

**THE SEMANTICS OF LANGUAGE TRANSLATION USING MOBILE SYSTEMS IN
SOUTH AFRICAN HEALTHCARE**

by

PHATHUTSHEDZO MAKOVHOLELO

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Supervisor: Prof Tiko Iyamu

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ABSTRACT

As in many parts of the world, the need for healthcare services is increasing rapidly in South Africa. Owing to many official languages in the country, health service delivery is continuously challenged by spoken language and semantics. The challenges result to poor health services in many areas of the country. Thus, this study was undertaken with the aim: to develop a framework which can be used to guide the selection and implementation of mobile systems in the translation of language semantics for improved healthcare service delivery in South Africa. For this purpose, the study was based on one significant research question: How can the challenge(s) of semantics and language translation in South African healthcare delivery be addressed using mobile systems?

In achieving the aim of the study, a qualitative study was conducted using the semi-structured interviews to collect the data. The analysis of the data was carried out using the hermeneutic approach within the interpretative paradigm, which was guided by two theories, actor network theory (ANT) and diffusion of innovation (DOI). The ANT was used to focus on the interaction and relationship between human and non-human actors within a heterogeneous networks, in the activities of healthcare. The DOI was employed to examine how mobile systems can be diffused, in addressing the challenges and barriers which the health facilities encounter from language perspective. The case study approach was followed, based on three cases, two healthcare organisations, and a community in the northern part of South Africa were used in the study.

Based on the analysis of the data, the influencing factors were found, and interpreted. The interpretation helps gain deeper understanding of the challenges, from which a framework (see Figure 6.5 in Chapter 6) was developed. From an understanding of the factors that influence language semantics, and its translation by using mobile systems, challenges in the South African healthcare can be reduced, and quality improved. The way in which the theories were used brought a fresh perspective to the study. In practice, the framework can be used by both healthcare practitioners and ICT specialists to guide the selection, use and support of mobile systems for the translation of language semantics in South Africa. The complementary use of ANT and DOI in the study contributes methodologically.

Keywords: Information Technology Communication, Healthcare, Mobile Systems, Language Semantics, Translation, Actor Network Theory, Diffusion of Innovations

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GLOSSARY

Terms/Acronyms/Abbreviations	Definition/Explanation
Healthcare	services provided by health organisation for medical treatment
Mobile systems	referring to mobile phones and tablets
Language semantics	meaning of words and sentences
Translation	the process of converting text or words from one language into another
ICT	Information and Communication Technology
ANT	Actor Network Theory
DOI	Diffusion of Innovation theory
SA	South Africa
TC	Tshwane Community
MH	Mukhethwa Hospital
SLH	Sweet Love Hospital
SMS	Short text message

CHAPTER 1

INTRODUCTION OF THE STUDY

1.1 Introduction

This chapter introduces the entire study, from Chapters 1 to 7. From an introductory point of view, this chapter presents the background, problem, questions and objectives of the research. An introductory literature review, and the discussion about the theories, Actor Network Theory (ANT) and Diffusion of Innovations (DOI) that underpin the study are also presented in this chapter and further expanded in Chapter 2. The research methodology that was employed in the study is also discussed in this chapter and expanded in Chapter 3. This is followed by the study's ethical considerations; the delineation of the study; and the significance of the study. Also presented in this introductory chapter is the overall structure of the thesis. Finally, a conclusion was presented, and recommendations drawn.

1.2 Background

The South African healthcare environment is currently changing, being transformed to fulfil new benefits and opportunities through technological innovations, such as mobile technology. However, these changes usher in both challenges and potential barriers. Overcoming the use of various languages within the healthcare system is one of the critical barriers (Naidoo, 2014) affecting the well-being of millions of people living in South Africa. Of about 54 million people in this country, only 4.9 million people are English-speaking, while the rest speak a variety of other languages such as isiZulu, isiXhosa, Sepedi, Tshivenda and Xitsonga as their first languages. Campbell and Young (2016) used one of the languages to give example, that the challenges arise when psychologists attempt to conduct psychotherapy with clients in the Xhosa language, by using English language. For many, their first language is their *only* language of communication. Consequently, the present healthcare delivery system is struggling to handle this diversity (Burns, 2012). According to Ayong and Atanga (2017), the issue of healthcare professionals having to care for patients with different cultural backgrounds and language barriers poses numerous critical challenges to healthcare systems. This necessitates redress through an advancement such as a mobile system.

In developing countries such as South Africa, the use of mobile technologies is increasing rapidly (Simpson & Calitz, 2014). De Pauw, Wagacha & De Schryver (2007)

describes experiments with a machine learning approach that was applied to some African languages Sesotho and Tshivenda. Hence, new research developments and studies in this space have been conducted. Nowadays, mobile systems are becoming an important ICT tool, not only in urban regions, but also in rural areas. According to Rahar (2011), the appropriateness and adaptability of mobile systems as tool to bridge the digital divide in the healthcare environment is influenced by factors such as the rapid advancements in the technologies, ease of use and the falling price.

Due to the numerous languages other than English language in South Africa, there is a clear need for translation so that both the healthcare service providers and receivers can benefit. However, Dong and Cremers (2014) asserted that translation of languages is not easy or straightforward as is popularly acclaimed. This is primarily because of the semantics in some of the languages. *Semantics of language* is referred to in this study as the meanings of words and sentences (Carston, 2013). Which impact on the interactions that occur between healthcare service providers and the recipients. Even though many studies including experiments has been conducted for many years, the challenges persist (Campbell & Campbell, 2016; Schlemmer & Mash, 2006).

The limits to an individual's language are commensurate to the limits to an individual's real-life world. The fact of the matter is that the 'real world' is, to a large extent, unconsciously built upon the language habits of a group: different communities of humans, speaking different languages, think differently to the extent that their languages differ from one another (Gleitman & Papafragou, 2012). The situation as described above happens in every part of South Africa. Thus, it is problematised for a possible solution through this study.

1.3 Problem statement

In 2015, the World Health Organization noted that countries, particularly in Africa, will not develop economically, socially and environmentally without substantial improvements in the health of their people. The economic shifts of the past few years have further impacted economic growth worldwide, unduly affecting developing countries. If anything positive can be said about the global recession, is that it deeply binds the fate of nations together and generate momentum for new and systemic approaches to persistent cross-border challenges.

Wu and Hall (2012) explained that experts have agreed that it will take an unprecedented transformation to reverse the tide of failing healthcare systems, particularly in light of shrinking resources that must now be used more efficiently. Fortunately, support is increasingly available through a set of breakthrough tools known as e-Health (electronic health) and M-health (mobile health), commonly understood to be the innovative application of emerging information and communications technology (ICT) in health systems. This includes the use of software and mobile systems by healthcare practitioners, working from any location to access, track and trace patients' records in order to provide services to them (Ventola, 2014).

Also, various methods and approaches has been explored towards finding solutions these challenges (Campbell & Campbell, 2016). De Pauw, Wagacha & De Schryver (2007) conducted a study on the use of automatic diacritic restoration in the context of South African languages. According to Eiselen and Puttkammer (2014), despite the use of machine learning approach, phrase like "I love him/her" has been challenging to simplistically translate because it is written as a single word, *ngiyamthanda*, in isiZulu, while it is written as four separate words in Sepedi, *ke a mo rata*.

However, this does not address the challenges of language and its semantics of translation, which is vital in providing improved services to communities in South Africa. Challenges arise, not only because of the content of word-for-word, literal translations, but also the linguistic form of the language, such as tone, syntax, manner of questions posed, and the concept of the consent; similarly, contexts of use affect meaning (Hanrahan *et al.*, 2015). For example, countless community members are hesitant to be enrolled for healthcare services primarily because they feared that a language they do not understand will be used as medium of communication. Interestingly, the same people are frequent users of the mobile phones. Therefore, this identifies a gap that needs to be addressed to be certain that a better healthcare service is rendered to everyone, irrespective of where they stay and which language they speak.

1.4 Research problem

Mobile systems, including cellular phones and computers (iPADs, tablets and notebooks) are becoming significant ICT tools for many activities and process, including service delivery in both urban and rural areas. This includes the use of mobile technology devices in the delivering of healthcare services, which is increasing in rapidity in many countries, particularly in developing countries such as South Africa.

In recent years, healthcare service providers have increasingly employed mobile systems in delivering services. However, the nature of the diversities in tribes and languages within many developing countries enhance the difficulty of delivering or receiving the services which are provided by many healthcare organisations. This is so because English language is the primary medium of communication, although many healthcare recipients are not conversant in English as they cannot speak English fluently or understand it coherently.

Due to the sensitivity, confidentiality, and private nature of healthcare information and services, a one-on-one consultation in the language with which the patients are comfortable is critical. Otherwise, the services and objectives of the healthcare organisations will continue to be challenging, often rendered obsolete. Essentially, language barriers prohibit necessary, even critical, healthcare services. To avoid this, semantics of language through translation must be addressed and language barriers rectified. A solution that employs the use of mobile systems for healthcare services is developed and proposed through a framework from this study.

1.5 Research questions

Based on the research problem as articulated above, questions were formulated. They include a main question and four sub-questions, as follows.

Main question

“How can the challenge(s) of semantics and language translation in South African healthcare delivery be addressed using mobile systems? This framework is intended to improve the delivery of services which healthcare organisations provide to communities, particularly in areas where many different languages are spoken, and as a result, many speakers, including the healthcare service providers, do not understand each other.

Sub-questions

The sub-questions include use of mobile systems in healthcare services, and the semantics of language translation.

i. Use of mobile systems in healthcare services

- a. How would mobile systems be employed in multi-language translation in the delivering of healthcare services to communities in South Africa?

- b. What are the factors influencing the selection and use of mobile systems for language semantics for healthcare service delivery in South Africa?

ii. The semantics of language translation

- a. What are the factors influencing spoken languages, and how can language semantics be translated from local dialects to English by using mobile systems, with the intent of improving healthcare services in South Africa?
- b. How does the translation of language semantics impact the services that healthcare organisations provide to the communities in South Africa?

1.6 Research aim and objectives

In alignment with the research questions, a research aim and objectives were formulated and presented as follows:

Aim

- To develop a framework which can be used to guide the selection and implementation of mobile systems in the translation of languages for improved healthcare service delivery in South Africa.

Objectives

- i. From language and a semantics perspective: to examine and understand the factors that hamper the delivery of healthcare services in South Africa.
- ii. To examine and establish the factors which can influence the selection and use of mobile systems for language semantics for South African healthcare organisations
- iii. To examine and understand how mobile systems can be employed in multi-language translation, to improve the delivery of healthcare services to communities within South Africa.

1.7 Literature review

This section presents a review of literature in the key areas relating to this research, including ICT, mobile systems, healthcare, semantics of languages and translation. A review was also carried out on the two theories – Actor Network Theory and Diffusion of Innovation – which underpin the study.

1.7.1 Information and communication technology

The need and use of Information and Communication Technology (ICT) has increased monumentally in recent years as nearly everyone has witnessed a vast expansion in the prevalence of phones and lowering of costs when owning a mobile device (Brown, 2018). ICT is defined as “tools that facilitate communication, information processing, storage and by electronic means” (Saleem *et al.*, 2013: 49). It is difficult to find an area of business (organisations included) or life that is not infiltrated by the service of ICT, especially as laquinta (2015) asserts that the use of ICT includes things such as computers (desktop or laptop), software and hardware, mobile systems and things such as video conferencing and distance learning.

According to Barr *et al.*, (2017) ICT is often viewed as the key for communication enhancement among healthcare providers. Furthermore, ICT encompasses a range of electronic digital and analogue devices such as radios, televisions, telephones (fixed and mobile), computers, electronic-based media such as digital text and audio-video recording, and the internet, while excluding non-electronic technologies (Green & Huang, 2017).

Among other things, ICT has drastically improved communications while reducing distances in terms of business meetings. ICT is the key to enhancing and improving communication among healthcare providers, especially for patients with chronic conditions (Barr *et al.*, 2017). Some examples include videoconferencing and distance learning. ICT has spread extensively into everyday life in an unprecedented way (Abdel-Aziz, Abdel-Salam & El-Sayad, 2016). In short, ICT is a way to communicate and share information using advanced technology allows for communication and sharing with people of vast distances. Bayo-Moriones, Billon and Lera-Lopez (2013) showed that communication improvement leads to better operational performance.

Even though ICT provides the platform, tools and artefacts to enable and support many processes and activities such as communication and information sharing, different individuals and groups apply it in various ways. The application of ICT is often based on know-how and interest. Ballon and Van Heesvelde (2010) argued that many ICT platforms fulfil several or all of these functions, instead of being limited to one of them. According to Rouleau, Gagnon and Côté (2015), ICT is viewed as a set of projects or services that allows knowledge transfer, remote care (mobile health) and interdisciplinary clinical support in the healthcare sector. According to Yagos, Olok, and Ovuga (2017), interventions such as e-Referral, teleconsultation, electronic

medical record and the use of mobile phones indicate that ICT applications bring significant benefits to health workers in rural and remote area.

Sometimes the interests of individuals and groups are impossible or difficult to fulfil. For example, not *all* African languages could conceivably be translated using the mobile systems. This makes it difficult for some services such as healthcare to be carried out in some areas of need. Remember, not all non-English speaking people speak the same language. This results in significant barriers; the existence of these barriers can cause delays in real-time communications (Daigle *et al.*, 2011).

