Complicated' Category. Must be factored into care plan and service model			

10.3.4 To what extent has stability of the network been achieved – and why?

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
Stability	• Ecosystem: Privacy and Security; The service* • Service Continuity: Service Continuity, including Sustainability and Evolution* • Ecosystem: Integration; Technical: Infrastructure and Interoperability* • Ecosystem: Integration; Programmatic - Maternal, Child and Women's Health* • Service Conceptualisation: Stake holders; Consultation and Collaboration* • Ecosystem: Organisational; Political* • Ecosystem: Organisational; Governance and Leadership* • MomConnect As a Case Example by Task Team Members: Stakeholders, Life Span within the NDoH^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, mHealth and eHealth Strategy^ • MomConnect As a Case Example by Task Team	*Domain 5 - The organisation* 'Complicated' category. Some work needed to build shared vision, engage staff, enact new practices, and monitor impact *Domain 7- Embedding and adaptation over time* 'Simple' category. Sense making, collective reflection, and adaptive action are ongoing and encouraged *Domain 7- Embedding*	• Design for Scale • Be Data Driven • Build for Sustainability	• Leadership and Governance: 5 • Strategy and Investment: 4 • Legislation, Policy and Compliance: 4 • Workforce: 2 • Standards and Interoperability: 4 • Infrastructure: 3 • Services and Applications: 4	The stability of the initiative was evident from the targets reached and the consistency of the task team. However, there was fear of sustainability. The recommendations given by participants did address the issue of stability. The rationalization and harmonization of mHealth services may result in stable networking where best practices and collaborations may be shared.

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	Members: Critical Considerations, Consideration of Ethics in Service Implementation (Including data security and ownership, content sent to mHealth Consumers)^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Uncertainty regarding Sustainability (Including culture of the team, consistency over time and evolution of the Initiative)^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Integration of Initiative within Health Programming^ • MomConnect As a Case Example by Task Team Members: Perspectives, Top-Down Communication / Power Issues^ • MomConnect As a Case Example by Task Team Members: Operations, Operations: M&E, DHIS, HR, Link to Care and Implementation Process^ • MomConnect As a Case Example by Task Team Members: Recommendations, Includes, but not limited to,	*and adaptation over time* 'Simple' category. Strong scope for adapting and embedding the technology as local need or context changes *Domain 5 - The organisation* 5D. 'Complicated' Category. New team routines or care pathways that align readily with established ones *Domain 5: The organisation* 5C. Complicated Category. Multiple organisations with		

	User Centred Design, Sustainability, Privacy and Security, Change Management and Stakeholder Management^ • MomConnect As a Case Example by Task Team Members: Outliars, Traditional Beliefs, the importance of telecommunications network, PEPFAR partners at districts. Need for information centre for eHealth^ • Governance and Leadership: Centralisation of mHealth, Rationalisation and Harmonisation of mHealth Services^^ • Governance and Leadership: Strategy, Perceptions on both the eHealth and mHealth Strategies^^ • Service Touch Point: Facility Level: Stakeholders, Clinicians (Capacity Building, NurseConnect)^^^	partnership relationship; cost-benefit balance favourable or neutral; new infrastructure (e.g. staff roles, training, kit) can mostly be found from repurposing *Domain 5: The organisation* 'Simple' Category. 5B. High tension for change, good innovation-system fit, widespread support *Domain 5: The organisation* 5A. 'Simple' Category. Well-led organisation with slack resources and good managerial		

| | | relations; risk taking encouraged

Domain 4: The adopter system 4A. 'Complicated' Category. Existing staff must learn new skills and/or new staff be appointed

Domain 3: The value proposition 3B. 'Simple' Category. Technology is desirable for patients, effective, safe, and cost effective

Domain 2 - The technology 2D. 'Simple' Category. Generic, 'plug and play,' or | | | |
|---|---|---|---|---|

		COTS[a] solutions requiring minimal customization; easily			
		Domain 2: The technology 2A. 'Simple' Category. Off-the-shelf or already installed, freestanding, dependable			
		Domain 1: The condition or illness 1B. 'Complicated' Category. Must be factored into care plan and service model			

APPENDIX P: MICRO-LEVEL QUESTIONS IN RELATION TO MAPPING THE RELEVANT PART OF THE NETWORK (NETWORK-IN-FOCUS)

10.4 Micro Level Questions *Focused on Specific Conjunctures within the Unfolding Process*

10.4.1 *Who are the **key human agent(s) involved** in this conjuncture?*

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
Human Agents	• Service Conceptualisation: Stake holders; Consultation and Collaboration* • Ecosystem: Organisational; Political • Roll out: The scaling process: National to Provinces* • Ecosystem: Integration; Programmatic - Maternal, Child and Women's Health* • Service Conceptualisation: Stake holders; Consultation and Collaboration* • Service Conceptualisation: Design Process; Expansion: Research* • MomConnect As a Case Example by Task Team Members: Stakeholders, Selection^ • MomConnect As a Case Example by Task Team Members: Critical	*Domain 5 - The organisation* 'Complicated' category. Some work needed to build shared vision, engage staff, enact new practices, and monitor impact *Domain 7- Embedding and adaptation over time* 'Simple' category. Sense making, collective reflection, and adaptive	• Design With the User • Understand the Existing Ecosystem • Design for Scale • Build for Sustainability • Be Data Driven • Use Open Standards, Open Data, Open Source, and Open Innovation • Be Collaborative	Leadership and Governance: 5 Strategy and Investment: 4 Legislation, Policy and Compliance: 4 Workforce: 2 Standards and Interoperability: 4 Infrastructure: 3 Services and Applications: 4	In this study, all stakeholders are key. The human agents in the initiative were users (at facility and helpdesk), the national department of health, implementing partners, telecommunications network organisations and the Ministerial Advisory Committee on eHealth. The server administrators, software developers and configuration process done as a continuous process to ensure smooth running of the initiative. The provincial departments of health have a implementation role.

	Considerations, Integration of Initiative within Health Programming^ • MomConnect As a Case Example by Task Team Members: The Ministry of Health, Responses that were about the National Department of Health^ • MomConnect As a Case Example by Task Team Members: Operations, Operations: M&E, DHIS, HR, Link to Care and Implementation Process^ • Governance and Leadership: Stakeholders, Engaging with and between mHealth Providers and Consumers^^ • Continuity of Service: Scale, NDoH: Both Human and Financial Resources^^ • Continuity of Service: Scale, Provincial Realities that are regarded as barriers in mHealth^^ • Continuity of Service: Design Thinking, South Africa Learning from Itself: MomConnect as a demonstration case^^ • Ecosystem: The MAC members background: Demography^^ • Service Touch Point: Facility	action are ongoing and encouraged *Domain 7- Embedding and adaptation over time* 'Simple' category. Strong scope for adapting and embedding the technology as local need or context changes *Domain 5 - The organisation* 5D. 'Complicated' Category. New team routines or care pathways that align readily with established ones *Domain 5: The organisation*	• Reuse and Improve		

	Level: Stakeholders, Mothers, Pregnant Women and where applicable, care givers^^^ • Service Touch Point: Facility Level: Stakeholders, Clinicians (Capacity Building, NurseConnect) ^^^ • Service Touch Point: Facility Level: Stakeholders, Foreign Nationals as users of mHealth, and barriers associated^^^	5C. Complicated Category. Multiple organisations with partnership relationship; cost-benefit balance favourable or neutral; new infrastructure (e.g. staff roles, training, kit) can mostly be found from repurposing *Domain 5: The organisation* 'Simple' Category. 5B. High tension for change, good innovation-system fit, widespread support *Domain 5: The organisation* 5A. 'Simple' Category.		

| | | Well-led organisation with slack resources and good managerial relations; risk taking encouraged

Domain 2: The technology 2A. 'Simple' Category. Off-the-shelf or already installed, freestanding, dependable | | | |
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10.4.2 *What are the **key technologies involved** in this conjuncture?*

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
Key Technologies Involved	• Service Conceptualisation: Design Process; Expansion: Research* • Ecosystem: Integration; Technical: Infrastructure and Interoperability* • Ecosystem: Organisational; Governance and Leadership* • MomConnect As a Case Example by Task Team Members: Critical Considerations, mHealth and eHealth Strategy^ • MomConnect As a Case Example by Task Team Members: Operations, Operations: M&E, DHIS, HR, Link to Care and Implementation Process^ • Continuity of Service: Design Thinking, Issues relating to Computing Infrastructure^^	*Domain 5 - The organisation* 'Complicated' category. Some work needed to build shared vision, engage staff, enact new practices, and monitor impact *Domain 7- Embedding and adaptation over time* 'Simple' category. Sense making, collective reflection, and adaptive action are ongoing and encouraged *Domain 7- Embedding and adaptation over time* 'Simple' category. Strong scope for adapting and	• Use Open Standards, Open Data, Open Source, and Open Innovation	• Leadership and Governance: 5 • Strategy and Investment: 4 • Legislation, Policy and Compliance: 4 • Workforce: 2 • Standards and Interoperability: 4 • Infrastructure: 3 • Services and Applications: 4	USSD may be regarded as the key technology, in this initiative. Supporting technologies being CasePro for the helpdesk and WebDHIS for data reporting and management.

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
		embedding the technology as local need or context changes *Domain 5 - The organisation* 5D. 'Complicated' Category. New team routines or care pathways that align readily with established ones *Domain 5: The organisation* 5C. Complicated Category. Multiple organisations with partnership relationship; cost-benefit balance favourable or neutral; new infrastructure (e.g. staff roles, training, kit) can mostly be found from repurposing			

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
		Domain 5: The organisation 'Simple' Category. 5B. High tension for change, good innovation-system fit, widespread support			
		Domain 3: The value proposition 3B. 'Simple' Category. Technology is desirable for patients, effective, safe, and cost effective			
		Domain 2 - The technology 2D. 'Simple' Category. Generic, 'plug and play,' or COTS[a] solutions requiring minimal customization;			

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
		easily *Domain 2: The technology* 2A. 'Simple' Category. Off-the-shelf or already installed, freestanding, dependable *Domain 1: The condition or illness* 1B. 'Complicated' Category. Must be factored into care plan and service model			

*10.4.3 What **technological, financial and organisational infrastructure** is needed to support the conjuncture?*

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
Technological	• Ecosystem: Integration; Technical: Infrastructure and Interoperability* • Ecosystem: Privacy and Security; Data Ownership* • Governance and Leadership: Centralisation of mHealth, Rationalisation and Harmonisation of mHealth Services^^ • Continuity of Service: Sustainability, Total Cost of Ownership and Cost Utility^^ • Continuity of Service: Sustainability, The ongoing culture of outsourcing, including Funding and Consultants^^ • Continuity of Service: Design Thinking, Issues relating to Computing Infrastructure^^ • Ecosystem: Grey Areas amongst IT, Data Mx and eHealth^^	*Domain 5 - The organisation* 'Complicated' category. Some work needed to build shared vision, engage staff, enact new practices, and monitor impact *Domain 7- Embedding and adaptation over time* 'Simple' category. Sense making, collective reflection, and adaptive action are ongoing and encouraged *Domain 7- Embedding and adaptation over time* 'Simple' category. Strong scope for adapting and embedding the	• Address Privacy <u>and</u> Security • Use Open Standards, Open Data, Open Source, and Open Innovation	• Leadership and Governance: 5 • Strategy and Investment: 4 • Legislation, Policy and Compliance: 4 • Workforce: 2 • Standards and Interoperability: 4 • Infrastructure: 3 • Services and Applications: 4	Telecommunications network, handset, computer for helpdesk, servers and data reporting software. The centralisation of mHealth may add to strengthening of technological infrastructure.

		technology as local need or context changes *Domain 5 - The organisation* 5D. 'Complicated' Category. New team routines or care pathways that align readily with established ones *Domain 5: The organisation* 5C. Complicated Category. Multiple organisations with partnership relationship; cost-benefit balance favourable or neutral; new infrastructure (e.g. staff roles, training, kit) can mostly be found from repurposing *Domain 5: The organisation* 'Simple' Category. 5B. High tension for			

		change, good innovation-system fit, widespread support *Domain 5: The organisation* 5A. 'Simple' Category. Well-led organisation with slack resources and good managerial relations; risk taking encouraged *Domain 3: The value proposition* 3B. 'Simple' Category. Technology is desirable for patients, effective, safe, and cost effective *Domain 2 - The technology* 2D. 'Simple' Category. Generic, 'plug and play,' or COTS[a] solutions requiring minimal			

		customization; easily			
		Domain 2: The technology 2A. 'Simple' Category. Off-the-shelf or already installed, freestanding, dependable			
		Domain 1: The condition or illness 1B. 'Complicated' Category. Must be factored into care plan and service model			
Financial	• Roll out: Operations and Performance* • MomConnect As a Case Example by Task Team Members: Critical Considerations, Cost for mHealth Service Consumer versus Cost for mHealth Service Provider^ • Continuity of Service: Sustainability, Total Cost of Ownership and Cost	*Domain 5 - The organisation* 'Complicated' category. Some work needed to build shared vision, engage staff, enact new practices, and monitor impact **Domain 7-** *Embedding and*	• Design for Scale • Build for Sustainability • Be Collaborative	• Leadership and Governance: 5 • Strategy and Investment: 4 • Legislation, Policy and Compliance: 4 • Workforce: 2 • Standards and Interoperability: 4	Budget from government itself to reduce dependence from external funding. Sustainability is strongly linked to the financial infrastructure.

	Utility^^ • Continuity of Service: Sustainability, The ongoing culture of outsourcing, including Funding and Consultants^^ • Continuity of Service: Scale, NDoH: Both Human and Financial Resources^^ • Continuity of Service: Scale, Provincial Realities that are regarded as barriers in mHealth^^	*adaptation over time* 'Simple' category. Sense making, collective reflection, and adaptive action are ongoing and encouraged *Domain 5 - The organisation* 5D. 'Complicated' Category. New team routines or care pathways that align readily with established ones *Domain 5: The organisation* 5C. Complicated Category. Multiple organisations with partnership relationship; cost-benefit balance favourable or neutral; new infrastructure (e.g. staff roles, training, kit) can mostly be found from repurposing		• Infrastructure: 3 • Services and Applications: 4	

		Domain 3: The value proposition 3B. 'Simple' Category. Technology is desirable for patients, effective, safe, and cost effective			
		Domain 3: The value proposition 3A. 'Complicated' Category. Business case underdeveloped; potential risk to investors			
		Domain 1: The condition or illness 1B. 'Complicated' Category. Must be factored into care plan and service model			
Organisational	• Ecosystem: Organisational; Governance and Leadership* • MomConnect As a Case	Domain 5 - The organisation 'Complicated' category. Some work needed to	• Design With the User • Understand the Existing Ecosystem	• Leadership and Governance: 5 • Strategy and Investment: 4	There was consensus among participants that there is a need to strengthen governance and leadership in mHealth

	Example by Task Team Members: The Ministry of Health, Responses that were about the National Department of Health^ • Governance and Leadership: Centralisation of mHealth, Rationalisation and Harmonisation of mHealth Services^^ • Governance and Leadership: Strategy, Perceptions on both the eHealth and mHealth Strategies^^ • Governance and Leadership: Stakeholders, Engaging with and between mHealth Providers and Consumers^^ • Service Touch Point: Facility Level: Stakeholders, Clinicians (Capacity Building, NurseConnect)^^^	build shared vision, engage staff, enact new practices, and monitor impact **Domain 7-** *Embedding and adaptation over time* 'Simple' category. Sense making, collective reflection, and adaptive action are ongoing and encouraged *Domain 7- Embedding and adaptation over time* 'Simple' category. Strong scope for adapting and embedding the technology as local need or context changes *Domain 5 - The organisation* 5D. 'Complicated' Category. New team routines or care pathways	• Design for Scale • Build for Sustainability • Be Data Driven • Use Open Standards, Open Data, Open Source, and Open Innovation • Reuse and Improve • Address Privacy and Security • Be Collaborative	• Legislation, Policy and Compliance: 4 • Workforce: 2 • Standards and Interoperability: 4 • Infrastructure: 3 • Services and Applications: 4	from the national department of health.

		that align readily with established ones			
		Domain 5: The organisation 5C. Complicated Category. Multiple organisations with partnership relationship; cost-benefit balance favourable or neutral; new infrastructure (e.g. staff roles, training, kit) can mostly be found from repurposing			
		Domain 5: The organisation 'Simple' Category. 5B. High tension for change, good innovation-system fit, widespread support			
		Domain 5: The organisation 5A. 'Simple' Category. Well-led organisation with slack			

		resources and good managerial relations; risk taking encouraged *Domain 4: The adopter system* 4A. 'Complicated' Category. Existing staff must learn new skills and/or new staff be appointed *Domain 3: The value proposition* 3B. 'Simple' Category. Technology is desirable for patients, effective, safe, and cost effective *Domain 1: The condition or illness* 1B. 'Complicated' Category. Must be factored into care plan and service model			

Actant's internal structures *relevant to the conjunctural situation*

10.4.1 Human agent's general dispositions *(e.g. socio-cultural schemas, hierarchies of values, virtues, cognitive capacity, embodied skills, past experience)*

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
Human agent's general disposition	• Ecosystem: Organisational; Governance and Leadership* • Service Conceptualisation: Stake holders; Consultation and Collaboration* • MomConnect As a Case Example by Task Team Members: Stakeholders, Selection • MomConnect As a Case Example by Task Team Members: Perspectives, Top-Down Communication / Power Issues^ • Governance and Leadership: Strategy, Feedback on applying the strategies^^ • Ecosystem: The MAC members background: Demography^^ • Service Touch Point: Facility Level: Service	*Domain 5 - The organisation* 'Complicated' category. Some work needed to build shared vision, engage staff, enact new practices, and monitor impact *Domain 7- Embedding and adaptation over time* 'Simple' category. Sense making, collective reflection, and adaptive action are ongoing and	•Design With the User •Understand the Existing Ecosystem •Build for Sustainability •Be Collaborative	• Leadership and Governance: 5 • Strategy and Investment: 4 • Legislation, Policy and Compliance: 4 • Workforce: 2 • Standards and Interoperability: 4 • Infrastructure: 3 • Services and Applications: 4	The human agents involved in this initiative were experienced and had relationship with each other and with the national department of health, they collaborated knowing the challenges that face mHealth implementations, this assisted the team in being rational and making independent decisions independently and collaboratively due to their experience and knowledge. There were power issues due to high profile nature of the project which was not mentioned as a constraint for success but an area of improvement.

	Implementation, Service Rating / Feedback / Feeling^^^	encouraged			
		Domain 7- Embedding and adaptation over time 'Simple' category. Strong scope for adapting and embedding the technology as local need or context changes			
		Domain 5 - The organisation 5D. 'Complicated' Category. New team routines or care pathways that align readily with established ones			
		Domain 5: The organisation 5C. Complicated			

| | | Category. Multiple organisations with partnership relationship; cost-benefit balance favourable or neutral; new infrastructure (e.g. staff roles, training, kit) can mostly be found from repurposing

Domain 5: The organisation 'Simple' Category. 5B. High tension for change, good innovation-system fit, widespread support

Domain 5: The organisation 5A. 'Simple' Category. Well-led organisation | | | |
|---|---|---|---|---|---|

		with slack resources and good managerial relations; risk taking encouraged *Domain 1: The condition or illness* 1B. 'Complicated' Category. Must be factored into care plan and service model			

10.4.2 Relevant technology's material properties and inscribed socio-cultural structures (2c in Fig. 2)

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Convergence: Synthesis
Relevant technology's material properties	• Ecosystem: Integration; Technical: Infrastructure and Interoperability* • Ecosystem: Privacy and Security; Data Ownership* • MomConnect As a Case Example by Task Team Members: Recommendation, Includes, but not limited to, User Centred Design, Sustainability, Privacy and Security, Change Management and Stakeholder Management^ • Governance and Leadership: Stakeholders, Engaging with and between mHealth Providers and Consumers^^ • Research & Development: Evidence Based Implementation, with emphasis on impact and Outcomes^^ • Continuity of Service: Design Thinking, South Africa Learning from Itself: MomConnect as a demonstration case^^	*Domain 5 - The organisation* 'Complicated' category. Some work needed to build shared vision, engage staff, enact new practices, and monitor impact *Domain 7- Embedding and adaptation over time* 'Simple' category. Sense making, collective reflection, and adaptive action are ongoing and encouraged *Domain 7- Embedding and adaptation over time* 'Simple' category. Strong scope for adapting and	• Build for Sustainability • Use Open Standards, Open Data, Open Source, and Open Innovation	• Leadership and Governance: 5 • Strategy and Investment: 4 • Legislation, Policy and Compliance: 4 • Workforce: 2 • Standards and Interoperability: 4 • Infrastructure: 3 • Services and Applications: 4	The use of USSD was based on the fact that it can work in any phone and there is no intense, if any, training needed, for users, in order to utilize the mHealth services. Recommendations did address the technology material properties.