1.7.2 Mobile systems

A mobile operating system (Mobile OS) “is a software platform on top of which other programs called application programs, can run on mobile devices such as personal digital assistant (PDA), tablets, cellular phones, smartphones and so on” (Okedirán *et al.*, 2014: 2). Mobile devices, including cellular phones and computers (iPADs, tablets and notebooks) are becoming significant ICT tools for many activities and processes, including service delivery in both urban and rural areas (Hlagala, 2015; Wang, 2013). This includes the use of mobile technology devices in the delivering of healthcare services, which is increasing in rapidity in many countries, particularly in developing countries. As a result, many aspects of clinical practice have been transformed through the use of mobile systems by healthcare practitioners. Mobile systems have become commonplace in healthcare settings, leading to rapid growth in the development of medical software applications (apps) for these platforms (Wallace, Clark & White, 2012; Aungst, 2013).

Both in developed and developing countries, the most adopted means of communication is the mobile communication devices (Kogeda & Mpekoa, 2013). The penetration of mobile devices is more quantifiable than all other electronic devices put together. Every mobile communication device needs some type of mobile operating system to run its services: voice calls, short message service, camera functionality and so on. Therefore, the purpose of this study will be to apply the term *mobile systems* in reference to all these mobile systems.

Mobile systems, including smartphones, have one unique and advantageous feature: their use of the popular and widespread native applications or “apps”. Instead of relying on Internet connectivity for the delivery of content that resides on a remote server which are developed for the mobile operating system, and reside on the user’s

mobile device, and may store data locally or exchange it via the Internet (Fanning, Mullen & McAuley, 2012).

1.7.3 Healthcare

Healthcare includes the diagnosis, treatment and prevention of disease, as well as illness, injury, and other physical and mental impairments in humans. However, healthcare such as: medicine, chiropractic, dentistry, nursing, pharmacy, allied health and other care providers are delivered by practitioners. It refers to the work done in providing primary care, secondary care and tertiary care, as well as public health (WHO, 2012; Gupta & Rokade, 2016).

In industrialized and developing countries the growth in adoption of mobile phones and the Internet has increased opportunities in “crowdsourcing,” which is engaging large groups of people to perform a task (Freifeld *et al.*, 2010). There is a particular promise held by mobile phones for this type of opportunity because they can be used as point-of-care devices, function in remote locations, and are readily carried and used at any time (Waegemann, 2010).

In order to provide holistic care, it is necessary to develop integrated approaches to health and social care delivery. Policymakers have realised that e-Health initiatives can promote information sharing. ICT makes it possible for those delivering health and social care to exchange patient data without being constrained by time and distance (King *et al.*, 2012).

Healthcare providers and facilities in many countries, are not yet using electronic information systems. Connectivity among systems in this context, is not an initial concern and not necessarily a high priority for policymakers. However, ICT users inevitably grows and the cost to a nation for supporting grows as well. The concern for all the providers use is the use of system interoperability that has also increased patients. Payers and policymakers use the system to access data from information systems to monitor and manage health services.

Healthcare information systems

The health information system consist of four main functions, which include data generation, compilation, analysis and synthesis, communication and use, primarily for decision-making. Jeyasekar and Saravanan (2018) referred to the World Health Organization which stated in 2008 that to analyses the data and ensures their overall

quality relevance and timeliness, and converts data into information for health-related decision making the health information system collects data from the health sector and other relevant sectors.

1.7.4 Language semantics

Language is the key to a person's self-identity. It enables a person to express emotions, share feelings, tell stories, and convey complex messages and knowledge. Semantics of language influence the meaning people give or associate to content. This can be a risk in terms of how healthcare services are provided and received. *Semantics of language* is referred to in this study of the meaning of words and sentences. *Semantics*, the study of meaning in language, can be applied to entire texts or to single words. For example, "destination" and "last stop" technically mean the same thing, but students of semantics analyse the subtle shades of meaning (Cruse, 2011).

Semantics of language is overtly critical in communication, particularly with illiterates and people in rural areas. In addition, semantics of language is significant in terms of how technologies are used for communication purposes (Dor, 2011).

Translation

One of the most prominent definitions of *translation* is stated by Newmark (1988: 5) who defines translation as "rendering the meaning of a text into another language in the way that the author intended the text". This definition stresses rendering the meaning of the source language text into the target language text as what is intended by the author.

Hatim and Munday (2004:6) define *translation* as "the process of transferring a written text from source language (SL) to target language (TL)". Translation is undeniably critical for interaction between healthcare practitioners and their recipients. According to DeCola (2011), translation of a medical visit by unqualified interpreters is prone to omissions, additions, substitutions, volunteered opinions, and semantic errors that can seriously distort care.

When rendering a text from one language into same version in another language Translation plays an important role, thus through translation, highly advanced international cultures can be created despite differences or similarities of the people's cultures and the degree of the level of their civilization and superiority (Qassim,

2014). According to Campbell and Young (2016:2), “culture shapes the way language is used to conceptualize feelings, thoughts, and behaviors, the terms and experiences used to describe psychological distress vary considerably across languages, making it difficult to find linguistically and conceptually equivalent terminology in many instances”.

1.7.5 Theory underpinning the study

In achieving the aim of this study, which is to develop a framework that could be used for the selection and implementation of mobile systems in the translation of language semantics in the delivering of healthcare services, the study was underpinned by two theories: Actor Network Theory (ANT) and Diffusion of Innovations (DOI). These two theories guided the study from two different perspectives, in the areas of data analysis and the interpretation of findings. ANT focused on the interaction and relationship between human and non-human actors within a heterogeneous network, while DOI was focused on how technologies, such as mobile devices, were diffused within an environment for a specific purpose.

Actor Network Theory

Actor Network Theory (ANT) is a distinctive social theory developed by Callon and Bruno (1981). It has since been increasingly used in information system studies. Some of the tenets of this theory include the actor, how networks are formed and heterogeneity of actors, as shown in Figure 1.1. The translation of an actor or actors into a network is achieved through four moments of translation (Callon, 1991). “Actor Network Theory incorporates the principles that integrate both human and non-human actors into the same network of common interest. However, non-human actors do not reason like human actors, but they are able to perform what they are directed to do” (Sekgweleo & Iyamu, 2014: 163).

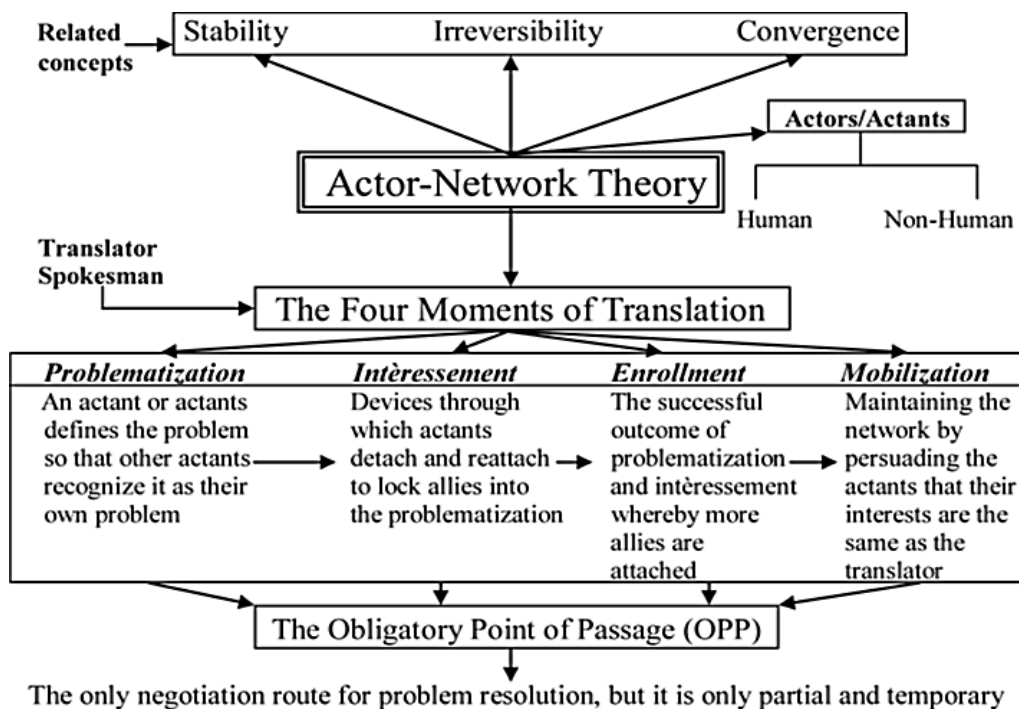


Figure 0.1: ANT - the four moments of translation

Source: Adapted from Rhodes (2009)

For the purpose of this study, the concept of *translation* was used in which innovators attempt to create a forum, a central network, which all the actors agree is worth building and defending. Callon (2003) has defined four moments of translation:

1. *Problematization*

“What is the problem that needs to be solved? Who are the relevant actors? Delegates need to be identified that will represent groups of actors. So, a union head represents workers, or a member of parliament represents his constituency. During problematisation, the primary actor tries to establish itself as an obligatory passage point (OPP) between the other actors and the network so that it becomes indispensable” (Tatnall, 2012: 112).

2. *Intèressement*

Getting the actors interested and negotiating the terms of their involvement. The primary actor works to convince the other actors that the roles it has defined for them are acceptable.

3. *Enrolment*

Actors accept the roles that have been defined for them during intèressement.

4. *Mobilisation of allies*

Do the delegate actors in the network adequately represent the masses? If so, enrolment becomes active support.

Diffusion of Innovation

Diffusion of innovations (DOI) has been widely applied in the studies of many disciplines, including education, sociology, communication, agriculture, marketing, and information technology. For example, DOI theory has been widely applied to public health and medical care for achieving effective disease prevention and also in the study for integration of Diffusion of Innovation theory into diabetes care (Lien & Jiang, 2017). In DOI, an *innovation* is “an idea, practice, or object that is perceived as new by an individual or another unit of adoption” (Rogers, 1995: 11). *Diffusion*, on the other hand, is “the process by which an innovation is communicated through certain channels over time among the members of a social system” (Rogers, 1995: 5). Therefore, the DOI theory argues that “potential users make decisions to adopt or reject an innovation based on beliefs that they form about the innovation” (Agarwal, 2000: 90).

As expressed in this definition, the four key components of the diffusion of innovations include innovation, communication channels, time and social system. According to Nemutanzhela and Iyamu (2015), the theory is concerned with the manner in which a new technological idea, artefact or technique, or a new use of an old one, migrates from creation to use.

The five steps involved in the innovation-decision process are: 1) knowledge, 2) persuasion, (3) decision, 4) implementation, and 5) confirmation (Rogers, 2003b). These stages typically follow each other in a time ordered manner, a process shown in Figure 1.2.

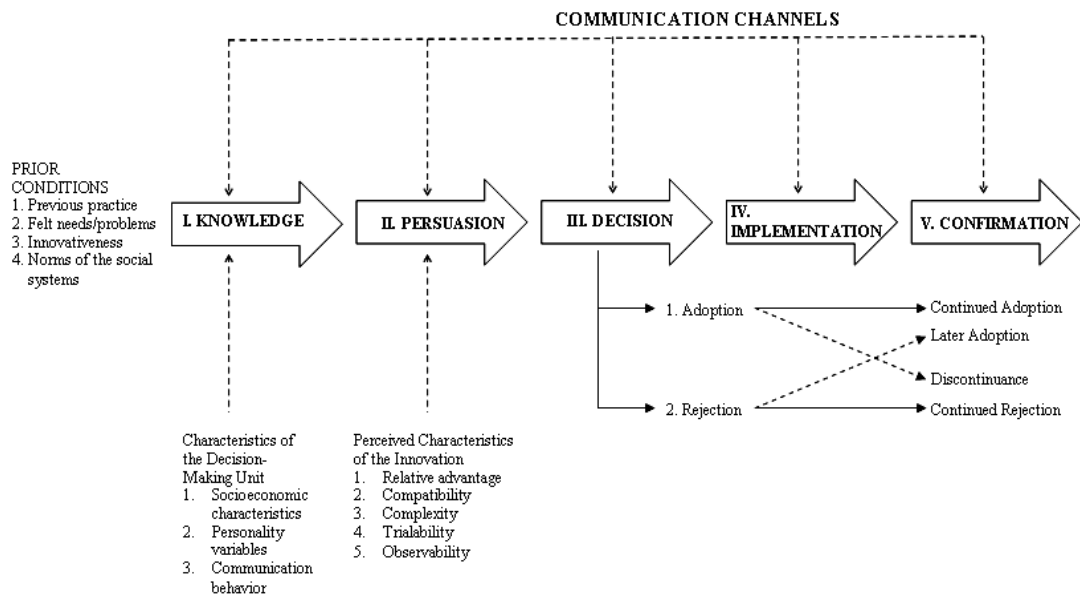


Figure 1.2: Diffusion of Innovations communication channel

Adopted from Rogers (2003a)

The Knowledge Stage: knowledge is the first stage of the innovation-decision process. In this stage, an individual learns about the existence of innovation and seeks information about the innovation. “What?” “How?” and “Why?” are the critical questions in the knowledge phase. During this phase, the individual attempts to determine “what the innovation is and how and why it works” (Rogers, 2003a: 21).

The Persuasion Stage: The persuasion step occurs when the individual has a negative or positive attitude toward the innovation, but “the formation of a favourable or unfavourable attitude toward an innovation does not always lead directly or indirectly to an adoption or rejection” (Rogers, 2003a:176). Observability will allow organisations and patients to observe how innovation works as this will give a positive impact on the users’ attitude toward the system and intention to use the system.

The Decision Stage: At the decision stage in the innovation-decision process, the individual chooses to adopt or reject the innovation. While *adoption* refers to “full use of an innovation as the best course of action available”, *rejection* means “not to adopt an innovation” (Rogers, 2003a:177).

The Implementation Stage: At the implementation stage, an innovation is put into practice. However, an innovation brings the newness in which “some degree of uncertainty is involved in diffusion” (Rogers, 2003a:6). Uncertainty about the outcomes of the innovation still can be a problem at this stage.