	• Service Touch Point: Facility Level: Service Implementation, Content of information as an mHealth service: Push and Pull SMSs^^^	embedding the technology as local need or context changes *Domain 5 - The organisation* 5D. 'Complicated' Category. New team routines or care pathways that align readily with established ones *Domain 5: The organisation* 5C. Complicated Category. Multiple organisations with partnership relationship; cost-benefit balance favourable or neutral; new infrastructure (e.g. staff roles, training, kit) can mostly be found from repurposing *Domain 5: The*		

		organisation 'Simple' Category. 5B. High tension for change, good innovation-system fit, widespread support			
		Domain 3: The value proposition 3B. 'Simple' Category. Technology is desirable for patients, effective, safe, and cost effective			
		Domain 2 - The technology 2D. 'Simple' Category. Generic, 'plug and play,' or COTS[a] solutions requiring minimal customization; easily			
		Domain 2: The			

		technology 2A. 'Simple' Category. Off-the-shelf or already installed, freestanding, dependable *Domain 1: The condition or illness* 1B. 'Complicated' Category. Must be factored into care plan and service model			

10.4.3 Human agent's conjuncturally-specific knowledge (perhaps imperfect): of relevant external structures (the strategic terrain) - *including socio-cultural knowledge of how other agents view the world (i.e. knowledge of domain of heading); of technology-in-focus's material properties and inscribed socio-cultural structures; and of technology-in focus's range of functionality relevant to the immediate situation* .

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
Human agent's conjuncturally-specific knowledge	• Ecosystem: Organisational; Governance and Leadership* • Service Conceptualisation: Stake holders; Consultation and Collaboration* • MomConnect As a Case Example by Task Team Members: Stakeholders, Selection^ • Governance and Leadership: Strategy, Feedback on applying the strategies^^ • Research & Development: Evidence Based Implementation, with emphasis on impact and Outcomes^^ • Continuity of Service: Design Thinking, South Africa Learning from Itself: MomConnect as a demonstration case^^ • Ecosystem: The MAC members background:	*Domain 5 - The organisation* 'Complicated' category. Some work needed to build shared vision, engage staff, enact new practices, and monitor impact *Domain 7- Embedding and adaptation over time* 'Simple' category. Sense making, collective reflection, and adaptive action are ongoing and encouraged *Domain 7- Embedding and adaptation over*	• Build for Sustainability • Use Open Standards, Open Data, Open Source, and Open Innovation • Design With the User • Be Collaborative • Understand the Existing Ecosystem	• Leadership and Governance: 5 • Strategy and Investment: 4 • Legislation, Policy and Compliance: 4 • Workforce: 2 • Standards and Interoperability: 4 • Infrastructure: 3 • Services and Applications: 4	The human agents had interdisciplinary knowledge in ICT and Health. The selection of stakeholders seemed purposive and linked to existing networks around mHealth, which had an advantage of diverse knowledge and skills.

	Demography^^	*time* 'Simple' category. Strong scope for adapting and embedding the technology as local need or context changes *Domain 5 - The organisation* 5D. 'Complicated' Category. New team routines or care pathways that align readily with established ones *Domain 5: The organisation* 5C. Complicated Category. Multiple organisations with partnership relationship; cost-benefit balance favourable or neutral; new infrastructure (e.g. staff roles, training, kit) can mostly be found			

		from repurposing *Domain 5: The organisation* 'Simple' Category. 5B. High tension for change, good innovation-system fit, widespread support *Domain 5: The organisation* 5A. 'Simple' Category. Well-led organisation with slack resources and good managerial relations; risk taking encouraged *Domain 4: The adopter system* 4A. 'Complicated' Category. Existing staff must learn new skills and/or			

		new staff be appointed			
		Domain 2 - The technology 2D. 'Simple' Category. Generic, 'plug and play,' or COTS[a] solutions requiring minimal customization; easily			
		Domain 2: The technology 2A. 'Simple' Category. Off-the-shelf or already installed, freestanding, dependable			

10.5 Active agency

10.5.1 *What does the **human agent do** – i.e. how does s/he reflexively relate to, and draw on, general dispositions, conjuncturally specific knowledge, and technological properties (actant's internal structures) in an unfolding sequence of action?*

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
human agent do	• Ecosystem: Organisational; Governance and Leadership* • Service Conceptualisation: Stake holders; Consultation and Collaboration* • MomConnect As a Case Example by Task Team Members: Perspectives, Operations: M&E, DHIS, HR, Link to Care and Implementation Process^ • Continuity of Service: Service Implementation^^ • Service Touch Point: Facility Level: Service Implementation, The MomConnect Helpdesk: Interactive communication with nurses^^^ • Service Touch Point: Facility Level: Service Implementation, Subscription and Marketing^^^	*Domain 5 - The organisation* 'Complicated' category. Some work needed to build shared vision, engage staff, enact new practices, and monitor impact *Domain 7- Embedding and adaptation* **over time** 'Simple' category. Sense making, collective reflection, and adaptive action are ongoing and encouraged *Domain 7- Embedding and*	• Be Collaborative	• Leadership and Governance: 5 • Strategy and Investment: 4 • Legislation, Policy and Compliance: 4 • Workforce: 2	Making decisions independently and collaboratively, as part of design, development, adoption and implementation of the initiative.

		adaptation over time 'Simple' category. Strong scope for adapting and embedding the technology as local need or context changes			
		Domain 5 - The organisation 5D. 'Complicated' Category. New team routines or care pathways that align readily with established ones			
		Domain 5: The organisation 5C. Complicated Category. Multiple organisations with partnership relationship; cost-benefit balance favourable or neutral; new infrastructure (e.g. staff roles, training, kit) can			

		mostly be found from repurposing			

Domain 5: The organisation 'Simple' Category. 5B. High tension for change, good innovation-system fit, widespread support

Domain 2 - The technology 2D. 'Simple' Category. Generic, 'plug and play,' or COTS[a] solutions requiring minimal customization; easily

Domain 1: The condition or illness 1B. 'Complicated' Category. Must be factored into care plan and service model

10.5.2 How do the **social structures** (e.g. norms, duties, physical and cognitive demands, rights, rewards/sanctions) **inscribed**, deliberately or inadvertently, **in the technology-in-focus** enable, influence, or constrain **the active agency** and **strategic orientations of agents**?

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
	• Ecosystem: Organisational; Governance and Leadership* • Service Conceptualisation: Stake holders; Consultation and Collaboration* • Service Conceptualisation: Design Process; Expansion: Research* • Service Conceptualisation: Design Process; Expansion* • Service Conceptualisation: Design Process; Considerations* • MomConnect As a Case Example by Task Team Members: Critical Considerations, mHealth and eHealth Strategy^ • Governance and Leadership: Centralisation of mHealth, Rationalisation and Harmonisation of mHealth Services^^ • Continuity of Service: Scale, Provincial Realities that are regarded as barriers in mHealth^^	*Domain 5 - The organisation* 'Complicated' category. Some work needed to build shared vision, engage staff, enact new practices, and monitor impact *Domain 7- Embedding and adaptation over time* 'Simple' category. Sense making, collective reflection, and adaptive action are ongoing and encouraged *Domain 7- Embedding and adaptation over time* 'Simple' category. Strong scope for	• Design With the User • Understand the Existing Ecosystem • Use Open Standards, Open Data, Open Source, and Open Innovation • Address Privacy a<u>nd</u> Security	• Leadership and Governance: 5 • Strategy and Investment: 4 • Legislation, Policy and Compliance: 4 • Workforce: 2 • Standards and Interoperability: 4 • Infrastructure: 3 • Services and Applications: 4	The National Department of Health was strictly regarded as the owner of the initiative. No implementing partner and/or funder could act as an owner of the initiative. The structure was in such a way that even on the health promotion material, the NDoH logo had to be more visible and the biggest if other logos were also included. The mHealth and eHealth strategies were main resources that explicitly refer to both mHealth and eHealth in which agents would refer to, and also their independent thinking and experience.

	•	adapting and embedding the technology as local need or context changes *Domain 5 - The organisation* 5D. 'Complicated' Category. New team routines or care pathways that align readily with established ones *Domain 5: The organisation* 5C. Complicated Category. Multiple organisations with partnership relationship; cost-benefit balance favourable or neutral; new infrastructure (e.g. staff roles, training, kit) can mostly be found from repurposing *Domain 5: The organisation*			

| | | 'Simple' Category. 5B. High tension for change, good innovation-system fit, widespread support

Domain 5: The organisation 5A. 'Simple' Category. Well-led organisation with slack resources and good managerial relations; risk taking encouraged

Domain 3: The value proposition 3B. 'Simple' Category. Technology is desirable for patients, effective, safe, and cost effective

Domain 2 - The technology 2D. 'Simple' Category. | | | |
|---|---|---|---|---|---|

		Generic, 'plug and play,' or COTS[a] solutions requiring minimal customization; easily *Domain 2: The technology* 2A. 'Simple' Category. Off-the-shelf or already installed, freestanding, dependable *Domain 1: The condition or illness* 1B. 'Complicated' Category. Must be factored into care plan and service model			

10.5.3 *What **role has the technology-in-focus** played in **the production of these positive and negative consequences**?*

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
Immediate consequences	• MomConnect As a Case Example by Task Team Members: Recommendations, Includes, but not limited to, User Centred Design, Sustainability, Privacy and Security, Change Management and Stakeholder Management^ • MomConnect As a Case Example by Task Team Members: Outliars, Traditional Beliefs, the importance of telecommunications network, PEPFAR partners at districts. Need for information centre for eHealth^ • Governance and Leadership: Centralisation of mHealth, Rationalisation and Harmonisation of mHealth Services^^ • Ecosystem: Grey Areas amongst IT, Data Mx and	*Domain 5 - The organisation* 'Complicated' category. Some work needed to build shared vision, engage staff, enact new practices, and monitor impact *Domain 7- Embedding and adaptation over time* 'Simple' category. Sense making, collective reflection, and adaptive action are ongoing and encouraged *Domain 7- Embedding and adaptation over time* 'Simple' category. Strong scope for adapting and	• Build for Sustainability • Be Data Driven • Reuse and Improve • Be Collaborative	• Leadership and Governance: 5 • Strategy and Investment: 4 • Legislation, Policy and Compliance: 4 • Workforce: 2 • Standards and Interoperability: 4 • Infrastructure: 3 • Services and Applications: 4	Implementation without piloting, research, Retrospective M&E due to ignorance, including Nurse Connect, Lack of integration within the health programming were the consequences that needed to be addressed. Recommendations address the perceived immediate consequences.

| | eHealth^^ | embedding the technology as local need or context changes

Domain 5 - The organisation 5D. 'Complicated' Category. New team routines or care pathways that align readily with established ones

Domain 5: The organisation 5C. Complicated Category. Multiple organisations with partnership relationship; cost-benefit balance favourable or neutral; new infrastructure (e.g. staff roles, training, kit) can mostly be found from repurposing

Domain 4: The adopter system 4A. 'Complicated' Category. | | | |
|---|---|---|---|---|---|

		Existing staff must learn new skills and/or new staff be appointed			
		Domain 3: The value proposition 3B. 'Simple' Category. Technology is desirable for patients, effective, safe, and cost effective			
		Domain 3: The value proposition 3A. 'Complicated' Category. Business case underdeveloped; potential risk to investors			
		Domain 2 - The technology 2D. 'Simple' Category. Generic, 'plug and play,' or COTS[a] solutions requiring minimal customization; easily			

| | | *Domain 2: The technology* 2A. 'Simple' Category. Off-the-shelf or already installed, freestanding, dependable

Domain 1: The condition or illness 1B. 'Complicated' Category. Must be factored into care plan and service model | | | |
|---|---|---|---|---|---|

10.6 Outcomes

10.6.1 What are the **immediate consequences** of specific actions (intended and unintended)?

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
consequences feed back on the position-practices	• MomConnect As a Case Example by Task Team Members: Recommendations, Includes, but not limited to, User Centred Design, Sustainability, Privacy and Security, Change Management and Stakeholder Management^ • MomConnect As a Case Example by Task Team Members: Critical Considerations, Research & Development (Including the Design Process, Evidence-based initiative, tech environment, Compliance with Normative Standards, Inclusions of clinicians^ • MomConnect As a Case Example by Task Team Members: Outliars, Traditional Beliefs, the importance of	*Domain 5 - The organisation* 'Complicated' category. Some work needed to build shared vision, engage staff, enact new practices, and monitor impact *Domain 7- Embedding and adaptation over time* 'Simple' category. Sense making, collective reflection, and adaptive action are ongoing and encouraged *Domain 7- Embedding and adaptation over time* 'Simple' category. Strong	• Reuse and Improve • Be Data Driven	• Leadership and Governance: 5 • Strategy and Investment: 4 • Legislation, Policy and Compliance: 4 • Workforce: 2 • Standards and Interoperability: 4 • Infrastructure: 3 • Services and Applications: 4	There should have been research and continuous call for inclusion. Factors such as staffing, budget and involvement of academics in early phases of the initiative were raised. Clarification of roles and development of eHealth (which includes mHealth) as an independent health programme.

	telecommunications network, PEPFAR partners at districts. Need for information centre for eHealth^ • Ecosystem: eHealth as a clinical service^^ • Ecosystem: Grey Areas amongst IT, Data Mx and eHealth^^ • Service Touch Point: Facility Level: Service Implementation, Service Rating / Feedback / Feeling^^^	scope for adapting and embedding the technology as local need or context changes *Domain 5 - The organisation* 5D. 'Complicated' Category. New team routines or care pathways that align readily with established ones *Domain 5: The organisation* 5C. Complicated Category. Multiple organisations with partnership relationship; cost-benefit balance favourable or neutral; new infrastructure (e.g. staff roles, training, kit) can mostly be found from repurposing *Domain 5: The*			

		organisation 'Simple' Category. 5B. High tension for change, good innovation-system fit, widespread support *Domain 5: The organisation* 5A. 'Simple' Category. Well-led organisation with slack resources and good managerial relations; risk taking encouraged *Domain 4: The adopter system* 4A. 'Complicated' Category. Existing staff must learn new skills and/or new staff be appointed *Domain 3: The value proposition* 3B. 'Simple' Category.			

		Technology is desirable for patients, effective, safe, and cost effective			
		Domain 2 - The technology 2D. 'Simple' Category. Generic, 'plug and play,' or COTSª solutions requiring minimal customization; easily			
		Domain 2: The technology 2A. 'Simple' Category. Off-the-shelf or already installed, freestanding, dependable			
		Domain 1: The condition or illness 1B. 'Complicated' Category. Must be factored into care plan and service model			

10.6.2 How do these **consequences feed back on the position-practices** in the network and wider external structures?

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
Positive:	This area could not be addressed by specific themes. However, from the data: USSD had a positive significance because it could scale easier and quicker nationally.	*Domain 7- Embedding and adaptation over time* 'Simple' category. Sense making, collective reflection, and adaptive action are ongoing and encouraged *Domain 7- Embedding and adaptation over time* 'Simple' category. Strong scope for adapting and embedding the technology as local need or context changes *Domain 5 - The organisation* 5D. 'Complicated' Category. New team routines or care pathways	•Design for Scale	• Leadership and Governance: 5 • Strategy and Investment: 4 • Legislation, Policy and Compliance: 4 • Workforce: 2 • Standards and Interoperability: 4 • Infrastructure: 3 • Services and Applications: 4	Scale, National Scale in short space

		that align readily with established ones *Domain 5: The organisation* 5C. Complicated Category. Multiple organisations with partnership relationship; cost-benefit balance favourable or neutral; new infrastructure (e.g. staff roles, training, kit) can mostly be found from repurposing *Domain 5: The organisation* 'Simple' Category. 5B. High tension for change, good innovation-system fit, widespread support *Domain 5: The organisation* 5A. 'Simple' Category. Well-led organisation			

		with slack resources and good managerial relations; risk taking encouraged

Domain 3: The value proposition 3B. 'Simple' Category. Technology is desirable for patients, effective, safe, and cost effective

Domain 2: The technology 2A. 'Simple' Category. Off-the-shelf or already installed, freestanding, dependable | | | |
| Negative: | This area could not be addressed by specific themes. However, from the data: Sustainability was regarded as a major risk for this initiative. | *Domain 5 - The organisation* 'Complicated' category. Some work needed to build shared vision, engage staff, enact new practices, and | • Build for Sustainability | | Data has shown that the sustainability of the initiative was the major risk. However, there were processes during the time of data collection that were being executed to mitigate this risk. |

		monitor impact *Domain 3: The value proposition* 3A. 'Complicated' Category. Business case underdeveloped; potential risk to investors *Domain 1: The condition or illness* 1B. 'Complicated' Category. Must be factored into care plan and service model			

10.6.3 What **significance** – both positive and negative – do these **consequences have for other**s in the network in terms of power, legitimacy, and other factors?

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
	This area could not be addressed by specific themes. However, from the data: (1) It was easy and quick to scale (2) Challenge to sustain	*Domain 7- Embedding and adaptation over time* 'Simple' category. Strong scope for adapting and embedding the technology as local need or context changes *Domain 5 - The organisation* 5D. 'Complicated' Category. New team routines or care pathways that align readily with established ones *Domain 5: The organisation* 5C. Complicated Category. Multiple organisations with	• Be Data Driven • Reuse and Improve • Use Open Standards, Open Data, Open Source, and Open Innovation	• Leadership and Governance: 5 • Strategy and Investment: 4 • Legislation, Policy and Compliance: 4 • Workforce: 2 • Standards and Interoperability: 4 • Infrastructure: 3 • Services and Applications: 4	USSD, as the technology-in-focus was easy and quick to scale. However, challenge to sustain due to the cost from the service providers side.

		partnership relationship; cost-benefit balance favourable or neutral; new infrastructure (e.g. staff roles, training, kit) can mostly be found from repurposing			
		Domain 5: The organisation 'Simple' Category. 5B. High tension for change, good innovation-system fit, widespread support			
		Domain 5: The organisation 5A. 'Simple' Category. Well-led organisation with slack resources and good managerial relations; risk taking encouraged			
		Domain 4: The adopter system			

		4A. 'Complicated' Category. Existing staff must learn new skills and/or new staff be appointed *Domain 3: The value proposition* 3B. 'Simple' Category. Technology is desirable for patients, effective, safe, and cost effective *Domain 2 - The technology* 2D. 'Simple' Category. Generic, 'plug and play,' or COTS[a] solutions requiring minimal customization; easily *Domain 2: The technology* 2A. 'Simple' Category. Off-the-shelf or already installed, freestanding, dependable			

		Domain 1: The condition or illness 1B. 'Complicated' Category. Must be factored into care plan and service model			

10.7 Policy/political implications

10.7.1 *How modifiable are the inscribed technological features of 2c (in Fig. 2) that have contributed to negative consequences? By whom are they modifiable, over what timescale and at what cost?*

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
How Modifiable	• Ecosystem: Integration; Technical: Infrastructure and Interoperability • Service Conceptualisation: Design Process; Expansion: Research* • MomConnect As a Case Example by Task Team Members: Critical Considerations, mHealth and eHealth Strategy^ • Governance and Leadership: Centralisation of mHealth, Rationalisation and Harmonisation of mHealth Services^^ • Governance and Leadership: Stakeholders, Clinicians, Technophobia / Capacity Building, As Users^^ • Governance and Leadership: Stakeholders, Engaging with and between mHealth Providers and	*Domain 5 - The organisation* 'Complicated' category. Some work needed to build shared vision, engage staff, enact new practices, and monitor impact *Domain 7- Embedding and adaptation over time* 'Simple' category. Strong scope for adapting and embedding the technology as local need or context changes *Domain 5 - The organisation* 5D. 'Complicated'	• Be Data Driven • Reuse and Improve • Use Open Standards, Open Data, Open Source, and Open Innovation	• Leadership and Governance: 5 • Strategy and Investment: 4 • Legislation, Policy and Compliance: 4 • Workforce: 2 • Standards and Interoperability: 4 • Infrastructure: 3 • Services and Applications: 4	The MomConnect Initiative was modifiable. Developing a data texting option (through WhatsApp) was done – most users had Smart Phones. A PMTCT component was added. A NurseConnect component was added. mHealth and eHealth strategies were being reviewed, this process may be also regarded as modification. By Implementers Scale: Immediately – based on number of users with smart phones (Free data?) Cost?

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
	Consumers^^ • Continuity of Service: Design Thinking, South Africa Learning from Itself: MomConnect as a demonstration case^^ • Ecosystem: eHealth as a clinical service^^ • Ecosystem: Grey Areas amongst IT, Data Mx and eHealth^^ • Service Touch Point: Facility Level: Service Implementation, Service Rating / Feedback / Feeling^^^ •	Category. New team routines or care pathways that align readily with established ones *Domain 5: The organisation* 5C. Complicated Category. Multiple organisations with partnership relationship; cost-benefit balance favourable or neutral; new infrastructure (e.g. staff roles, training, kit) can mostly be found from repurposing *Domain 5: The organisation* 5A. 'Simple' Category. Well-led organisation with slack resources and			

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
		good managerial relations; risk taking encouraged *Domain 4: The adopter system* 4A. 'Complicated' Category. Existing staff must learn new skills and/or new staff be appointed *Domain 3: The value proposition* 3B. 'Simple' Category. Technology is desirable for patients, effective, safe, and cost effective *Domain 2 - The technology* 2D. 'Simple' Category. Generic, 'plug and play,' or COTS[a] solutions			

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
		requiring minimal customization; easily *Domain 2: The technology* 2A. 'Simple' Category. Off-the-shelf or already installed, freestanding, dependable *Domain 1: The condition or illness* 1B. 'Complicated' Category. Must be factored into care plan and service model			

10.7.2 Addressing 1 ('how modifiable'?) should be linked to lessons learned from analysis of prior negotiations about standards, codes, fields, access privileges, interoperability, and other 'technical' questions. E.g., who were the players in these negotiations, who 'won', and why?