The Confirmation Stage: The innovation-decision already has been made, but at the confirmation stage the individual looks for support for his or her decision. According to Rogers (2003a), this decision can be reversed if the individual is “exposed to conflicting messages about the innovation” (2003a:189).

1.8 Research methodology

The methodology applied in the study is discussed in this section. This includes the philosophical assumption, research approach, methods and design. Also covered in the section are data collection and analysis.

1.8.1 Philosophical assumption

Based on the objectives of the research as stated above, interpretivism was selected, primarily because the interpretivist paradigm allows researchers to view the world through the perceptions and experiences of the participants. While looking for research answers, the researcher who follows interpretive paradigm uses those experiences to construct and interpret an understanding from the gathered data (Thanh & Thanh, 2015). Interpretivism helps to avoid rigid structural frameworks such as in positivist research and adopt more personal and flexible research structures (Carson *et al.*, 2001). This is done through seeking an explanation within the realm of individual consciousness and subjectivity, and within the socially constructed sphere of human relation (Zyl, 2015).

1.8.2 Research approach

The inductive approach, which is more often than not associated with the interpretivist paradigm, was selected. This approach, also known as inductive reasoning, is more of a concept that start from specific to general. The inductive approach guides development of theories from its results (Goddard & Melville, 2004). This approach aims to generate meanings from the data set collected, identifying patterns and relationships to build a theory; however, the inductive approach does not prevent the researcher from using existing theories to formulate the research questions to be explored (Saunders, Lewis & Thornhill, 2012).

1.8.3 Research methods

There are different types of research methods, including qualitative, quantitative and mixed methods. In quantitative methods objective measurements and the statistical, mathematical or numerical analysis of data collected through polls, questionnaires

and surveys, or by manipulating pre-existing statistical data using computational numerical data using computational techniques are emphasized (Bernard, 2017). Quantitative research focuses on gathering numerical data and generalizing it across groups of people to explain a particular phenomenon (Almalki, 2016).

Some researchers consider mixed methods to be any project that involves both qualitative and quantitative methods (Halcomb & Hickman, 2015). Morse (2010) asserts that a mixed method design needs to consist of one project, known as the core project, which must be a complete method on its own, and a second project consisting of a different type of data or analysis, using a strategy (and there may be more than one) that is incomplete, that is not comprehensible or publishable apart from the core project. For the purpose of this study, the qualitative method was applied. This decision was informed and guided by the objectives of the study.

Qualitative research

Rwegoshora (2016) asserts that the ability to provide complex textual descriptions of how people experience a given research issue can be considered as the strength of qualitative research. The information about the 'human' side of an issue is provided: the often-contradictory behaviours, beliefs, opinions, emotions and relationships of individuals. This research will have a qualitative attribute because this allows data to be gathered about perceptions and opinions concerning language semantics.

The ultimate qualitative research is to offer a perspective of a situation and provide well-reports that reflect the researcher's ability to illustrate or describe phenomenon (Myers, 2000). One of the strongest strengths of the qualitative is the richness and depth of explorations and descriptions.

1.8.4 Research design

In terms of design, the case study approach was applied in the study. The case study approach is regarded as an empirical inquiry that investigates a contemporary phenomenon within real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used (Yin, 2013). Adhering to the case study approach, three cases were selected for the study, including two healthcare organisations, and a community in the norther part of South Africa.

A community called Soshanguve, in the Tshwane locality in South Africa, was selected for the study. The community members therefore formed part of the study, in that they are recipients of healthcare services. The other factor that played a role in the selection of this community was the variety of different languages spoken in this particular area. It is uncommon in South African to have many different spoken languages within the same community (locality). At the time of this study, the community was dominated by isiZulu, Sepedi, Tshivenda and Xitsonga-speaking people; consequently, these four languages were used to elicit information about language semantics from the community members.

The other two cases were Mukhethwa Hospital (MH) and Sweet Love Hospital (SLH). Mukhethwa Hospital was a public hospital, and Sweet Love Hospital was non-governmental health service provider. The public facility was general to the community, while non-government healthcare focuses on chronic diseases. This selection was based on the fact that it is vital for patients and healthcare providers to understand each other. Communication is vital when dealing with chronic patients, as they retain on-going treatment for the remainder of their lives.

1.8.5 Data collection

Qualitative data was collected using the semi-structured interview technique. The selection of this method and technique was based on the objectives of the study as presented in the section above. Hence this eliminated the need to discuss quantitative methods and other techniques and approaches, such as structured interviews, questionnaires and observation. A full discussion is presented in Chapter 3 (Research methodology) of this thesis.

Interview

Interview is defined as “a method of data collection in which one person (an interviewer) asks questions of another person (a respondent): interviews are conducted either face-to-face or by telephone” (Farooq & de Villiers, 2017). The qualitative research interviews seek to describe and the meanings of central themes in the life world of the subjects: “The main task in interviewing is to understand the meaning of what the interviewees say” (Kvale, 1996: 20; Abdou, 2014).

Semi-structured interview

The most popular interview technique over recent years for collecting data in qualitative research is ‘semi-structured’ (sometimes called ‘moderately scheduled’). As thus, the semi-structured interview technique is not highly structured, it consists of

a case that only have closed-ended questions, nor is it unstructured, so that the interviewee is simply given a license to talk freely about the topic. According to Blandford (2013), for semi-structured interviews, most of questions or at least themes are planned ahead of time, but lines of enquiry are only pursued within the interview to follow up on interesting and unexpected avenues that emerge.

For the purpose of this study both healthcare service providers and community members, the organisation stakeholders (literate and illiterate; different age groups; both genders), were interviewed. The number of people interviewed was met on the point of saturation. Point of saturation is when no new information is coming forth from the participants.

1.8.6 Data analysis

Qualitative analysis involves a continual interplay between theory and analysis. The analysis was carried out using the hermeneutic approach within the interpretative paradigm, which was guided by two theories ANT and DOI. In the analysis of the qualitative data, patterns such as changes over time or possible causal links between individuals and spoken language were followed in gaining an understanding of healthcare services.

Two theories – Actor Network Theory (ANT) and the Diffusion of Innovation (DOI) theory – were employed to guide the analysis of the data, which was qualitative. These two theories were employed due to the scope and nature of the study. It would have been difficult or impossible to achieve the objectives of the study if only one theory was applied. While the analysis was carried out separately, the findings were combined for final interpretation. A review of the theories was conducted, as presented in the literature review section 1.5 above.

ANT was used for several reasons: first, to examine how healthcare services are problematised in the different communities; secondly, to understand the various networks of healthcare service providers and recipients are formed, on the bases of health conditions, and spoken languages; and finally, to examine the relationship and interactions that happens between the healthcare service providers and communities' members through spoken languages. Thereafter, the DOI theory was employed.

The DOI was used to examine how technology solution can be diffused in the unique communities, using mobile systems: first, to address the challenges of language

translation for healthcare services' purposes; and secondly, for the translation of the semantics in the languages.

1.8.7 Unit of analysis

The analysis of the data was done through units at case level, concerning factors such as age, race, sex and level of education. According to Iyamu (2011), the units of analysis approach allows data to be analysed on unit-by-unit basis. Demographics are used by governments, corporations and non-government organisations to learn more about a population's characteristics for many purposes, including policy development and economic market research (Hauser & Duncan, 1959).

1.9 Ethical consideration

Cape Peninsula University of Technology (CPUT) Research Code of Ethics was followed. For example, an Ethical Clearance Letter was obtained from the faculty. A Consent Letter to grant permission to collect data from the organisations was sent to the prospective participants. This letter considered the research purpose, procedures, objectives, potential benefits and risks of the study. Permission was granted, and a Letter of Consent was signed and returned to the university by participants.

The following were taken into consideration and addressed with the participants, especially those working in healthcare:

Confidentiality, privacy and anonymity: The Hippocratic Oath embeds the promise that whatsoever you shall see or hear of the lives of men or women which are not fitting to be spoken, you will keep inviolably secret.

In this regard, therefore, the following ethical ideals were adhered to:

- i. At the start of each interview, the participants were informed of the purpose of this study.
- ii. Right to withdraw from the interview at any time was explained.
- iii. Consent to record the interview and to make notes from the interview was sought from each participant.
- iv. The interviews had to adhere to the standards set by the World Health Organization (WHO) for keeping participant information confidential.
- v. During selection, the participants were informed of the study's purpose and further informed that their participation was voluntary.
- vi. During intervention, the participants were granted respect and when they were unwilling to respond to specific questions, this choice was respected.

1.10 Structure of the thesis

This thesis is divided into seven chapters, summarised as follows:

CHAPTER 1: Introduction of the study

Chapter 1 introduces the entire scope of research as documented in the thesis. This includes the problem statement; research question; the objectives of the research; the methodology applied in the research; an overview of the research cases; data analysis; and finally, the conclusion and recommendations. This chapter presents the relevance of the study and outlines the different chapters.

CHAPTER 2: Literature review

Chapter 2 presents the literature review, divided into two parts. The first part focuses on the key components (or keywords) that are related to the study, including ICT, mobile system, healthcare, and language semantics. Literature primarily included peer reviewed articles. Acknowledgements were made of all the literature references. Through the review, gaps in the area of study were highlighted which prompted the researcher to pursue the objectives of the research. The second part of the chapter focuses on the theories that underpin the study. An extensive and comprehensive review of theories was conducted, including how the theories relate or underpin the study. Examples of where and how the theories have been applied before on other studies were also acknowledged. Reasons for choosing the theories were addressed.

CHAPTER 3: Research methodology

This chapter discusses the research methodology, which include the research philosophy, approach, design and methods applied in the study. Also within this chapter, a discussion on why and how the different techniques, methods and approaches were employed in the study was presented.

CHAPTER 4: Case study overview

This chapter presents the overview of the cases that were studied. Specifically, this chapter introduced the three cases studied by presenting the background, structure and manner by which these cases fit into the research.

CHAPTER 5: Data analysis

This chapter presents the analysis from the three cases, to which the two theories, Actor Network theory and Diffusion of innovations, were applied.

CHAPTER 6: Results and interpretation

Chapter 6 presents the results and careful interpretation of the results, including the framework that was developed from these results.

CHAPTER 7: Conclusion and recommendations

This chapter gives a summary of the findings, draws conclusions from those summaries and presents relevant recommendations.

1.11 Delineation of the research

The study focused on translation of language semantics using mobile systems specifically for healthcare organisations in South Africa. Therefore, this study only concentrated on healthcare and the use of mobile systems. For the study, *mobile systems* referred to cellular phones and iPads or tablets. The study was conducted in South Africa and targeting participants who speak Tshivenda, isiZulu, Xitsonga and Sepedi languages, living within the same community of South Africa and requiring healthcare services.

1.12 Significance of the research

The benefits of the study are three-fold, from both healthcare and academic perspectives. Thus, the study is significant in the following ways:

- i. Healthcare practitioners in South Africa are able to understand their patients better with the intent of improving the services they provide. This will help reduce the numbers of fatalities.
- ii. Government will receive a greater understanding of the influencing factors to help develop a framework to guide translation of languages for improving the healthcare environment.
- iii. Other African countries will benefit, as the findings from the study will be of critical significance to countries with many languages experiencing similar semantic challenges in healthcare due to these language variations.
- iv. To the academic, this study is significant in that it was conducted in an emerging country where more research is needed. Also, the complementary joining of the ANT and DOI theories, which have not previously been jointly applied prior to this study, makes another significant contribution.

1.13 Conclusion

This chapter has introduced the research study as discussed in the thesis by highlighting some challenges faced in healthcare due to the semantics of language

translation. In this chapter, the background of the research problem, the research questions and objectives, a high-level overview of literature and related underpinning theories, research methodology, data analysis and data collection methods, as well as ethical considerations, limitations and significance of the study were all introduced.

In the next chapter, the literature reviewed, as well as the theories applied as the lens for data analysis, will be discussed in detail to give a background to the research problem.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter presents the literature review, divided into two parts. The first part focuses on the key components (or keywords) related to the study. These include ICT, mobile system, healthcare, and language semantics. The literature primarily consisted of peer reviewed articles. Acknowledgements were given to all the literature that was referenced. Through the review, gaps in the area of study were highlighted, prompting the researcher to pursue the objectives of the research. The second division of the chapter expounded the theories that underpin the study. An extensive and comprehensive review surrounding these theories was conducted, including an explanation of how these theories relate to and underpin the study. Examples of where and how the theories have been applied previously with other studies were also acknowledged. Reasons for choosing the theories were addressed.

2.2 Information and communication technology

The need and use of Information and Communication Technology (ICT) has augmented quickly in current years as most people have seen the reduced cost of mobile device when owning a mobile device (Brown, 2018). *ICT* is defined as “tools that facilitate communication, information processing, storage and by electronic means” (Saleem *et al.*, 2013: 49). Most areas of business including organisation relies on ICT services. However, laquinta (2015) asserts that the terms of use of ICT comprises of personal computers software and hardware, mobile systems and other artefacts such as video conferencing and distance learning.

In the provision of healthcare, ICT is perceived as vital tool that effectly used as a means of communication, which improves interactions and services (Barr *et al.*, (2017). Furthermore, ICT embraces a variety of of electronic digital and analogue devices such as radios, televisions, telephones (fixed and mobile), computers, electronic-based media such as digital text and audio-video recording, and the Internet (Green & Huang, 2017).

Among other things, ICT has significantly enhanced communications while reducing travelling regarding business meetings. ICT is the key to enhancing and improving communication among healthcare providers and patients with chronic conditions

(Barr *et al.*, 2017). Some examples of ICT artefacts embrace video conferencing and distance learning. ICT has widely moved into our everyday life in an exceptional way (Abdel-Aziz, Abdel-Salam & El-Sayad, 2016). Through ICT the world is able to communicate and share information through the utilisation of cutting-edge technology irrespective of distance between people. Bayo-Moriones, Billon and Lera-Lopez (2013) argued that through improved communication, operational performance is enhanced.