Strong Structuration Theory Area of Focus	Phase 1: Themes	Phase 2: NASSS Framework	Phase 3: Principles of Digital Development	Phase 4: Global Digital Health Index	Synthesis
lessons learned	• Service Conceptualisation: Stake holders; Consultation and Collaboration* • MomConnect As a Case Example by Task Team Members: Recommendations, Includes, but not limited to, User Centred Design, Sustainability, Privacy and Security, Change Management and Stakeholder Management^ • Continuity of Service: Design Thinking, South Africa Learning from Itself: MomConnect as a demonstration case^^ • Service Touch Point: Facility Level: Service Implementation, Service Rating / Feedback / Feeling^^^ • Service Touch Point: Facility Level: Stakeholders, Clinicians	*Domain 5 - The organisation* 'Complicated' category. Some work needed to build shared vision, engage staff, enact new practices, and monitor impact *Domain 7- Embedding and adaptation over time* 'Simple' category. Strong scope for adapting and embedding the technology as local need or context changes *Domain 5 - The organisation* 5D. 'Complicated' Category. New team routines or	• Be Collaborative • Understand the Existing Ecosystem • Design for Scale • Build for Sustainability • Be Data Driven • Use Open Standards, Open Data, Open Source, and Open Innovation • Reuse and Improve • Address Privacy and Security • Design With the User	• Leadership and Governance: 5 • Strategy and Investment: 4 • Legislation, Policy and Compliance: 4 • Workforce: 2 • Standards and Interoperability: 4 • Infrastructure: 3 • Services and Applications: 4	Most participants had smart phones however they preferred SMS over data-based text. This may be linked to the fact that PHC service is free, so they were not prepared to pay for the mHealth service either. The MomConnect Task Team has played a major role, has managed to implement this initiative regardless of the challenges in the mHealth implementation. The team could also be retrospective and proactive in mitigating risks. The lessons learned from this initiative may be used in the implementation strategy to contribute to the practice of mHealth at least in South Africa.

	(Capacity Building, NurseConnect) ^^^ • Service Touch Point: Facility Level: Stakeholders, Foreign Nationals as users of mHealth, and barriers associated^^^ • Service Touch Point: Facility Level: Service Implementation, Content of information as an mHealth service: Push and Pull SMSs^^^ • Service Touch Point: Facility Level: Service Implementation, Ethical considerations^^^ • Service Touch Point: Facility Level: Facility Environment^^^ • Service Touch Point: Facility Level: Operations^^^	care pathways that align readily with established ones *Domain 5: The organisation* 5C. Complicated Category. Multiple organisations with partnership relationship; cost-benefit balance favourable or neutral; new infrastructure (e.g. staff roles, training, kit) can mostly be found from repurposing *Domain 5: The organisation* 'Simple' Category. 5B. High tension for change, good innovation-system fit, widespread support *Domain 5: The organisation* 5A. 'Simple' Category. Well-		

		led organisation with slack resources and good managerial relations; risk taking encouraged			
		Domain 3: The value proposition 3B. 'Simple' Category. Technology is desirable for patients, effective, safe, and cost effective			
		Domain 3: The value proposition 3A. 'Complicated' Category. Business case underdeveloped; potential risk to investors			
		Domain 2 - The technology 2D. 'Simple' Category. Generic, 'plug and play,' or COTS[a] solutions requiring minimal			

		customization; easily *Domain 2: The technology* 2A. 'Simple' Category. Off-the-shelf or already installed, freestanding, dependable *Domain 1: The condition or illness* 1B. 'Complicated' Category. Must be factored into care plan and service model			

APPENDIX Q: PARTICIPANTS' OVERALL VERBATIM RESPONSES

- *"Minister wants a single unique number (code) for all network operators"*
- *"… gave a brief account on minister's meeting at Emperors Palace on 30th July and informed that the minister has announced that he will be embarking on a road shows to introduce MomConnect to the health professional in each province"*
- *The minister has confirmed the date to launch MomConnect (21st Aug 2014)"*

  Verbatim Quotation 5.1.2.1.A

- *"We need to take into account the vision of the department which is to computerize the facilities and the eHealth strategy and interoperability framework"*
- *"Content of messages is aligned to NDoH policy for MNCH"*
- *"MomConnect is a NDoH project . Any partner should run all activities by the department at the first opportunity so that the department can review and direct as required. This applies to all discussions with the funders, presentations, conferences, communications with external stakeholders and so forth"*

Verbatim Quotation 5.1.2.1.B

- *"Feedback on MomConnect weekly reports was followed by clarifying the process of handling complaints which had to be in line with the NDoH's complaints management policy: "These are sent to the district and provincial focal points."*
- *"Objectives of the departmental strategy to increase registrations mainly due to the fact that after one year of the implementation we only reached 50% of all the antenatal booking at the facilities, this strategy is focused on mainly 3 areas: (1) retraining of staff, (2) batch registrations, (3) improved communication"*
- *"MomConnect governance/sustainability: a date for the governance workshop is set."*

 Verbatim Quotation 5.1.2.1. C

- *"Funding update how integrated digital health systems can assist in EMTCT"*
- *"Several initiatives are underway, namely: requesting the minister of communications to zero rate the SMSs and USSD calls. Start using revenue generating schemes. Budget bids from department within NDoH"*
- *"There is a desire to introduce 3rd party subscription and registration channels in order to increase the reach of MomConnect , and to reduce the cost of enrolling into MomConnect messaging"*
- *"Drafting vision for MomConnect"*
- *"Governance to be appointed to oversee the grant. The team will be led by (a lawyer) who will be engaging with the TT members".*
- *Look into ways to make MomConnect more sustainable and generate funds. Two possible ways were looked into which are still in the exploratory mode: - the first one was to reduce costs by using WhatsApp and this was seen as an avenue to assist increasing sign-ups. – the second was to explore MomConnect data to be used by other organisations other that NDoH for research at a cost".*

  Verbatim Quotation 5.1.4.1.C

- *"Emeritus professor – independent consultant 2010 since eHealth"*
- *"8 years in eHealth, I'm mostly involved in requirements standards and system design, and implementation itself"*
- *"I am a health informatics professional, working in designing and implementing mHealth 15 years"*
- *"I have on solutions for the NDoH, mainly for the public health system"*

Verbatim Quotation 5.2.4.1.B

- *"I have maternal and child health experience, I am a midwife I also have PHC experience, the largest part of my life I worked as a midwife and can relate ANC to what happens in the labour ward, and you cannot really separate the two but in the health system is completely separate"*
- *"When I started the design was already half-way"*

Verbatim Quotation 5.2.4.1.C

- *"We couldn't get nurse representatives, such as Denosa to give a view, to support whether they have this add more work to the nurses"*
- *"We were asked by department to get expertise, department lacked"*
- *"The NDoH couldn't do it by itself, there was no internal necessary capacity"*

"It was the first one of its kind so people wanted to be involved, wanted it to succeed, each"

Verbatim Quotation 5.2.4.1.D

- *"I have worked with both eHealth and mHealth strategies outside MomConnect in my role and my general assessment about those documents is that they are very theoretical and difficult to implement in real terms especially the eHealth strategy is very high level and doesn't really explain concrete how to do the things that are recommended. So my feeling is that there need to be concrete objectives that are achievable that people can easily understand. So take it away from the theoretical and make it more practical"*
- *"The other thing about the eHealth and mHealth is the lack of governance, it's just a document that is sitting there and nobody in the government who is following up with the implementations they don't even know who the implementers are. So it is one thing to tell people what to do you also need to check on them"*
- *"It's so high level, if you look at this implementation plan it doesn't tell an individual implementer the things they need to do in order to be in compliance with this implementation strategy… all of that is good but it's government level"*
- *"What does it mean for me as an implementer? It is more of a political document. As much as they call it an implementation plan it is more of an mHealth justification from a political point of view. Instead of having these justification statements have aim that you need from each mHealth implementer in order for them to fit into your strategy and tell people what they need to do to meet those requirements"*

Verbatim Quotation 5.2.4.2.D

- *"There was potentially a great danger in this programme"*
- *"One huge danger of MomConnect, and that is you are going to empower women, give them information expectation and they are going to expect that quality of service from the clinics and hospitals, unless the clinics and hospitals are equally empowered to that information the woman is going to demand a service that can't be provided and that potential raise conflict because staff cannot deliver the expectation"*
- *"Consistent but now evolved, it stand just now with PMTCT, NurseConnect and WhatsApp*
- *"Also develop parallel programme for health workers"*

Verbatim Quotation 5.2.4.2.L

- *"Whenever refer to eHealth strategy there's two sides of the story basically at the time MomConnect was rolled out there was not enough substantiated evidence to support national roll out of but clearly there was political. It was high profile political project to support meeting MDGs"*
- *"Something that was a huge problem, is that, we didn't talk at all around research which I think is an ongoing real problem"*
- *"Impact contribution etc, there wasn't space for that"*
- *"Reporting on the impact is difficult – other confounding factors"*
- *"Academics should be involved… not what donors want to hear"*

Verbatim Quotation 5.2.4.2.O

- *"If we had a lot of support from different clusters in the NDoH we could have done much better"*
- *Service Integration: "Messages cover all clusters, EPI, PHC, NHI – if all clusters can contribute certain percentage"*
- *"The idea that led to MomConnect was from the minister"*
- *"Unless we can embed it to move institutionally, its uncertainty of it will keep going as such a project after Motsoaledi leaves which is almost certain because he has already served two terms"*

Verbatim Quotation 5.2.4.3.A

- *"MomConnect has been good at leadership coming from the department, nobody does anything unless the NDoH signed on it, it is very clear that the government is the leader on this implementation and I think that has been good".*
- *"The part of NDoH that is responsible for mHealth is not strongly leading the eHealth strategy expired in 2016 I think and in 2018 we do not have a new one".*

Verbatim Quotation 5.2.4.3.A

- *"We were always at the back as academics"*
- *"Communication was quite top down"*
- *"The information we got was a need to know basis, so it was a top-down structure which made it difficult for me"*

• *"It must be as participatory as possible… there was so much behind the scenes"*
• *"It is crucial that people are involved from the word go"*
Verbatim Quotation 5.2.4.4.A

• *"This is the first mHealth project that the department calls a success that you can do mHealth through formal health system"*
• *"Strength, it is available to everyone using lowest common denominator technology so its as widely available as possible. Free to the users, it's built as an substantiate of the normative standards framework"*
Verbatim Quotation 5.2.4.4.F

• *"The MomConnect indicators were haphazardly developed, they would say things like, registrations, when I started looking at the data I say what do you mean by registrations, these is all women that are registered, and the fact that I asked it clearly means that the element/indicator is not described properly"*
• *"The problem is not even communication, always playing catch up. The principle is all indicators should comply with NIDS requirements"*
• *Registration – Pregnant women registered – Mothers with babies 1-2 years"*
• *"There will have to be some criteria or guideline that a project should comply with and one of them would be indicators"*
Verbatim Quotation 5.2.4.5.A

• *"Before it was launched we had a roadshow. The minister called all senior management to sensitize them on MomConnect. The minister ensured that before we leave the province we have focal people who will actually liaise with the NDoH"*
• *"Political members were also sensitised"*
• *"He named and shamed that were not doing well"*
Verbatim Quotation 5.2.4.5.J

• *"Three things that came immediately in my mind. 1. The people that you Users, S expect to use this, the end user, the client. Health workers have to be involved and recognize the need for it and its going to be easily for them and what is in it for them, and when we did reorientation, there was a lot of misunderstanding. 2. Sustainability, the cost of messaging, a major component. 3. Confidentiality, I know MomConnect does not have so much information"*
• *"There needs to be balance between all those different considerations you mentioned"*
• *"One of the major things that influenced the design was that we had to design the service on the tech that already existed and could work in any clinic immediately – we had a launch within two months. No time to pilot. Hence we chose USD – it's no perfect"*
• *"1 - There was a regulatory policy framework in place which was the health normative standards framework which was used to guide the design of the system, to make sure it was designed according to regulatory framework prescribed by the NDoH. 2 - To have the design and development coordinated by the NDoH and ensuring that it*

meets the requirements. 3 - Having a sat of partners to work on the actual solution and to work on the open architecture, to make sure that its open to others to contribute.
• *4 - Using free and open software that was readily available and could be cost effective and easily procured"*
<u>Verbatim Quotation 5.2.4.6.A</u>

• *"Eish, difficult question to answer but at a rate that we are going, I don't think its sustainable, when you compare it with Ghana and Kenya, their countries have WiFi everywhere we still have to buy data. Unless data is less than now. It is expensive"*
• *"It is expensive to maintain"*
• *"Cost is a huge factor where sustainability is concerned"*
• *"Our biggest challenge is cost"*
• *"We did not know the financial part or sustenance of MomConnect"*
<u>Verbatim Quotation 5.2.4.6.G</u>

• *"We knew that donors are not gonna just pop money into this thing"*
• *"There was very little discussion on cost, surprisingly little, because various donors came up"*
• *"To be honest there was very little discussion on sustainability"*
• *"We are looking at MomConnect governance going forward"*
• *"Register MomConnect as a separate organisation, different legal considerations, central board of directors and central management team"*
<u>Verbatim Quotation 5.2.4.6.J</u>

• *"Limit the number of projects so that you can support those that can come to scale"*
• *"Advice for rationalization of mHealth projects. Ensure you keep number to minimum. Maturity levels. Rationalise projects that come to government. Do they make impact? etc"*
• *"There should be a database of what is happening in the space, there's lots of duplication of projects, every telemed eHealth filed. That way we minimize duplication of projects"*
• *"Infrastructure is with the department of premier, all government institutions, centralized under corporate services"*
<u>Verbatim Quotation 5.3.1.1.A</u>

"The fact that it's in the health act we need to implement it, but as I said we need the senior decision makers to understand that and support it to ensure that it happens – I am not saying nothing has been done"
"The mHealth strategy is not sufficiently integrated into both eHealth strategy and the health strategies of the country and I think through that we are missing an opportunity to ensure that the various types of mHealth that is being practiced in the country is fully aligned with the health transformation work that is being led by the ministry and the department"

Verbatim Quotation 5.3.1.2.D

"Ensure buy in, for sustainability, partnerships are key, NGOs", Universities, CSIR, Innovation hubs" "As health, because of priorities, we have limitations in terms of spending o eHealth but if we partner with other government departments like DST that have budget for research and development" "Strong partnerships not just funding but for tech as well" "The stakeholder environment is very broad in eHealth, hence I think we haven't done enough, we have started but we haven't done enough and it is important to include everyone you could possibly include that has role to play definitely" "It's a shared responsibility, we can't wait for the other person-One has to work with other institution.
Verbatim Quotation 5.3.1.3.C

"Stakeholder engagement should cross public and private sector because either one not being involved could be a disrupter in the implementation of the strategy" "I am very keen to see more work done on areas such as stakeholder engagement, I think we need to put a lot more effort into creating a strong stakeholder platform in South Africa that brings in a whole wide range of different types of stakeholders particularly health workers and patients" "We need to find balance between the two sectors: private and public" "You can't have all stakeholders in one room, that's just impossible to manage, but there should be key times where there are separate discussions with all of them"
Verbatim Quotation 5.3.1.3.E

"User experience is something that we need to look at, unlike designing something that a team of experts believe and train them on" – their behaviour… "Building our apps in the best possible way now…" "User interface design"
Verbatim Quotation 5.3.1.3.F

"The overall strategy need to be set on within impact framework, what I mean by that is some work is need to be done to understand where the benefits, what value needs to be delivered and value for money so there is a cross benefit component to this" "An impact framework for eHealth needs to stretch beyond economic model"
Verbatim Quotation 5.3.2.1.A

"We do not look at running cost" "Lack of total cost of ownership understanding, a lot of people would see a piece of software and think that is the best thing… consider infrastructure, people to implement etc" "Entire cost of ownership, between 3 to 5 years. At times we look at initial cost, in the long run it is costly"

> *"Upfront, do clear assessment of this process before accepting, know the cost of ownership"*
> *"When we take over will we manage"*
> *"Not brought in proper channels of acceptance"*
> *"From onset, look at applications holistically"*
> *"Theft – most people not permanent"*
>
> <u>*Verbatim Quotation 5.3.3.1.A*</u>

> *"As an implementing authority one must be self-sufficient, so that including having people with necessary skills to not depend on external provided for the system that needs to be sustained"*
> *"You are more on a sustainable position if you don't depend more on external people"*
> *"How can we sustain anything if 50% of it is from donors – our sustainability is at risk"*
> *"The NDoH uses consultants, that consultant has a life span at the department, you can only employ that person for so long"*
>
> <u>*Verbatim Quotation 5.3.3.1.C*</u>

> *"Issues of coordination and rationalisation, you find lots of projects piloted over the period, you find that they could not come to scale"*
> *"Government coordination"*
> *"What is key at national level is to provide guidance, to provide strategic direction"*
> *"Nobody is asking that question, there's so many initiatives happening and there is nobody evaluating anything. Even at provincial offices we do not know what is happening at clinics, people have got no idea"*
> *"One thing that is very important is that we should not rely on donors only, we should have our own planning, we should have our own funding on the project we want to embark on and we should follow our own strategy. We should not be haphazard. Just because USAID comes with this project we should not run for it – that's a key message"*
>
> <u>*Verbatim Quotation 5.3.3.2.A*</u>

> *"Provinces are struggling with budget are being cut every year are going down – the challenges that the provinces are facing are big"*
> *"There has to be allocation of funding, nationally, if we leave it to the provinces it's gonna fail"*
> *"Only when they are about to handover that's when they involve us"*
> *"I would blame the funders than the system, because as a funder you have this money, you pilot the system but you do not think about long-term"*
>
> <u>*Verbatim Quotation 5.3.3.2.D*</u>

> *"Majority do not come to scale"*
> *"mHealth projects have not gone out of pilot for five years and haven't gone full implementation"*
> *"They don't do proper use case analysis in terms of where they want to implement and whether is feasible to do it"*
>
> <u>*Verbatim Quotation 5.3.3.2.E*</u>

> *"The thing about scalability and where we can have economies of scale, is with an mHealth App, all we require is a good hosting environment, stable infrastructure environment. It must be health owned, to host several instances of mHealth, they must invest in a solid infrastructure that will allow some level of interoperability with some provincial data centres so that we can harness our data"*
>
> *"For scalability the first thing is to look for platform and where this platform is…"*
>
> Verbatim Quotation 5.3.3.2.F

t

> *"The national Health Council should be involved so that they can plan to take over"*
>
> *"Provinces do not share they compete"*
>
> *"There are critical things than your mobile phones projects"*
>
> *"There's this tendency of national to come up with projects and provinces are told that there's this project to be implemented"*
>
> *"A beautiful system, a necessary system but when it comes to budgetary implications it is struggling"*
>
> *"When provinces take decisions do not adhere to what the NDoH has decided…"*
>
> Verbatim Quotation 5.3.3.2.G

> *"The other thing is the infrastructure, it's a major issue I think that the 'm' has a major role to play given that we have infrastructure in different settings."*
>
> *"You can't have mobile app if you don't have mobile network"*
>
> *"The infrastructure may not be resilient they have to take into account that fact"*
>
> Verbatim Quotation 5.3.3.3.B

> *"One of the things that I picked up when I got here about 7 years ago, we are very poor in managing our own home grown solutions. We don't put a lot of rigor you know the governance, like the change control, you know if you want to make a change to the system it feels like a free for all because it is internal. A vendor will not let you rock up make the change without proper due diligence performed where they first assess if the changes are warranted and there proper sign off for it, do statement of work"*
>
> Verbatim Quotation 5.3.3.3.D

> *"Create clear framework, so that the project is implemented within a clear framework and that is guiding implementation to ensure sustainability"*
>
> *"The mHealth strategy is not clear, and I think that's a limitation in terms of potential for implementation"*
>
> *"There are important things in that act but we have not implemented it"*
>
> Verbatim Quotation 5.3.3.4.A

> *"I think if the system is just giving information to patients (only) the link to other systems is not that important"*
>
> *"There needs to be integration, the MomConnect is there but is it integrated to the existing health services"*
>
> *"I'm quite aware about MomConnect"*

> *"MomConnect is one of those projects that were very well managed, one of the projects better implemented by national. On two accounts. When we were planning on how were are going to support MomConnect in the province we knew every mom had a cellphone so there was not so much infrastructure layer required"*
>
> *Verbatim Quotation 5.3.3.4.C*

> *"Public Health specialist need to be capacitated in business analysis stakeholder approach-support for clinical scientist in digital health*
> *"HPCSA needs to come to the party because if you say you are a clinician, for continuity of care you will require access to this data"*
>
> *Verbatim Quotation 5.3.4.1.A*