ICT avails various platforms, tools and artefacts to enable and support many processes and activities such as communication and information sharing. The use of ICT relies on the know-how and interest of the individuals. Ballon and Van Heesvelde (2010) argue that many ICT platforms fulfil several or all of these functions, instead of being limited to one of them. According to Rouleau, Gagnon and Côté (2015), ICT is perceived as a set of services that enables and supports activities such as knowledge transfer, remote care (mobile health) and interdisciplinary clinical support in the healthcare sector. According to Yagos, Olok and Ovuga (2017), services such as e-Referral, teleconsultation, electronic medical records and utilisation of mobile phones indicated substantial benefits to health workers in rural and remote area.

At times it is not easy or deemed impossible to fulfil the interest of individuals and groups. For example, not *all* African languages could be translated using the mobile systems, rendering *some* healthcare services still difficult to carry out in *some* areas of need. Moreover, not all non-English speaking people speak the same language. As such barriers that causes real-time communications barriers are created (Daigle *et al.*, 2011).

There is a change of face in the world that will live in through the application of ICT (Noor-UI-Amin, 2013). According to Idowu (2003), families, friends and colleagues are enabled by ICT to communicate and gain access around global libraries, information resources, and numerous other opportunities all over the world. Therefore, the use of ICT patient-centred healthcare can certainly be promoted to improve the quality of care and enhance the education of both health professionals and patients (Rouleau, Gagnon & Côté, 2015).

According to Nemutanzhela and Sekgweleo (2018), the application of information and communications technology in healthcare has grown exponentially over the last 15 years; its potential to improve effectiveness and efficiency has been recognized by governments worldwide.

However, international discussion surrounds the consideration of ICT's potential to make major impacts in improving the health and well-being of poor and marginalized populations, combating poverty, and encouraging a sustainable development and governance (Clarke, Wylie & Zomer, 2013). According to the World Health Organization (WHO, 2010), ICTs in health are used for many desired outcomes and across the entire health systems, not necessarily for technology only (Khatun, Sima & Rokshana, 2015). For example, ICT can be applied to those with chronic conditions to hasten the process of dispensing medication and sending reminders to patients. Health sectors are, then, able to integrate ICTs to improve quality of life for individuals with chronic conditions. However, the services are rarely fulfilled as they are frequently developed without valuable input from patients (Vermeulen *et al.*, 2014).

According to Ball *et al.* (2015), healthcare delivery systems have faced problems such as the incorrect recording of diagnoses, unavailability of patient information, delays in accessing critical information, space limitations for record-keeping and insufficient personnel for patient monitoring before the application of ICT. Based on these needs, ICTs have revolutionised rapidly, as have businesses surrounding their implementation (Mihalič, Praničević & Arnerić, 2015). Therefore, the need to develop and organise new ways for providing efficient healthcare services has thus been accompanied by major technological advances that have resulted in a dramatic increase in ICT applications in healthcare and mobile health.

One relevant study showed that ICTs can be used to accelerate access and provide a wider range of health services to enhance the well-being of underprivileged people, as those in the Eastern Cape Province of South Africa. Thus, ICTs are widely perceived to have the capability, if used effectively, to bridge social and economic gaps that divide rural and urban communities (Ruxwana, Herselman, & Conradie, 2010).

In this study, the definition of ICTs adopted is, according to DiCarlo *et al.* (2015), that ICTs for healthcare are tools used to facilitate communication, processing and transmission of information electronically to improve health. These communications can be done via phones as a short text messages, media such as television, newspaper or magazines, and also on mobile systems and via the Internet.

There is no doubt that ICT is transforming the way things are carried out, particularly in regard to functions in healthcare (Bhati, 2015). Organisations can enhance healthcare service tools electronically such that barriers like time, distance and space

no longer matter with ICT (Zakaria, Affendi & Zakaria, 2010). For example, healthcare organisations can offer more efficiency and more variety of services for health consumers such as access to their own health records, accessibility of further medical information, knowledge about one's illness over the Internet, free and speedy communication between patients and doctors, and online psychological support for communities of patients who suffer from the same illness. However, Zakaria, Yusof and Zakaria (2010) caution that with the amplified role played by ICT, there are some technological challenges that arise such as ease of use, usability, information security and compatibility of the system with the existing one.

In developing countries, the role of ICT has been examined as people are absorbing the new information, ideas and approaches, making sense of information using their own social and local contexts. This aids in dealing with their own situations better (Chetley *et al.*, 2006). It is also concluded that there are opportunities available in the healthcare sector of developing countries through the use of ICT. However, there are a number of issues requiring careful and deliberate consideration in each intervention and setting.

One of the most well-known studies is the Peña-López (2010) report, entitled "Improving Health Sector Efficiency: The Role of Information and Communication Technologies". This report demonstrates that there are a number of actions that governments can take for effective implementation of ICTs. It has been illustrated that ICT can make significant improvements in healthcare delivery, reducing medical errors, improving clinical care through adherence to evidence-based guidelines, and preventing duplication and inefficiency in the delivery of clinical care (Peña-López, 2010).

Mobile health – the use of mobile computing and communication technologies in healthcare and public health – is a rapidly expanding area within e-health. Mobile health has been considered in the healthcare sector, with huge potential noted for mobile-health interventions in poor settings to have beneficial effects on health and health service delivery processes (Free *et al.*, 2013). Interventions already in place will establish a platform upon which other challenges in healthcare might be addressed. Hence, for the purpose of this study, mobile systems will be used for semantics of language translation.

2.2.1 Mobile systems

A mobile operating system (Mobile OS) “is a software platform on top of which other programs called application programs, can run on mobile devices such as personal digital assistant (PDA), tablets, cellular phones, smartphones and so on” (Okediran *et al.*, 2014). Mobile devices, including cellular phones and computers (iPADs, tablets and notebooks) are significant ICTs tool for many activities and processes, including service delivery in both urban and rural areas (Hlagala, 2015; Wang, 2013). There is an increase use of mobile technology systems in developing countries for the delivery of healthcare services. Through these increase in mobile systems usage by healthcare practitioners clinical practice aspects have been transformed. Mobile systems have become commonplace in healthcare settings, leading to the accelerated development of medical software applications (‘apps’) for these platforms (Wallace, Clark & White, 2012; Aungst, 2013).

In both developed and developing countries the most adopted means of communication is the mobile communication devices (Kogeda & Mpekoa, 2013). Mobile devices penetration is far more invasive as compared to all other electronic devices put together. Every mobile communication device needs some type of mobile operating system to run its services: voice calls, short message service, camera functionality, and so on. Therefore, for the purpose of this study, the term *mobile systems* will refer to all these mobile systems.

In recent years, healthcare service providers have increasingly employed mobile devices in delivering services (Free *et al.*, 2013). According to Nemitanzhela and Iyamu (2016), the nature of the diverse tribes and languages within some developing countries make it difficult to deliver or receive the provisional services of healthcare organisations. This is so because the English language is most often used the default language of health communication, although many healthcare recipients are not conversant with nor about to understand English.

Due to the sensitivity, confidentiality, and private nature of healthcare information and services (McCullough & Schell-Chaple, 2013), a one-on-one in the preferred language of the patient is critical. Otherwise, the services and objectives of the healthcare organisations will continue to be impugned. Essential healthcare services will be prohibited. To avoid this, we need to address the semantics of language through translation. To this end, we propose a solution which employs the use of mobile systems for healthcare services. In order to achieve these objectives, the following keywords are reviewed to support this research problem, even though many

mobile health technologies could broaden access to care, either by extending the reach of providers through remote monitoring of patients or by giving advice when users otherwise would not visit a medical professional (Nathan *et al.*, 2014).

Mobile systems are defined by Viega and Michael (2010) to be the sorts of things you might expect: iPhones, BlackBerry devices, Android phones, Windows Mobile systems, etc. According to Partovi and Sears (2014), this includes pocket-sized devices that can access the Internet via Wi-Fi and cellular/3G. They stretch the definition even wider to include traditional laptops and tablet computers such as the iPad and maybe even conventional cell phones and thumb drives. According to Hlagala (2015), communication is enabled between people by mobile systems; these devices give them the capability to communicate and exchanging data with other.

According to Bhatt and Gupta (2013), “The mobile systems stores applications that generate data when executed, including at least one application that generates data for communication over the WWAN”. Seebode (2015) asserts that nowadays it is not uncommon for people carry small but powerful computers in their pockets: modern smartphones. These mobile systems are not only tools to call a person but can be used for a variety of applications beyond telephony and messaging.

Mobile systems have one unique and advantageous feature, smartphones in particular: the usage of a popular and widespread native applications or “apps”. instead of depending on Internet connectivity to deliver content that resides on a remote server (i.e., the method utilized by “web apps”), their operating system’s native apps developed for the mobile store data locally or exchange it via the Internet and reside on the user’s mobile systems (Fanning, Mullen & McAuley, 2012).

Users of mobile systems often focus on more than one task simultaneously: “A mobile application may not be the focal point of the user’s current activities” (Holland & Morse, 2001: 3755). Mobile systems that demand too much attention may distract users from more important tasks. The designs for mobile system interface requires a little attention; therefore, they need to be carefully designed (Poupyrev, Maruyama & Rekimoto, 2010) which can sometimes be accomplished by designing for hands-free interaction or even eyes-free interaction.

Use of mobile systems has offered physicians contemporary ways to conduct professional communication, easier access to decision support and expedited, efficient specialist consultation. However, risks associated with the use of smart

phones to produce and store medical images include privacy breaches, insecure data storage and physician or institution liability for failure to obtain patient consent (Bromwich & Bromwich, 2016). According to Ventola (2014), in healthcare settings mobile systems have become commonplace, which increases the growth in the development of medical software applications (apps) for these platforms. While some devices have limitations, they offer productivity tools in a compact form and at relatively low cost and are quickly becoming ubiquitous in today's business environment. However, in order to send and receive electronic mail and browse the Internet, most of the handheld devices simply require configuring for these tasks. Communication is key in chronic disease management, and the manner in which patients and providers can exchange information has been altered via the Internet (Tarver *et al.*, 2018). Adoption of secure messaging differs among patients due to the digital divide that keeps some populations from having effective access to online resources.

The need for a pager, cell phone and PDA functionality by healthcare professionals is now accomplished through the use of smartphones or tablet computers (Mosa, Yoo & Sheets, 2012). Due to the popularity of mobile technologies that led to high and increasing ownership of mobile technologies, interventions can now be delivered to a large number of people. In 2009, more than two-thirds of the world's population owned a mobile phone and 4.2 trillion text messages were sent (Sanou, 2013). According to Mosa, Yoo and Sheets (2012), smartphones and tablets have both computing and communication features in a single hand-held device stored in a pocket, with an easy access and use at the point of care. In addition to voice and text, new mobile device models offer more advanced features such as web searching, global positioning systems, high quality cameras and sound recorders (Boulos *et al.*, 2011).

Nowadays, the number of mobile phone subscriptions in many high-income countries is more than the population (Ofcom, 2009). In low-income countries, mobile communication technology is the fastest growing sector of the communications industry and geographical coverage is high (Donner, 2008). Another potential benefit of mobile phones in Africa is for the delivery of medical and health information, particularly to rural areas (Wobbrock, 2006). Volunteer physicians could use phones to store and retrieve medical histories without needing to have bulky, power-hungry laptops on hand. People in rural areas whose phones have connectivity are enabling better informed diagnosis and treatment because they can more readily access information about symptoms and treatments,

In 21st century African computing platforms, there are certain ways that mobile phones should be used. Microsoft has highlighted this opportunity with a \$1.2 million funding offer for related projects (Wobbrock, 2006). However, research is needed pertaining to the usability, the interfaces and interaction of the system. The social, economic, educational, and medical issues will have to be understood before software can be written or user interface designed. This is a large task that could have colossal benefits to Africans and the computing disciplines.

The discipline of mobile health has been gaining ground as mobile system penetration rates grow rapidly, increasingly prompted by plunging hardware and usage costs, as developing world consumers adopt this accessible communication technology (Chib, 2010). The use of technology in healthcare is nothing new for healthcare professionals; they have long applied a range of technologies to assist themselves and patients (Nagel, Pomerleau & Penner, 2013). However, today's medical technologies increasingly involve digital components, pose new opportunities for Internet-based remote monitoring and exploit mobile technology and smartphones (Nakrem *et al.*, 2018). In South Africa, the use of short message service (SMS) has been recorded as a means for HIV/AIDS prevention and control, and for treatment of tuberculosis (Atun, 2005); consultation services and dissemination of critical health information in rural communities in India (Källander *et al.*, 2013); and the use of Personal Digital Assistants (PDAs) to collect data.

Some of the benefits of using mobile technologies include access to accurate medical information in a timely manner (Bouri & Ravi, 2014); pre-treatment of primary healthcare problems; improving internal communication within the complex healthcare system (Chib, 2010); and with the external patient community, ability to integrating data in the form of electronic medical records into a central database for efficient tracking and enhancing of the administrative effectiveness of healthcare providers (Mavhemwa, 2013).

Important benefits can be delivered in healthcare settings through the use of mobile phones because of their ability to provide and improve access to communication and information resources. This can happen within the healthcare system and remote community healthcare workers by allowing them to communicate with physicians (Maru *et al.*, 2009) with external medical resources, and with beneficiaries such as patients and their communities (Chandrasekar & Ghosh, 2001).

The ICT4H model based on the value-of-ICTs-to-education model (United Nations Development Programme, 2005) argued that to improve productivity of health professionals; ICT tools such as mobile phones can act as a producer of opportunity, enhancing capabilities, capacity and potential increase; strengthening communication links within the medical hierarchy to enable social ties, and with the patient community, and generate knowledge that would allow critical information to be shared and used effectively (Taran, 2011).

Nowadays people carry their mobile phone with them wherever they go due to its mobility and popularity, granting real-time interaction of the delivery intervention and allows the intervention to claim people's attention when it is most relevant (Free *et al.*, 2013). For example, reminders for appointments are sent to patients the day before and/or morning of their appointment.

2.3 Healthcare

The World Health Organization defines *health* as a “state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (WHO, 2017). According to Ge *et al.*, (2014: 342), *healthcare* is the “diagnosis, treatment, and prevention of disease, illness, injury, and other physical and mental impairments in humans”. However, healthcare services such as: medicine, chiropractic, dentistry, nursing, pharmacy and allied health among others are delivered by different practitioners. It refers to the work done in providing primary care, secondary care and tertiary care, as well as in public health (WHO, 2012; Gupta & Rokade, 2016).

In industrialized and developing countries the growth in adoption of mobile phones and the Internet has increased opportunities in “crowdsourcing,” which engaging large groups of people to perform a task (Freifeld *et al.*, 2010). Mobile phones hold particular promise for this type of opportunity because they can be used as point-of-care devices, function in remote locations and are readily carried and used at any time (Waegemann, 2010).

Integrated approaches to health and social care delivery must be developed in order to provide holistic care. Policymakers have realised that e-Health initiatives can help promote information sharing. Delivering health and social care to exchange patient data without being constrained by time and distance has been made easy through the use of ICT (King *et al.*, 2012).

For a healthcare system to be a well-functioning system, several things are required: a robust financing mechanism; a well-trained and adequately-paid workforce; reliable information on which decisions and policies made can be based; and well-maintained facilities and logistics to deliver quality medicines and technologies (WHO, 2012). In the past, the term *medical technology* was often used to describe the set of techniques, drugs, equipment, and procedures used by healthcare professionals to deliver medical care to individuals. Therefore, the past ICT deployments are considered under this heading (Catwell & Sheikh, 2009).

Another benefit of ICT in healthcare delivery is that advanced information technologies furnish healthcare providers with the opportunity to improve patient care by streamlining clinical processes and creating a seamless flow of information in addition to containing costs (Nemutanzhela, 2014).

Many healthcare service providers are currently using paper-based records to track a patient's receipt of healthcare services. Unfortunately, the use of such records resulted to inadequate documentation of the care-giving process, which leads to the flow of patient- related information disruption, and in the healthcare services delivery delays. According to Patel *et al.* (2000), there are advanced information technologies such as computer-based patient records, portable computers, and expert information systems that provide real-time access to clinicians with patient information at the point of care.

Clinical decision support is another important area of application of ICT, one that is heavily dependent on ready access to medical knowledge databases, as well as sophisticated search engines, which automatically adapt and learn from the user's search history (Ayers & Wensley, 1999). This is an excellent example of a Clinical Information Access Program that provides information resources to support evidence-based practice at the point of care. Another example is the Quick Clinical project which is developing an experimental online information retrieval system for use in the clinical setting (Walther, Nguyen & Garsden *et al.*, 2002).

ICT is used to describe "a range of technologies for gathering, storing, retrieving, processing, analysing, and transmitting information" (Tomei, 2008: 48). Information is acknowledged as a key element to achieving these objectives, as is a workforce trained in the appropriate health information skills (Omotosho, Emuoyibofarhe, & Adegboola, 2011). It is an unfortunate reality that healthcare is not as safe as it should be. Adverse events and preventable errors that cause patient harm and death are

commonplace in healthcare. ICT has helped in bridging distances and providing access to clinical knowledge, specialised expertise and health services, thus saving lives and costs. ICT provides access to clinical information, telemedicine, online discussion groups and other tools.

In today's daily activities, ICT has significantly changed the way information is collected, stored, shared and used (Kabashiki, 2015). With modern ICT systems, health information, knowledge and expertise can be captured once and re-used several times when needed. By placing health information on integrated information systems, healthcare stakeholders can be provided with access to health information anytime and anywhere through pervasive computing technologies. ICT has the potential to make patient information available to multiple healthcare providers in real-time, throughout and outside the hospital, through the use of wireless tablet personal computers or handheld devices (Samples, Ni & Shaw, 2014).

With the increase of health consumerism, patients want to be active participant in their own care, and they like to influence decisions relating to their own care (Effken & Abbott, 2009). As they have the potential to improve communication between individuals and their healthcare providers, ICT systems, like personal health records (PHR), increase a patient's participation in healthcare. Fix *et al.* (2016) believe in the potential of health ICT systems to engage patients in their healthcare and concomitantly increase their satisfaction. The implementation of personal health portals allows patients to use PHR systems irrespective of time and location.

In many countries, healthcare providers and facilities are not yet relying electronic information systems. In such a context, connectivity among systems is not an initial concern and is often not a high priority for policymakers, leading to some fatalities in certain areas, like the tragedy, for example, at Life Isidimeni in which patients lost their lives because proper steps were not followed (Dhai, 2018). However, as the ICT usage cultivates and the cost to a nation for supporting universal health coverage grows, system-to-system interoperability increasingly becomes a concern for *all* the providers, patients, payors and policymakers who need data from information systems to monitor and manage health services.

2.3.1 Healthcare information systems

Health system strengthening is a global priority (WHO, 2010); one of the core components is the need to improve health information systems (HIS) (WHO, 2010;

Hotchkiss, Diana & Foreit, 2012). These are described by the World Health Organization as an integrated effort to collect, process, report, and use health information and knowledge to influence policy making, programme action, and research (WHO, 2003).

Finnell and Dixon (2015) describe four key functions – data generation; compilation; analysis and synthesis; and communication and use – that are underpinning the decision-making health information system. The health information system collects data from the health sector and other relevant sectors, analyses the data and ensures their overall quality, relevance and timeliness, and converts data into information for health-related decision-making (WHO, 2008). However, the Health Information Systems (HIS) serve multiple users and a wide array of purposes that can be summarised as the generation of information. Therefore, HIS should produce reliable and timely information on health determinants, health status and health system performance (Mutale *et al.*, 2013). To identify problems and needs, the health system at all levels must enable the decision-makers to make evidence-based decisions on health policy and allocate scarce resources optimally (Aghajari, Hassankhani & Shaykhalipour, 2013). HIS are called upon to enable tracking along the continuum of inputs to the health system, processes and outputs, as well as outcomes and impact.

Health information is described differently in different settings around the world. The current general consensus is that health information is information about “all resources, organisations and actors that are involved in the regulation, financing, and provision of actions whose primary intent is to protect, promote or improve health” (Hymel *et al.*, 2011). Health information is therefore perceived as being essential for planning and decision making at all levels of the healthcare spectrum. The healthcare spectrum relating to the context of this chapter includes diverse groups such as consumers, beneficiaries of medical schemes, data transmission companies, administrators, managed care organisations, authorities and government.

In order to exchange information between computer applications from healthcare providers to data transmission companies, from data transmission companies to medical schemes and from medical schemes to regulatory authorities, the applications need to speak a common ‘language’ (Matshidze & Hanmer, 2007). This implies that applications must understand the message, the data elements or fields, the schema and the choreography of the data in the exchange process. The issue of language spoken, and its semantics, is an immense challenge in the healthcare sector.

There are numerous message formats in use in the South African private healthcare environment. The public sector faces similar challenges, as the information systems of districts, provinces and the National Department of Health (DOH) are different.

There is limited integration of data and data flow between health information systems in the private and public sectors. A 2002 survey of key informants from the public and private healthcare sectors raised the concern relating to the development of silos of information in different sectors of the South African healthcare system, including the public and private sectors, other sectors such as non-governmental organisations (NGOs), traditional medicine and health research sectors (Rispel, 2015).

Good healthcare depends profusely upon having high-quality information about a patient (Gutacker *et al.*, 2016). The problem is that data lives across multiple providers and institutions, and that the industry has yet to fully conquer the challenge of exchanging and integrating this information, thanks to the use of multiple vocabularies, formats, and systems by all the players in the chain. It does not matter whether public or private hospital; as long as there is a provider and a recipient, translation issues of language semantics will exist.

2.4 Language semantics

Semantics of language influence the meaning people give or associate to contents within various contexts. This can be attributed to reasons such as the fact that the South African languages do not really have electronic dictionaries to perform diacritic restoration of meaning (De Pauw, Wagacha & De Schryver, 2007). This can be a risk in terms of how healthcare services are provided and received. Semantics of language refers to the study of the meanings of words and sentences. *Semantics*, the study of meaning in language, can be applied to entire texts or to single words.

The limits of language are the limits of a person's world and the fact of the matter is that the 'real world' is to a large extent unconsciously built upon the language habits of the different communities of humans, speaking different languages. Different groups think differently to the extent that their languages differ from one another (Gleitman & Papafragou, 2012).

One of the challenges to be confronted by the healthcare industry is semantic interoperability. *Semantic interoperability* is the ability of a healthcare system to share

information and have that information properly interpreted by the receiving system in the same sense as intended by the transmitting system. Semantic Web provides enabling technologies to achieve semantic interoperability (Iftikhar *et al.*, 2010). Web Services, as a catalyst in this process, provide seamless communication of information between healthcare systems, thus providing more open accessibility to patient information and improved healthcare.

The term *interoperability* has many meanings, including the notions of communication, exchange, cooperation, and sharing of resources between systems. In fact, the essence of interoperability is that of a relationship between systems, where each relationship is a manner of communication, exchange, cooperation and sharing (Carney *et al.* 2005).

The advancement in information technology, as it is playing an increasingly dominant role in healthcare, has managed to improve the efficiency of health services to common people. According to Iftikhar *et al.* (2012), health informatics plays a vital role in the integration of information technology in the healthcare domain. However, healthcare organisations are facing problems related to communication of right information to appropriate recipients. Due to data deluge, information retrieval and analysis has emerged as a substantial problem in various fields, including healthcare. Semantic web technologies provide extensible, flexible and efficient information. "Language is a mirror of mind in a deep and significant sense. It is a product of human intelligence" (Chomsky, 1975: 4; Idalovichi, 2014).

A key requirement for realising context-aware systems is to give computer systems the ability to understand their situational conditions. Achieving this requires contextual information to be represented in ways that are adequate for machine processing and reasoning.

The Semantic Web languages can be used as meta-languages to define other special purpose languages such as communication languages for knowledge sharing, policy languages for privacy and security (Chen, Finin & Joshi, 2005). A key advantage of this approach is better interoperability. Semantic interoperability is the ability for information shared by systems to be understood at the level of formally defined domain concepts so that the information is computer processable by the receiving system.

However, semantic interoperability is not an 'all-or-nothing' concept. "The degree of semantic interoperability depends on the level of agreement between sender and receiver regarding the terminology, and the content of archetypes and templates to be used" (Voros & Antonopoulos, 2015: 206). Semantic interoperability is essential for automatic computer processing to underpin real value-added electronic health records clinical applications such as intelligent decision support and care planning. Indeed, healthcare delivery deals predominantly with information and knowledge management (Rocha, 2012). What is at stake here is not only exchanging data and information but reusing and processing this data, with semantic interoperability as the objective.

The advancement in Information and Communication Technology (ICT) is playing an increasing role in healthcare and has managed to improve the efficiency of health services to common people. Health informatics plays a vital role in the integration of ICT in healthcare domain. The critical need is to encourage healthcare systems to be more efficient and provide more workable solutions that have benefited from ICT (HIMSS, 2011).

Information retrieval and analysis has arisen as tenacious challenges for healthcare domain. These challenges can be handled effectively with the assistance of semantics and cloud computing (Yang *et al.*, 2017). Managing healthcare data with semantics results in cost-effective, easily accessible, accurate and manageable data processing solutions. At present, electronic medical record (EMR) systems are designed for hospital operations within the premises, but now have to be modified to support patient primary care settings, mostly outside the walls of a hospital. The traditional primary care teams also have to redesign the workflow as they add new care coordination staff and EMR technology to achieve the desired goal of improving the clinical outcome at reduced costs (Menachemi & Collum, 2011).

Interoperability is the ability of a healthcare system to share information and have that information properly interpreted by the receiving system in the same sense as intended by the transmitting system. Standardisation provides us an effective way of communication to achieve the goal of semantic interoperability. Health Level 7 (HL7) is one of the healthcare standards that allow communication of healthcare systems and sharing of data around the globe. The important requirement is to capture relevant information and then make it widely available for others. Therefore, the need is to have a system that can provide best services in terms of meaningful data sharing and discovery. HL7, as it evolves, helps us with a technical business model to fulfil the

vision of standard-based information exchange in diverse, integrated health information systems (HL7, 2011).

Language barriers

Language barriers have been shown to affect the quality of healthcare received by limited English proficiency patients. In late 1999, the Institute of Medicine highlighted the effects of language barriers in its report on medical errors and patient safety (Kohn *et al.* 1999). Error rates were higher when physician and patient spoke different languages (Gandhi *et al.* 1998). Woloshin *et al.* (1995) describes the association between language barriers and inaccurate medical history taking and misdiagnoses of medical conditions.

Language barriers may also reduce patients' abilities to follow provider instructions and adhere to treatments (Collins *et al.* 2002; David & Rhee 1998; Manson, 1988) or to comply with instructions for follow-up care (Enguidanos & Rosen, 1997; Manson, 1988). Poorer medical outcomes among patients with hypertension and diabetes were also associated with language barriers (Perez-Stable *et al.*, 1997; Tocher & Larson, 1998). However, the relationship between language barriers and adherence is not consistent (Kaplan *et al.*, 1989).