> *"To provide eHealth services and ensuring that the service delivery is…"*
> *"I don't believe eHealth, as in electronic information system is all we need"*
> *"The communication between IT and Health – the bridging between them is a critical role"*
> *"mHealth is not an add on but it is an integral part"*
>
> *Verbatim Quotation 5.3.4.1.B*

> *"Technology evolving so fast you can't really prescribe what eHealth strategy should say"*
> *"It's important, if eHealth has to be implemented there has to be somebody with clinical background, who understand the technicalities required to support…"*
> *"You cannot get IT person to manage eHealth"*
> *"If you have IT person managing eHealth, their priorities are different, there priorities are managing connectivity etc from IT level not clinical perspective"*
>
> *Verbatim Quotation 5.3.4.1.C*

> *"There a model that works well in Canada, all eHealth Coordinators are either doctors, nurses, pharmacists etc, anybody with clinical background"*
> *"There must be an option to become a clinician scientist in digital health"*
> *"The reporting creates problem because there's IT steering committee as per DPSA, the Provincial HIS Committee, which is provincial subcommittee of NHISSA per health act. The 80% of discussions at NHISSA is data management."*
> *"There should be funding that needs to be allocate, eHealth should become a priority"*
>
> *Verbatim Quotation 5.3.4.1.D*

> *"It must not fall under IT, it must fall under clinical health"*
> *"eHealth person to engage POPI regulator on this matter as well"*
>
> *Verbatim Quotation 5.3.4.2.A*

> *"To just say you are doing eHealth is sufficient, I think we must say we're doing digital health"*
>
> *Verbatim Quotation 5.3.4.2.B*

> "Currently there is still a difference as to where is the difference between IT and eHealth in Health"
> "CIOs are appointed based on IT background, they get bored in those meetings are data management, they get bored they don't attend. My take on that, the CIO of health should not be like any other departments, we should not really have CIO with IT background only"
> "IT person is not interested in those things"
> "Telemedicine we are talking the use of medical equipment there, the IT person is not interested in managing and supporting those systems…"
> "When it comes to tech they aren't – engineering is responsible for maintaining equipment not software"
> "How do you link the systems to service delivery"
>
> *Verbatim Quotation 5.3.4.2.C*

> "Our vision is to improve health outcomes that matter to the people by aligning to national strategic objectives of the national health"
> Our mission is to establish eHealth as an integral part of transformation and improvement of the healthcare services in the province.
> "I can look for this quote for you from the WHO… that says universal health coverage will not be possible without eHealth"
> "NHI is based heavily on information and using information to manage healthcare"
>
> *Verbatim Quotation 5.3.4.2.D*

> "Because one of the key issues with any strategy in the space of health technology is transforming so fast and alongside we have a health system that is changing with re-engineering in that environment of change having a strategy of five years is actually too little, even if we have a major milestone every five years, we need to have something in between, a more interactive approach to strategically development that will allow us on a more regular basis at least annually to reflect how our strategy aligns country's real needs and also whether we are picking up on emerging technology opportunities that are also changing on rapid grade".
>
> *Verbatim Quotation 5.3.4.3.A*

> "There has to be some directive, and now we have the health normative standards framework sorted out, and now with NHI on the corner they should take it seriously and allocate some funding"
> "The stakeholder aspect in interoperability need to be emphasized as well, especially between private and public sector and looking at NHI we will expect to share information and a lot of interoperability standards need more work to be developed further to make that easier"
>
> *Verbatim Quotation 5.3.4.4.A*

> "I was part of the team that developed eHealth strategy"
> "I have been involved in eHealth, to be exact since 1978… in Hospital Information Systems"
> "I worked for eHealth company in the UK"
> "Worked with WHO on eHealth Advisory Committee, headed informatics in hospitals"

"I basically look after all applications within health implementation, to support, business analysis, user registration, user experience design, vendor management to procurement and all those"

"I was in a division responsible for telemedicine and mHealth"

> Verbatim Quotation 5.3.4.5.A

"Each mHealth case should comply with this".

"Lack of documentation is a limitation. I am totally guilty myself of not documenting well enough to be able to share"

"Look at which of those are working best and where they are working and how can we learn from it or start to expand on it to other provinces or areas".

> Verbatim Quotation 5.3.4.6.A

"Comply with national health standards framework"

"Another piece is regulation. I think we have been quiet passionate from the eHealth side in the kind of regulation change that we've been pushing for that deals with issues around confidentiality and privacy and there are a number of gaps on POPI when one looks at electronic health records"

"The health act makes provision for regulation"

"Top decision making is very critical"

"GDPR-EU, POPI covers most of it but not all of it"

> Verbatim Quotation 5.3.4.6.C

"Review the NHA, because within the NHA the national health by definition cannot have access to patient identifiable information. If we host at NDoH, it means somehow they will have patient identifiable information somehow. POPI is very clear in terms of clinical care, POPI says… its quite lenient on the continuity of care on the patient in terms of sharing information, that if you're using this information trying to have a life or proper clinical care you will need all relevant information about this patient to give them the best possible care or health outcomes"

"PAIA Public access to information act, the legislation around PAIA is that any patient can have access to any record via this mechanism and is how we give access to patients via this"

> Verbatim Quotation 5.3.4.6.D

"Some verification of patients via mobile number"

"Other emerging issues like cyber security"

"Critical data is secured and keep reviewing security protocols"

"Privacy considerations for patients"

"If we are going to look at security and privacy every 5 years we are going to have major security breaches"

"There is one thing that this social apps, Facebook, Instagram etc got right, they were in a space where they looked at privacy of their client information and gave the client the right to what they share and what can be shared"

> Verbatim Quotation 5.3.4.6.E

> *"One of the things it needs is the understanding, in the decision-making about services if people understood that information is a resource that you need in order to run a service, than the idea that you must budget for information systems is not a question"*
>
> <u>*Verbatim Quotation 5.3.4.6.G*</u>

> *"Change Management. What we normally talk about with any kind of eHealth including mHealth we talk about change because of the technology used we don't want people to continue doing things the old way with the technology helping them we want them to fundamentally change the way they behave as a citizen or in the healthcare practice, as a health worker. That fundamental change is usually not backed in the design of the project and far too often we are missing an opportunity by simply giving people a device and say this will help you do your job better and missing the point that by simply conceptualizing the apps in the right way we can fundamentally change and improve the way the health system function, so change management is critical"*
>
> *"Leadership we need in mHealth space… transformation leadership"*
>
> *"Change Management – without that it is not going to happen"*
>
> <u>*Verbatim Quotation 5.3.5.1.A*</u>

> *"Security dealt with deliberately and assertively in all our eHealth programmes, we have to address it strategical and at design level"*
>
> *"The reality of the matter is that without paying the due diligence to data diligence, access controls, good governance policies, access to data…"*
>
> <u>*Verbatim Quotation 5.3.5.1.B*</u>

> *"Every manager must have information management as part of their responsibilities, must be in the job description of every manager.*
>
> *"Leadership and orientation, 80% of the time you are an administrator and 20% you're a clinician– they don't know that".*
>
> <u>*Verbatim Quotation 5.3.6.1.C*</u>

> - *"We need to know the content of the messages, receive them ourselves so that we can use them as reference when mothers ask regarding them"*
> - *"Have messages put on poster in consultation room"*
> - *"MomConnect is helpful teaching tool for patients"*
> - *"Messages can be used by staff as health education tool"*
> - *"It would be good to know message content"*
>
> <u>*Verbatim Quotation 5.4.1.2.C*</u>

> - *"You get patients who thinks that the messages are sent from the facility e.g. Go to the clinic to get your HB tested" – they then come for tests on random days not per appointments.*
> - *"It would be better if patients were given a better understanding why they are on MomConnect and what to expect".*

- *"I have witnessed registration done, never once did it myself".*
- *"Never received training on MomConnect was only told that it is vital to ensure that every client is registered on MomConnect".*
- *"Remove ID numbers on the registration – the system kicks out on that stage – most do not know their ID numbers – they do not bring IDs for risk of being robbed".*

Verbatim Quotation 5.4.1.3.A

APPENDIX R: RESEARCHER'S CURRICULUM VITAE

Curriculum Vitae
of
Idon-Nkhenso Sibuyi, MPH

PERSONAL DETAILS

Surname (Legal)	: Sibuyi
Names (Legal)	: Idon Nkhenso
Preferred Name (Known-As)	: Idon-Nkhenso
Date of Birth	: 16 July 1987
Race	: African
Gender	: Male
Nationality	: South African
Marital Status	: Divorced, with 1 child
Languages	: English, xiTsonga, sePedi & tshiVenda
Drivers' License	: Code C1

CONTACT DETAILS

Mobile Phone	:083 338 9132
Email	:insibuyioptometrist@gmail.com
E-Fax	:086 776 4235
Postal Address	: PO Box 2151, Rant-en-Dal, 1751, Gauteng, South Africa

QUALIFICATIONS DETAILS

NATIONAL QUALIFICATION FRAMEWORK (NQF) LEVEL	NAME OF QUALIFICATION	ACADEMIC INSTITUTION	YEAR
NQF 10	Doctor of Technology (DTech): Informatics	Cape Peninsula University of Technology (CPUT)	2020 (Expected)
NQF 9	Master of Public Health (MPH) - with specialisation in Medical Informatics (Information Systems)	University of South Africa (UNISA)	2014 (Completed)
NQF 7	Bachelor of Optometry (B.Optom)	University of Limpopo (UL)	2008 (Completed)
NQF 6	Advanced Diploma Information Resource Management (Coursework)	University of South Africa (UNISA)	2016 (Incomplete)
NQF 6	Advanced Certificate (Health Management)	Foundation for Professional Development (FPD)	2015 (Completed)
NQF 4	Senior Certificate / Matric	Orhovelani High School (Limpopo)	2003 (Completed)

REGISTRATION WITH PROFESSIONAL BODY

NAME OF BODY	PROFESSION	REGISTRATION NUMBER
• Health Professions Council of South Africa (HPCSA)	Optometrist	OP 0044962

SHORT COURSES		
COURSE	**INSTITUTION**	**PERIOD / YEAR**
• Clinical Management of HIV/AIDS for Health Professionals	Foundation for Professional Development	June 2018
• Emerging Management Development Program	University of Pretoria	October 2010
• Principles and Methods of Health Research (For MCur: Non-degree purpose)	University of South Africa	May 2012
• Inspection for Health Establishment	National Department of Health	November 2011
• Mentoring and Facilitation	Measure Evaluation – SIFSA	June 2014
• Crucial Conversation Training	Vital Smarts	March 2013
• District Health Information Software (DHIS2)	University of South Africa	December 2014
• DHIS2 Academy Workshop	University of Oslo, Norway / HISP-SA	March 2015
• Building Design and Engineering Approaches to Airborne Infection Control Course	University of Pretoria	June 2012
• Computer Literacy	University of Limpopo	September 2008

AREAS OF EXPERTISE AND KNOWLEDGE
• Technical assistance to the South African government (SAG) public health system
• Experience in implementation of digital health services and innovations at national level, including piloting and scale-up.
• In-depth knowledge of health information systems, the DHIS software (South African health care environment) and National Indicator Data Set (NIDS)
• Understanding of the District Health Management Information Systems (DHMIS) Policy and associated standard operating procedures
• Experience in implementation of health information systems strengthening strategies, in particular the eHealth and mHealth Strategies in South Africa
• Knowledge and experience in implementation of Human Resources for Health (HRH) and Human Resources Information System (HRIS), including the ICSP online system.
• Experience in facilitation and/or implementation of HIV/TB prevention, care, and treatment programs.
• Experience with working with and reporting to U.S. Funders in health programs.
• Knowledge and interest in working with the following groups in HIV programming: women, children, adolescents and LGTBI+
• In-depth knowledge, experience and understanding of the National Core Standards (NCS) for Health Establishments in South Africa and its reporting system.
• Experience in Health Systems Strengthening, including Monitoring and Evaluation.
• Experience in compliance and regulatory processes in health sector.
• Public Health, Research and Report Writing.
• Capacity development and support: Training and Facilitation.
• Eye Care: Optometry.