Language barriers may also lead doctors to over-treat limited English proficiency patients, sending patients for additional tests and procedures that increase costs of care and likely carry additional risks to the patient (David & Rhee, 1998; Lee & Rosenberg, 1998). This could be one of the motivating factors why Campbell and Young (2016) explain how various studies have reported the difficulties in finding Xhosa equivalents for psychological terms that are commonly used in English language.

Quality of care can be measured by patient satisfaction. Research comparing English and non-English speaking patients revealed that language barriers were associated with lower patient satisfaction among non-English speaking patients (David & Rhee, 1998; Morales *et al.*, 1999). Findings from a mail survey by Morales *et al.* (1999) reported significantly greater dissatisfaction with provider communication among Spanish-speaking respondents. Another survey of patients who sought care in an emergency department found that while over 70% of English-speaking patients were satisfied, only 52% of non-English speaking patients were satisfied (Carrasquillo *et al.*, 1999). Non-English speakers were also less willing to return to the same emergency department for care and also reported more problems with communication. Other

research shows that patient satisfaction increased when interpreter services were available as this reduced language barriers (Baker *et al.*, 1998). Therefore, it is necessary to design and implement a semantic-based healthcare service on cloud for storage, retrieval and manipulation of patient data and medical records.

Language skills are not only listening, speaking, reading, and writing, but also include translation. Translation is very important when it is related to science and technology books because most of them are written in foreign language, especially in English, so the translator needs to be highly knowledgeable to be capable of translating with precision. Campbell and Young (2016) conducted a study which was aimed to translate the Clinical Outcomes in Routine Evaluation – Outcome Measure (CORE-OM), a measure of general distress and dysfunction developed in the UK, into Xhosa for use in South African.

2.4.1 Translation

One of the most prominent definitions of *translation* is stated by Newmark (1988:5) who defines translation as “rendering the meaning of a text into another language in the way that the author intended the text”. According to Anari and Sanjarani (2016:145) “translation, involving the transposition of thoughts expressed in one language by one social group into the appropriate expression of another group, entails a process of cultural de-coding, re-coding and en-coding”. Hatim and Munday (2004:6) define *translation* as “the process of transferring a written text from source language to target language”.

Translation is critical for interaction between healthcare practitioners and their recipients. According to Gany *et al.* (2007), translation of a medical visit by unqualified interpreters is prone to omissions, additions, substitutions, volunteered opinions, and semantic errors that can seriously distort care, with potential drastic results. Even though machine learning approach has been used for South African languages, a lot of phonological, morphological and lexical information is lost in the process, which could have been useful in the context of language technology (De Pauw *et al.*, 2007). The machine learning also finds it difficult to eradicate the several challenges as a result of the differences between the languages, which require different methods and approaches (Eiselen & Puttkammer, 2014).

Translation plays an important role in rendering a text from one language into an equivalent version in another language; thus through translation, highly advanced

international societies can be joined despite the differences or similarities of their people's culture and the degree of the level of their civilization and superiority (Qassim, 2014).

In theory, *communicative translation* addresses itself solely to the second reader who does not anticipate difficulties or obscurities and would expect a generous transfer of foreign elements into his own culture as well as his language; where necessary, (Newmark, 1988) communicative translation is likely to be smoother, simpler, clearer, more direct and more conventional, conforming to a particular register of language and tending to under-translate. Basically, communicative translation emphasises the swift passage of messages (Munday, 2016). *Semantic translation* remains within the original culture and assists the reader in its communications only if they constitute the essential method where there is a conflict. Semantic translation tends to be a more complex, more awkward, more detailed, and more concentrated thought-process as compared to the intention of the transmitter (Newmark, 1988).

The trend in the immigration of diversified migrant groups means that societies have to come to terms with a considerable cultural diversity, in terms of linguistic, cultural and socioeconomic specificities that are different from the homogeneous population (Paula & Mendes, 2013). Other studies on ethnic minorities and health professionals also reveal structural and psychological factors as barriers to providing care (Parmet *et al.*, 2017). Cultural diversity poses many challenges to healthcare systems whereby health professionals have to care for patients with different cultural backgrounds.

Semantic translation is objective and neutral, a natural translation, not adding, reducing or repairing. It only changes the meaning and text force of the source language to the target language (Nord, 2014).

2.5 Underpinning theories

This study is underpinned by Actor Network Theory (ANT) and Diffusion of Innovations (DOI). ANT theory originates from sociology field and focuses in bringing people and objects (i.e. technology) together through processes of translation to form heterogeneous networks with similar interests (Cho, Mathiassen & Nilsson, 2008). People and objects are referred to as *actors*. In ANT, people are not the only entities to act nor beings with agency all are actors (including objects) and they play equal roles within the network (Luoma-Aho & Paloviita, 2010). Each actor has something to contribute for the network to be functional.

Actor Network Theory (ANT) puts more emphasis on human and non-human actors and their heterogeneity (Callon & Bruno, 1981). According to Iyamu and Sekgweleo (2013), human and non-human actors work in partnership as a collective to provide the information systems that are requested by an organisation. In the context of this study, the moments of translations were employed, from the ANT perspective, to examine how the networks of both recipients and recipient of healthcare are created and maintained. The networks, in turns, enable and simultaneously constrain the manner of technology use to diffuse delivering of healthcare services over time and geographical space. The Diffusion of Innovation theory has been extensively adopted in various disciplines including education, sociology, communication, agriculture, marketing and information technology (Rogers, 1995; Karahanna, Straub & Chervany, 1999; Agarwal, Sambamurthy & Stair, 2000).

The intention of this study was to implement guide to a framework for translation of semantic languages on mobile systems used by healthcare systems for an organisation's employees and patients to better understand. The Actor Network Theory (ANT) complemented by the Diffusion of Innovation theory (DOI) have been applied for analysis of the study results.

2.5.1 Actor Network Theory

Actor Network Theory, abbreviated as ANT, is a distinctive approach to social theory and research which originated in the field of science and technology studies (Kumar, 2013). Although it is best known for its controversial insistence on the agency of non-humans, ANT is also associated with forceful critiques of conventional and critical sociology.

Actor network cannot exist without the actor or network. Teles and Joia (2011) posit that Actor Network Theory is a combination of agency and structure or context in which neither of them (Actor or Network) exists independently of the other. The two complement each other in such a way that if one is absent the actor/network becomes dysfunctional. It is vital to understand the entire concept of actor network. Williams-Jones and Graham (2003) state that for us to distinguish the origins of power and structure in a network, we need to consider all components that collaborate, co-operate, compete and lead to creation, persistence or perishing of that network. The actor/network proposes that knowledge is created; nevertheless the creation is the result of a heterogeneous, diverse network of people, devices and texts which make a form of steadiness (Steen, 2010).

Moments of translation

In ANT, the translation is triggered by the four moments of translation. The term *translation* is associated with the network in terms of representation of actors or networks. Translation is described as a way of collaborating different entities and convincing them to have interest in connecting and relating to produce results (Van Der Duim, 2007). The translation occurs between humans and objects once the actor/network has been formed (Comber, Fisher & Wadsworth, 2003).

Within the moments of translation, the focal establishes itself indispensable and sets the obligatory point of passage (OPP) which is the channel through which the actors should pass (Lee & Oh, 2006). Iyamu and Sekgweleo (2013) further describe OPP as the entity that represents other actors in accordance to their significance and actions in the translation world. OPP is a state of little or no negotiation (Tatnal, 2014).

Translating involves showing how actors' nonaligned interests may become aligned. Skills, practices, organisational arrangements and contracts may all be part of the process, and alignment is established in inscriptions that give particular viewpoints precedence.

Figure 2.1 depicts the key translation concepts and their associated notions. It is not intended as a flow diagram, but as a visual representation of ANT, with each concept described as follows:

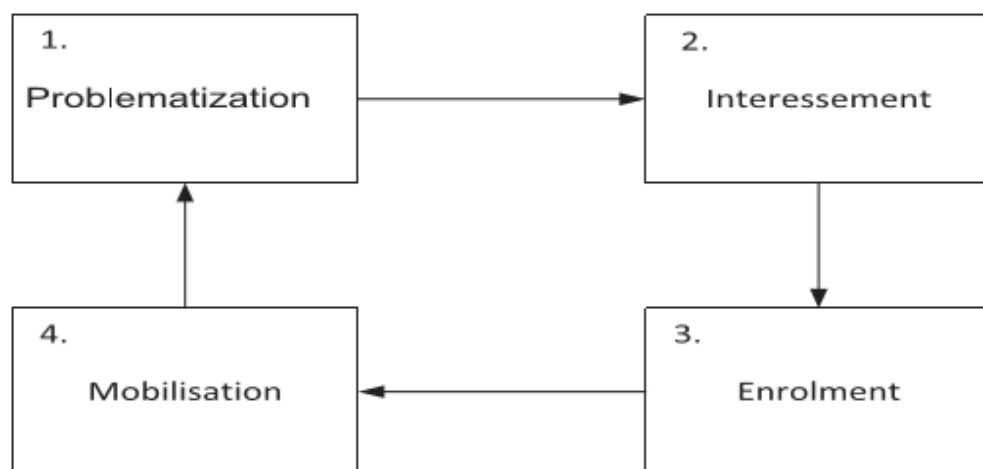


Figure 2. 1: Moments of Translation (Callon, 1986)

For the purpose of this study, the concept of translation was applied by which innovators attempt to create a forum, a central network in which all the actors agree that the network is worth building and defending. Wernick *et al.* (2008) state that irrespective of whether the actor is human or non-human, they are both weighed equally as they offer the same contribution to the formed network. Translation is a promising concept to bring agency to the foreground in niche-based approaches (Smith, 2007). Translation is the process through which actors realise their actor-worlds (Callon, 1986a; 1986b). Translation can be seen as constituted by various moments. Callon's (1986) four moments of translation include the following, problematisation, interessement, enrolment and mobilisation:

1. *Problematisation*

This stage is concerned with an initiative that have been articulated, a problem that requires a solution. The various actors are identified during problematisation. The focal actor establishes itself as the initiator, driver and obligatory passage point (OPP) between the other actors within the network and it becomes indispensable.

Problematisation refers to the links between actors through the identifying of what they need to do or see happen (Callon, 1986). OPP is the process through which a focal actor convinces all other actors to accept the proposal of a network. OPP also refers to a process in which a focal actor demonstrates the interest in all the actors who accept the proposed network (Callon, 1986).

2. *Interessement*

The second stage of the moments of translation is interessement it relates to the sequence of processes where by the focal actor attempts to lock other actors into a position that they have been offered in the network. Actions to solve the problem are defined during problematisation process (Callon, 1986). If the interessement succeeded, then enrolment could take place.

3. *Enrolment*

Enrolment is the third moment of translation. This stage is concerned with the set of strategies which a focal actor attempts to define as various roles that allow other actors to enrol. The process of enrolment involves "group multilateral negotiations, trials of strength and tricks that accompany the interessement and enable them to succeed" (Callon, 1986:211). The inscription kicks in when the negotiation between

actors has been attained. The inscription is a process which warrants the protection of some interests (Sarker, Sarker & Sidorova, 2006).

The enrolment refers of roles defined by the focal actor through the process of bargaining and making concessions (Madon, Sahay & Sahay, 2004; Sarker, Sarker & Sidorova, 2006).

4. *Mobilisation of allies*

Mobilisation is the final moment of translation. It is whereby the focal actor ensures that all actors have representatives to avoid betrayal by various collectives from the latter (Callon, 1986; Madon, Sahay & Sahay, 2004). The representatives are actors who speak for other actors (Walsham, 1997). In the Scallop case, the researchers, as focal actors, were the legitimated speakers for the Scallops at St. Brieuc Bay (Gunawong & Gao, 2010).

Application of ANT in IS study

ANT is useful in appreciating the complexity of reality (including the complexity of organisations) and the active role of technology in this study. In many IS studies, ANT has been used to study network stability and hence technology adoption as the complexity and dynamic nature of the networks are recognised (Alexander & Silvis, 2014). According to Iyamu (2015), with regards to stability, “ANT attempts to answer how a diverse group of actors’ reach agreement at all times; that is, how a social order establishes a certain degree of stability or exhibits structural properties”. The process of *iterativeness* is of actors’ interactions and actions over time and space (Orlikowski *et al.*, 2016). ANT allows items that have gone the full circle of re-engineering through the moment of translation to be re-problematised. ANT provides “a fresh perspective on the importance of relationships between actors” (Tatnall, 2012:1) which is acquired through negotiation overtime. This perspective is vital when developing and implementing technology whithin the organisation. Both the development and implementation of technology require the process of negotiation, interest and norm (Akrich, 1992).

Actor Network Theory has been applied in many studies. Here’s a short, non-exhaustive list of a few studies where ANT has been applied: Iyamu and Mgudlwa (2017) applied ANT as a lens to transformation of healthcare big data. Kerry London and Zelinna Pablo (2017) applied ANT as an approach to developing an expanded conceptualization of collaboration in industrialized building housing construction. Montenegro and Bulgacov (2014) sought to expand understanding of the Governance

Network Theory by proposing the inclusion of human and non-human actors from the Actor Network Theory perspective. Elgali and Kalman (2010) applied ANT to understand the construction of the concept of failure in the national ICT integration programme. In healthcare, ANT has been applied for its role in understanding the implementation of information technology developments in healthcare (Cresswell, Worth & Sheikh, 2010).

Like in any other theories or studies or research conducted, ANT has limitations and critics. There are four broad strands of criticism against the ANT recognised by Walsham (1997), as follows: 1) its limited analysis of social structures; 2) its stance on moral and political issues; 3) its symmetric treatment of humans and non-humans; and 4) its tendency to describe as opposed to explain, together with the problem of managing masses of detail. Due to this criticism, the research investigated additional theories that could complement the ANT, to cover areas that the Actor Network Theory neglected to cover. Diffusion of Innovation (DOI) was deemed fit for this process as its strength will be elaborated below.

2.5.2 Diffusion of Innovation (DOI)

Diffusion of innovation has been extensively adopted in disciplines including education, sociology, communication, agriculture, marketing and information technology (Rogers, 1995; Karahanna, Straub & Chervany, 1999; Agarwal, Sambamurthy & Stair, 2000). An *innovation* is “an idea, practice, or object that is perceived as new by an individual or another unit of adoption” (Rogers, 1995:11). *Diffusion*, on the other hand, is “the process by which an innovation is communicated through certain channels over time among the members of a social system” (Rogers, 1995:5). Therefore, the DOI theory argues that “potential users make decisions to adopt or reject an innovation based on beliefs that they form about the innovation” (Agarwal, 2000:90).

DOI consists of five significant innovation characteristics: relative advantage, compatibility, complexity, and reliability and observability. With Diffusion of Innovations, we therefore define this theory as the process by which an idea, practice, or object that is perceived as new by an individual or other unit of adoption is communicated through certain channels over time among the members of a social system. This definition guides the use of DOI in the context of this study (Rogers, 2003).

Explanation of the Diffusion of Innovation theory

Diffusion of Innovation (DOI) theory, applied in many areas such as instructional technology, electronic publishing, and media literacy programmes, has assisted in developing models and theories to explain the process of adoption and diffusion.

“Diffusion includes the awareness and knowledge about the innovation, and focuses on examining attitude change, decision making, and implementation of the innovation” (Sutherland, 2003:6). “The real challenge is to identify and implement the correct change” (Oliver, 1996:7).

The concept considers three main components: the Innovation, the diffusion process and the adoption. *The innovation* is defined as “an idea, practice or object that is perceived as new, whether or not it is objectively new as measured by the lapse of time since its first use or discovery” (Rogers, 2003a:12). *Diffusion* is defined as “the process by which an Innovation is communicated through certain channels over time among the members of a social system” (2003a:5). And finally, *adoption* is seen as “the decision to make full use of an Innovation as the best course of action available” (2003a: 21).

Elements of the diffusion of innovations

There are four main elements of Diffusion of Innovation (DOI). Diffusion is a process by which (1) an Innovation; (2) is communicated through certain channels; (3) over time; and (4) among the members of social system (Rogers, 2003a). The four main elements – the innovation; communication channels; time; and the social system – are elaborated below:

i. Innovation

According to Rogers (2003a), in an innovation, newness doesn't not only refers to the new knowledge, it might also refer to knowledge known about an innovation for some time but not yet developed. It can be something that someone had a favourable or unfavourable attitude toward it, nor have adopted or rejected it. Innovation “Newness” can be expressed in terms of knowledge, persuasion or decision to adopt (2003a: 12).

ii. Communications Channels

Rogers defines communication as the process by which participants create and share information with one another in order to reach a mutual understanding. The essence of the diffusion process is the information exchange through which one individual communicates a new idea to one or several others, and at its most elementary form,

the process involves (1) an innovation; (2) an individual or other unit of adoption that has knowledge of, or experience with, the innovation; and (3) a communication channel. A communication channel is the means by which messages get from one individual to another (2003b:18).

iii. Time

Time is the third element of the diffusion process. Rogers (2003b: 20) states that “much other behavioural science research is timeless in the sense that the time dimension is simply ignored or does not matter”. However, he specifies that the time dimension is involved in (1) the innovation-decision process by which some individual passes from first knowledge of an innovation through its adoption (that is, the relative earliness/lateness with which an innovation is adopted) as compared with other members of the system, and (2) an innovation’s rate of adoption in a system, usually measured as the number of members of the system who adopt the innovation in a given time period.

iv. A Social System

Rogers (2003b: 23) defines social system as a “set of interrelated units that are engaged in joint problem solving to accomplish a common goal”. However, he mentions that diffusion occurs within a social system and the social structure affects the innovation’s diffusion in several ways. The social system provides a medium through which, and boundaries within which, innovation is adopted.

Perceived attributes of innovations

It should not be assumed, as it sometimes has been in the past that all innovations are equivalent units of analysis. “This assumption is a gross oversimplification” (Rogers, 2003b:15). The following are characteristics of innovations as perceived by individuals, to help to explain their different rates of adoption:

- i. *Relative advantage* – is the “degree to which an innovation is perceived as better than the idea it supersedes” (Rogers 2003b:15);
- ii. *Compatibility* – is the “degree to which innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters” (Rogers 2003b:15);
- iii. *Complexity* – is the “degree to which an innovation is perceived as difficult to understand and use” (2003b:16);

- iv. *Trialability* – is the “degree to which an innovation may be experimented with on a limited basis” (2003b:16). New ideas that can be tried on an instalment plan may be adopted more quickly than innovations that are not divisible; and
- v. *Observability* – is the “degree to which the results of an innovation are visible to others”. The easier it is for individuals to see the results of an innovation, the more likely they are to adopt (2003b:16) as visibility stimulates peer discussion of new ideas.

Innovation-decision process

The innovation-decision process is the part borrowed from Rogers’ Diffusion of Innovation theory to underpin this study. It is, according to Rogers (2003b:20), defined as the process through which an individual (or other decision-making unit) passes from first knowledge of an innovation, to the formation of an attitude toward the innovation, to a decision to adopt or reject, to implementation and use of the new idea, through to confirmation of this decision.

In DOI, Individuals possess different degrees of willingness to adopt innovations and thus it is generally observed that the portion of the population adopting an innovation is approximately normally distributed over time (Rogers, 2003a). Breaking this normal distribution into segments leads to the segregation of individuals into the following five categories of individual innovativeness (from earliest to latest adopters): innovators, early adopters, early majority, late majority and laggards (Rogers, 1995).

DOI theory is worried about the manner in which a new technological idea, artefact or technique, or a new use of an old one, drifts from creation to use. In DOI theory, technological innovation is communicated through particular channels, over time, among the members of a social system (Nemutanzhela & Iyamu, 2011). According to Rogers (2003b), the innovation-decision process involves five steps: 1) knowledge; 2) persuasion; 3) decision; 4) implementation; and 5) confirmation. These stages typically follow each other in a time-ordered manner, a process shown in Figure 2.2.

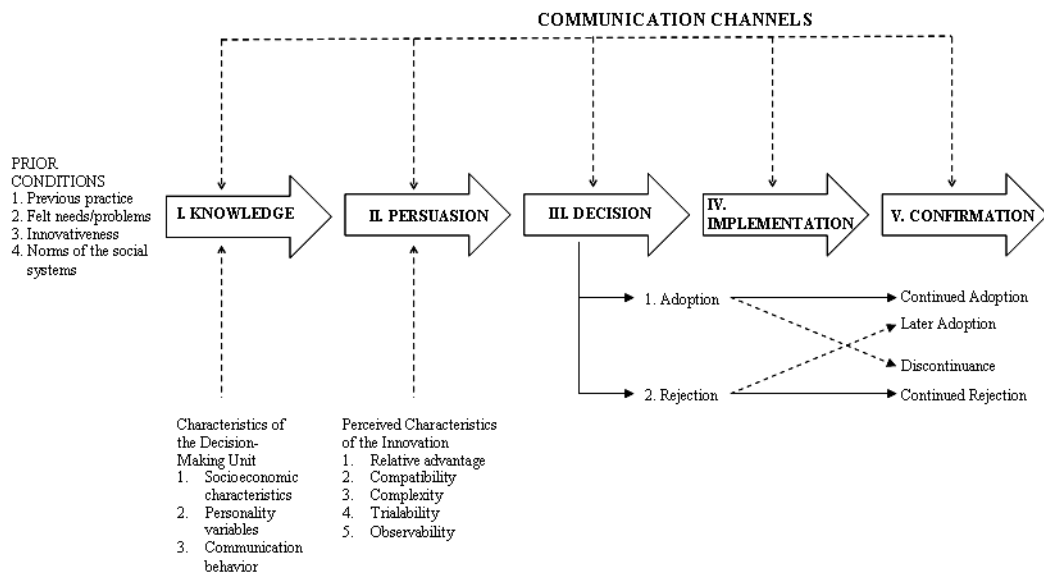


Figure 2. 2: Innovation-decision process
Adopted from Rogers (2003a)

The innovation-decision process is characterised as a process that occurs while individuals participate in a series of actions related to decisions (Rogers, 1995:162). Knowledge occurs when individuals are aware of the innovation and gain understanding of its functions. Persuasion is when individuals or decision-making units exhibit favourable or unfavourable behaviour toward the innovation. Decision indicates when the individual or unit decides to adopt or reject the innovation. Implementation occurs when the individual or unit decides to use the innovation. Confirmation occurs when decision makers confirm or reject their decision to adopt the innovation (Rogers, 1995:162).

Innovation diffusion plays an important role in theories describing information technology (IT) implementation (Rogers, 2003a). It can be studied using both factor and process approaches (Fichman, 1992). Innovation diffusion within an organisation requires change management to facilitate and encourage people to adopt ICT initiatives. Organisations can do this by motivating staff; providing appropriate training and technical support; and ensuring supervisor support for an open-discussion sharing environment (Senge *et al.*, 1999).

To create innovations and new value, an organisation is required to sacrifice some efficiency by allocating resources to uses that do not yield the highest immediate returns. By creating an environment in which people can create new combinations of resources, companies can create new value and new markets (Ghoshal, 2000).

Application of DOI in IS study

DOI has been applied in many areas of Information Systems and technology such as software development, infrastructure development and in healthcare. According to Makovhololo *et al.* (2017:465), “the theory focuses on the fact that new ideas (innovations) or technologies, are being created continually and that communication becomes vital in spreading or disseminating the innovation to society or communities”.

DOI theory is widely accepted in information system research literature and has proven to be a useful tool to measure the way in which new technologies are adopted. It has been applied to Evaluate Technology Acceptance and Sustainability (Aizstrauta, Ginters & Eroles, 2015). According to Makovhololo *et al.* (2017), the Diffusion of Innovation theory was employed as a lens to examine influencing factors and how decisions are made in applying technologies for organisational strategy. DOI was also applied in a study to investigate how relationships between goals, classroom practices, and student achievement in English as a foreign language (EFL) education have changed in Japan from 1994 to the present (Sasaki, 2018). Additionally, it has been applied in healthcare to understand the factors impacting patient acceptance and use of consumer e-health innovations (Zhang *et al.*, 2015).

Some of the reason for the lack of success with the Diffusion of Innovation theory is due to a few limitations. Social norms and standards of acceptance into society greatly outweigh the idea of taking on a new innovation, even at the sake of the health, well-being and greater levels of education for the community (Rogers, 1962). Secondly, DOI did not originate in public health and was not developed to explicitly apply to the adoption of new behaviours or health innovations (Boston University, 2013). Thirdly, if the individual has had past experience with the old behaviour but has not seen consequences from it, then they are more likely to not want to innovate (Rogers, 1962). And finally, DOI does not take into account an individual's resources or social system (Hayden, 2014).

Hence, for this study, DOI was applied in conjunction with ANT to compensate for these limitations, such as taking an individual's resources or social system by first using ANT to identify all actors involved in the study, either human or non-human actors, and the relation they create in the form of networks.

2.6 Conclusion

The literature review has shown that language in healthcare continues to act as a barrier that quite seriously affects service delivery. However, some of the studies have also clarified that, with the use of ICT, most healthcare challenges are being addressed. Examples were provided of the two theories selected for this study to help eradicate some of the challenges which healthcare is facing. The research is confident that the theories chosen are of the best fit to be applied in this study. The next chapter will present the application of the research methodology that underpins this study.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents and discusses the research methodology that was applied in this study. As shown in Table 3.1, the methodology includes research philosophy, approaches, design, techniques and methods. The selection of the philosophy, approaches, techniques and methods were guided by the aim of the study, which was to develop a framework that can be used to guide the selection and implementation of mobile systems in the translation of language semantics for effective healthcare service delivery in South Africa.

The philosophical assumption and stance are discussed in the first two sections. This is followed by the research approach and methods, covered in the third and fourth sections. The design approach, data collection and data analysis that were applied in the study are explained in the fifth, sixth and seventh sections, respectively. Also discussed in this chapter are the ethical considerations that were adhered to during the study. Finally, a conclusion was drawn.

Table 3. 1: Summary of the research methodology

Methodology	Choice
Philosophical assumption	Epistemology
Research paradigm	Interpretivist
Research approach	Inductive
Research methods	Qualitative methods
Research design	Case study: three cases (government healthcare organisation, non-government healthcare organisation and community)
Data collection	Interviews: semi-structured
Data analysis	<ul style="list-style-type: none"> - Moments of translation of ANT, at micro-level - The innovation decision process of DOI, at macro-level
Unit of analysis	Case-by-case

3.2 Philosophical assumption

There are two main philosophical assumptions – ontology and epistemology – that are commonly followed in information systems research (Pirainen & Gonzalez, 2015). *Ontology* refers to the study of the nature of reality and what exists or what is known (Smith, 2006). According to Tsang (2014), ontology emphasises the existence of a phenomenon before reaching the knowledge while epistemology emphasises the fact that there has to be knowledge before the existence of something. *Epistemology* is concerned with the study of knowledge, its focus on investigating what knowledge exists and how and why it was produced (Alpaslan, Yalvac & Loving, 2017). Yousefzadeh and Azam (2015:25) put it this way: epistemology is “a study of beliefs about the origin and acquisition of knowledge”. Cecez-Kecmanovic, Kautz and Abrahall (2014) discussed the successes of both ontological and epistemological assumptions in IS studies.