RECENT HIV PROJECT ACHIEVEMENT:
• Designed and implemented a 2-year project called Faster to Zero to eliminate mother-to-child transmission of HIV (EMTCT), also known as PMTCT MomConnect http://healthenabled.org/wordpress/faster-to-zero/

CONFERENCE PRESENTATIONS
• Health Information Systems Program (HISP) International Conference, Bloemfontein, South Africa, April 2015: *Staff Experiences in Data Management and utilisation of the District Health Information System (DHIS) in Primary Health Care*
• Health Information Systems Program (HISP) International Conference, Bloemfontein, South Africa, April 2015: *National Core Standards: Using the DHIS to Measure and Monitor health facilities Compliance Against Quality Standards*

EMPLOYMENT HISTORY		
PERIOD	**ORGANISATION**	**POSITION**

April 2019 – September 2019	International Training and Education Centre for Health (I-TECH), University of Washington, South Africa.	Technical Advisor: Human Resources for Health (HRH) Information Systems (Fully Seconded to National Department of Health)
November 2015 – June 2018	HealthEnabled	Digital Health Expert: South Africa (Fully Seconded to National Department of Health)
June 2013 – October 2015	Health Information Systems Program (HISP – SA)	Senior Facilitator: Health Information Systems Strengthening (Partly Seconded to: (i) Limpopo Department of Health & (ii) National Department of Health)
Dec 2011 – May 2013	National Department of Health (NDoH)	Assistant Director (Inspectorate) : Office of Standards Compliance
Jan 2009 – Nov 2011	Limpopo Department of Health (LPDoH)	Optometrist: Dr CN Phatudi Hospital & Van Velden Hospital

INDEPENDENT CONTRACTING HISTORY		
PERIOD	ORGANISATION	POSITION
August 2015 – September 2015	John Snow Inc	Consultant: Data Quality Compendium, Products and Tools Package
July 2015	Transnet Foundation (Phelophepha Health Train)	Clinical Supervisor: Optometry

CURRENT & PAST JOB DESCRIPTIONS AND EXPERIENCE

1. **April 2019 to September 2019 (Technical Advisor: Human Resources for Health (HRH) Information Systems)**

The Technical Advisor Human Resources for Health Information Systems is responsible for mentorship of National Department of Health (NDOH) staff engaged in the development, piloting and implementing the information systems for health work force, including but not limited to, Human Resources for Health Information Systems (HRHIS) as described by the World Health Organisation (WHO). Also providing technical support to the data systems and monitoring/evaluation work stream contributing to the NDOH Human Resources for Health Strategy 2030, adapting the National Health Workforce Accounts framework for HRHIS implementation in South Africa, developing a situation analysis for adapting HRIS for adaptation in South Africa, and supporting HRIS strategy communications to the National Health Council.

1.1. Leadership
- Provide guidance and professional expertise to the implementing partner designated for the design and creation of HRIS
- Represent I-TECH South Africa at high-level meetings with stakeholders, donors and other partners to discuss overall vision and project plan for projects/programmes
- Provide technical assistance to stakeholders in implementing of existing systems and help to determine how specific data could best be analysed, transformed and disseminated for stakeholders to make data-driven decisions
- Provide technical support to the data systems and monitoring/evaluation work stream contributing to the NDOH Human Resources for Health Strategy 2030

1.2. Quality Assurance and Analysis
- Continuously test systems for improvements
- Conduct testing of the system and document all required changes/improvements
- Train stakeholders on the use of systems and outputs

1.3. Project Management
- Develop a situation analysis for adapting HRIS for adaptation in South Africa
- Ensure HRIS outputs are delivered on time and of high quality
- Manage and communicate across all stakeholders on the project status

1.4. Reporting Responsibilities
- Provide project reports with status updates
- Document implementation roll out
- Provide monthly and quarterly reports, visualisations and presentations, as designated by stakeholders

1.5. Capacity Building
- Mentor NDOH staff to develop capacity for technical oversight over HRIS
- Develop capacity building plans for health professional councils to provide data to HRIS
- Develop capacity building plans for HRIS data users at the national, provincial, and district levels.

2. November 2015 to June 2018 (Digital Health Expert):

The Digital Health Expert reports to the Country Director and is partly seconded to the National Department of Health (NDoH):

Responsibilities:

2.1. Design and Implement a 2-year pilot called Faster to Zero to eliminate mother-to-child transmission of HIV (EMTCT) through an integrated digital health approach as an HIV component of the MomConnect initiative of the National Department of Health in 5 Districts.
- Implement a helpdesk where high risk (in terms of PMTCT) women will contact clinical nurse practitioners by phone and SMS
- Support facilities (both ANC & EPI) in implementing PMTCT MomConnect
- Monitor, evaluate and provide evidence for national scale of the service

2.2. Supporting strategy development, including:
- Conducting a situational analysis of Digital Health in South Africa.
- Assisting with the development of a HealthEnabled Country Strategy for South Africa.

2.3. Enabling partners to implement digital health at scale, including:
- Assessing various Digital Health Tools for their suitability for implementations at scale.
- Supporting the implementation of facility- and district-level digital health systems for EMTCT.
- Providing expert advice and support to select partners.

1.4. Building digital health capacity in South Africa, including:
- Conducting a digital health capacity assessment of partner organisations.
- Assisting in developing and delivering a digital health training curriculum.
- Planning and developing appropriate digital health guides and other resources.

1.5. Donor & Stakeholder Relationship Management
- To support strategic information reporting and compliance with existing contracts.

1.6. Research and Development
- Participate and report on research and development activities

1.7. Operations & People Management
- Support operations of project implementation and human resources management and development

1.8. Any other reasonable tasks as may be required, as part of secondment to the National Department of Health

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2. June 2013 to October 2015 (Senior Facilitator: Health Information Systems Strengthening):

2.1. Function as a *National Coordinator Functions – National Department of Health*:

2.1.1. Provision health information system services, with particular emphasis on National Core Standards and Quality Improvement/Assurance, including but not limited to:

- Providing technical support for the use of District Health Information System and related software
- Addressing the induction of and providing training for new employees
- Contribute and participate in development of new measures and/or indicators
- Liaise with the Office of Health Standards Compliance (OHSC), National Department of Health and other stakeholders
- Provide technical input on the NCS reporting system as per requirements of the OHSC
- Coordinate the planning, implementation and monitoring of the project activities
- Apply sound project management principles, ensuring accurate record-keeping, punctual reporting and optimal use of all project resources
- Contribute to the preparation/compilation of documentation for meetings and workshops
- Assist in managing risk mitigation strategies

2.1.2. Provision of national program coordinator services to all project related activities at the national department of health using an integrated and holistic project work plan approach, including but not limited to:

- Serve as key contact person for NCS program
- Serve as mediator between software developers and program managers
- providing required management and administrative support
- liaison with project funders and clients, including but not limited to attending meetings as instructed by the HISP-SA Project Manager or HISP-SA Project Director
- timeous delivery of project deliverables
- Project progress reporting

2.1.3. Technical support of DHIS Software at national and provincial department of health, including but not limited to:

- Assist and guide provincial coordinators on NCS
- Design and update training manuals
- Data management
- Coordinate and conduct basic testing of software updates

2.2. Function as a *Provincial Coordinator – Limpopo Department of Health*:

2.2.1. Provision of health and/or health information system services, with particular emphasis on primary health care and hospital services, including but not limited to:

3. designing and implementing health information systems focused on information at facility district and provincial levels;
4. providing technical support for the use of District Health Information System and related software;
5. providing technical support for health information system- and health programme strengthening;
6. training in the use of information and software for management;
7. addressing the induction of and providing training for new employees;
8. contributing towards the research and development of new and innovative mechanisms to manage and report health information;

2.2.2. Provision of provincial coordinator services to coordinate all project related activities in a specific province using an integrated and holistic project work plan approach in representing all HISP-SA interests at provincial, district, sub-district and facility level, with wide-ranging obligations, including but not limited to the responsibility for:

- coordination of designated staff with respect to project functions and reporting;
- providing required management and administrative support;
- assist with the induction and training of new employees;
- timeous delivery of project deliverables;
- submitting reports and any related obligation;
      reporting on project progress

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4. From December 2011 to May 2013 (Assistant Director: Compliance Inspections):

- Assisting with the conduction and management of external inspections of PHC establishments and hospitals
- Handling of appeals and communication of certification outcomes to establishments and relevant stakeholders.
- Work with development of audit criteria methods.
- Establish and train audit teams.
- Draft National status report and analysis.
- Dissemination of Standards, tools and policies.
- Report writing, monitoring and evaluation.
- Development of Indicator.
- Undertake research.
- Benchmark against other certification systems.
- Support provincial Quality Assurance Units.
- Assist with the development of training materials and training of assessors.
- Effective and efficient management of human, financial and material resources (tangible and non-tangible assets).
- Maintain internal controls and risk management systems.

5. 2009 January to 2011 November (Optometrist):

- Worked at Dr CN Phathudi Hospital for entire 2009 and then founded a new optometry section in Van Velden Hospital in February 2010.
- Responsibilities, amongst others were doing optometry clinical work, leading and managing the Optometry Section.
- Doing sectional head duties, such as quality improvement, business/operational plan, providing statistics, doing service delivery reports, attending district and provincial optometry meetings.
- Also started doing community outreach to the surrounding clinics and referring patients to the new optometry clinic in the Hospital.

REFERENCES

- Available on request

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