This study follows a combination of both philosophical assumptions in that, (1) ontologically, it is a well-known and established fact that health conditions, health facilities, community and challenges of language semantics exist; and (2) epistemologically, what was not known was the impact of the challenges and how the challenges can be addressed.

3.3 Research paradigm

In information systems research, there are two main philosophical paradigms, the positivist and interpretivist (Walsham, 2006). The *positivist paradigm* focuses mostly on, to test theories, hypotheses and experiments through objectivism and quantifiable measurements (Mackenzie & Knipe, 2006). The *interpretivist paradigm*, on the other hand, focuses on acquiring essential knowledge through a subjective understanding of participant perspectives of the phenomenon that is being studied (Chen & Hirschheim, 2004).

3.3.1 Positivist

The positivist paradigm states that knowledge is based on natural phenomena, which include their properties and relations. One of the common beliefs within the positivist paradigm is that “reality is stable and can be observed and described from an objective viewpoint” (Leedy, 2005). In positivist paradigm, real events can also be observed empirically and often explained with different methods, such as logical analysis (Helmer, Holt & Thompson, 2015). Carson *et al.* (2001) clearly states that

positivist researchers are often detached from the people who participate in their research in order to remain emotionally free from the discussion or incident. Within the positivist paradigm, there is a belief in a distinction between fact and value (Edirisingha, 2012). Gregor (2006) asserts that in IS research the challenges such as inconsistency of results experienced may be attributed to the inappropriateness of the positivist paradigm for the domain because they seek objectivity and use consistently rational and logical approaches to research.

3.3.2 Interpretivist

Based on the objectives of the research as stated in Chapter 1, and as discussed in the introduction section of this chapter, the interpretivist paradigm was selected for this study. This is primarily because the interpretivist paradigm allows researchers to view the world through the perceptions and experiences of the participants. While looking for research answers, “the researcher who follows an interpretivist paradigm uses those experiences to construct and interpret an understanding from the gathered data” (Thanh & Thanh, 2015: 24). The interpretivist paradigm avoids rigid structural frameworks such as in positivist research and adopts more personal and flexible research structures (Carson *et al.*, 2001). This is done through a seeking explanation within the realm of individual consciousness and subjectivity, and within the socially constructed sphere of human relation (Zyl, 2015). Following the interpretivist paradigm enables a researcher to increase understanding of the critical, social and organisational issues related to the adaptation and adoption of mobile systems for semantics of language translation in healthcare and related communities. According to Vosloo (2014:296), in “the interpretive approach is the assumption that access to reality is only possible through social constructions such as language and shared meanings”.

3.4 Research approach

Information systems research consists of two main approaches, inductive and deductive (Lee, Pries-Heje & Baskerville, 2011), which shape the direction of the steps and procedures that are adopted in the design, data collection and analysis.

3.4.1 Deductive

Creswell and Plano Clark (2007:23) argue that the deductive researcher “works from the ‘top down’, from a theory to hypotheses to data to add to or contradict the theory”. According to Zalaghi and Khazaei (2016:24), “In deductive approach, in order to achieve a consensus, the structure of logical reasoning needs to be quite formal”. In IS

studies, the deductive approach is commonly associated with quantitative research methods (Hyde, 2000). The deductive approach can be argued to apply new solutions to existing challenges (Graham & Carmichael, 2012). Most importantly, the deductive approach generally makes use of evidence to support a conclusion, where hypotheses are developed for confirmation or rejection. When a deductive approach is applied in research, a set of hypotheses are formulated, for test, by using relevant methods. The deductive approach includes formulating assumptions and testing them via research processes, while inductive studies have nothing to do with assumptions (Zalaghi & Khazaei, 2016).

3.4.2 Inductive

The inductive approach, which is more often than not associated with the interpretivist paradigm, was carefully selected for this study. The approach, also known as inductive reasoning, is more of a concept that starts from specific to general. It begins with observations and theories are then proposed towards the end of the research process as a result of observations (Bendassolli, 2013). These inductive approaches are generally associated with qualitative research (Liu, 2016). The inductive approach guides development of theories from its results (Goddard & Melville, 2004). To generate meanings, this approach aims to identify patterns and relationships to build a theory from the data set collected in order; however, with the inductive approach, no one is refrained to apply the existing theory to formulate the research question to be explored (Saunders, Lewis & Thornhill, 2012).

3.5 Research methods

While the qualitative and quantitative methods are commonly used individually in IS/IT studies (Mkhomazi & Iyamu, 2013), a combination of both, which is called mixed method, can also be applied (Halcomb & Hickman, 2015).

There are three different types of research methods, then: qualitative, quantitative and mixed methods. Quantitative methods emphasize objective measurements and the statistical, mathematical, or numerical analysis of data collected through polls, questionnaires, and surveys, or by manipulating pre-existing statistical data using computational numerical data using computational techniques (Bernard, 2017). Quantitative research “focuses on gathering numerical data and generalizing it across groups of people or to explain a particular phenomenon” (Almalki, 2016: 291).

Some researchers consider mixed methods to be any project that involves both qualitative and quantitative methods (Halcomb & Hickman, 2015). Morse (2010) asserts that a mixed method design needs to consist of one project, known as the core project, which must be a complete method on its own, and a second project consisting of a different type of data or analysis, using a strategy (and there may be more than one) that is incomplete: that is, that is not comprehensible or publishable apart from the core project.

The design selected for research should be the one most suited so as to achieve an answer to the proposed research question (Whall, Sinclair & Parahoo, 2006; Vosloo, 2014). For the purpose of this study, the qualitative method was applied. This decision was informed and guided by the objectives of the study.

3.5.1 Quantitative methods

Applying quantitative research methods means the collection of information can be analysed numerically and the results can be presented using statistics, tables and graphs (Labaree, 2009). Questionnaires, surveys and experiments are quantitative methods used for data collection; through the use of statistical analysis, the data can be revised and tabulated and characterised (Hittleman & Simon, 1997:31). The aim of quantitative methods is to test pre-determined hypotheses and produce generalizable results. Therefore, researchers using quantitative analysis can draw conclusions using logic, evidence and argument. Quantitative methods address questions such as 'how many' and 'how much'. After general guidelines shape the interpretation of raw data, the data can then be presented to evaluate assertions made and assess the validity of the instrument (Soiferman, 2010). Quantitative method remains the most dominant paradigm and most applied in health studies.

3.5.2 Qualitative methods

“Qualitative research is a systematic, subjective approach to describe life experiences and give them meaning” (Grove, Burns & Gray, 2014:17). The qualitative methods enable researchers to gain deeper understanding about human behaviours, perspectives, opinions and experiences of a situation (Tashi *et al.*, 2014). Rwegoshora (2016) asserts that one of the strengths of the qualitative research methods is in its ability to explore and provide descriptions about people experiences, from a depth, quality and complexity perspectives. According to Fabijan, Olsson and Bosch (2015), the qualitative methods help to understand some of the factors that are considered contradictory, such as behaviours, beliefs, opinions, emotions and

relationships between individuals and groups. The research had a qualitative attribute because this allowed data to be gathered concerning perceptions and opinions about language semantics.

The ultimate qualitative research offers a perspective of a situation, reports clearly - written are provide and they reflect the researcher's ability to illustrate or describe a phenomenon (Myers, 2000). One of the strongest strengths of the qualitative method is the richness and depth of explorations and descriptions.

3.6 Research design

Research design is “the conceptual structure within which research is conducted, constituting the blueprint for the collection and analysis of data” (Kothari, 2004:283). “Research design provides an outline for the research, thereby facilitating smooth implementation of the various research operations” (Kothari, 2004:283). The case study approach was applied in the research.

3.6.1 The case study approach

The case study approach is viewed as an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used (Yin, 2013).

With a case study, the holistic and meaningful characteristics of real-life events such as (individual life cycles, organisational and managerial processes, neighbourhood change, international relations and the maturation of industries) are allowed to be retained through an investigation (Macário, 2011). Therefore, the case study approach is especially useful in situations where contextual conditions of the events being studied are critical and where the researcher has no control over the events as they unfold (Tashakkori & Teddlie, 2010).

It is easier to extract cultural knowledge and identify actions and instruments that participants utilise in their everyday life when studying organisations through the case study approach (Sutton & Austin, 2015). Also, Yin (1994) argues that case study approaches, by contrast, are conducted within a defined time frame, which helps with finalisation of research within a defined time and space. However, the approach does have its weaknesses as well as strengths.

Strengths of case study

Some of the strengths of the case study approach are as follows:

- i. The case study approach provides detailed information about the semantics of language translation using mobile systems in South African Healthcare as noted by Hofstee (2006:123): “The case study method is useful when detailed knowledge is required of any particular case”.
- ii. The case study provides opportunities to create new hypotheses and also create an interest for further study in the field of semantics of language translation using mobile systems in South African healthcare. This is supported by Cooper and Schindler (2006) when they assert that “a single, well-designed case study can provide a source of new hypotheses and constructs simultaneously”.
- iii. Through the case study approach, new theories and insights can be provided which contribute to qualitative methods. Harland, however, warns that a researcher must be cautious while writing the study to write descriptively with a critical audience in mind (2014). As analysis of the study object never stops, researchers need to keep in mind that the thickness of a study does always represent the amount of time put into the research.

Weaknesses of the case study approach

The weaknesses of the case study approach include the following:

- i. It is not easy to generalise results because usually one case is studied. Hofstee (2006:123) asserts that there is a “difficulty of obtaining results that can be generalised”.
- ii. “It is not easy to keep a case study focused because of its in-depth study into only one case; as Hofstee (2006:123) points out, it is difficult to keep it focused”.

The weakness of the actual case study method of research was well-addressed, as presented below.

How weaknesses were handled

The researcher recognises the importance of study validity and reliability and therefore the weaknesses of the case study were mitigated in the following ways:

- i. The study used three cases rather than one, a choice which was intended to broaden the coverage of the study in terms of size and content. One of the cases is an entire community, which focuses on members (these are people

who require and receive healthcare services); the second case is a government hospital (it renders services to the community and has a mandate to render this service to all members of the community); and the third case is non-government hospital (this specific one has a mandate to render services to those who cannot afford it and yet are suffering from chronic conditions). Also, five (English, isiZulu, Sepedi, Tshivenda and Xitsonga) of the eleven official languages were used in the study. This was to ensure that there was at least ground for developing a more generalisable theory as it covers all entities involved in the healthcare service.

- ii. The study combined the interviews with the participants from the organisations that were engaged in the study. Thus, the facts gathered during the study were cross-checked against the information gathered during the interviews with the participants.

Based on the aim of the study, the case study approach was selected. Following the approach, a community and two organisations, referred to as 'cases' were used in the study.

The first case is a community called Soshanguve, situated in the Tshwane locality in South Africa. The community members form part of recipients and users of healthcare services. The other factor that played a role in the selection of this community was the large variety of languages spoken in the area. It is uncommon in South African to have many different languages spoken in the same community (locality). This community, however, is dominated by isiZulu, Sepedi, Tshivenda and Xitsonga-speaking people, and these were the three languages that were used to elicit information about language semantics from the community members.

Of the two health facilities, one was a public hospital and the other was non-governmental health service provider. The public facility was general to the community while the non-government healthcare facility focused on suffers of chronic diseases. The reason for this decision was that it is vital for the patients and healthcare providers to understand each other. Communication is vital when dealing with chronic patients, as they must remain on treatment consistently for the rest of their lives.

The three cases

- ❑ **Case #1:** Tshwane (Pretoria) community was targeted primarily because within the community Tshivenda, isiZulu, Xitsonga and Sepedi were the languages spoken by the residents.
 - The primary focus was:
 - To explore the impact of language semantics, and the factors that can influence its translation in receiving healthcare services, from those who either do not speak and understand or are not fluent in these languages.

- ❑ **Case #2:** Mukhethwa Hospital: Although it is a government (public) hospital, the majority of the visitors or patients were Tshivenda and Sepedi speaking community members, and majority of the health practitioners were not fluent in any of the dominant languages at the time of this study.
 - The primary focus was:
 - To explore the language semantics translation when healthcare providers interact with the community.
 - To understand the implications in providing and receiving health services.

- ❑ **Case #3:** Sweet Love Hospital (SLH) is non-government hospital. The hospital was selected as one of the cases to be used in the study, because the hospital is different from many of the other hospitals as it focuses on chronic health conditions. Thus, the patients are different from the normal patients that visit the general hospitals. Additionally, the patients need to be regularly informed of their next visits, as well as their medication refills.
 - The primary focus was:
 - To understand how the communication was carried out, through which medium; and
 - To explore the language semantics, and its translation, in the process of receiving notifications in only one language, which was English.

To conclude, data was collected from three case studies, two healthcare organisations and a community in the northern part of South Africa.

3.7 Data collection

Data collection is the process of gathering and measuring data according to its characteristics and variables of interest, in an established methodical approach that enables one to answer the questions of the research being undertaken, including hypotheses and outcomes that are evaluated (Prabha & Kabadi, 2016). The data collection techniques are common in all fields of study, including information systems. While methods vary by discipline, the emphasis on ensuring accurate and honest collection remains the same. Capturing quality evidence is the goal for all data collection, and ability to translate to rich data analysis and allows the building of a convincing and credible answer to questions that have been posed (Spector & Yuen, 2016). There are several different techniques for data collection, including observation, documentation and interview.

3.7.1 Observation

Marshall and Rossman (1989: 79) refer to *observation* as "the systematic description of events, behaviours, and artefacts in the social setting chosen for study". The ethical aspects need more attention and these techniques can be very obstructive (Urquhart, 2015). According to Kawulich (2005), observation techniques provide the researcher an opportunity to view or participate in an unscheduled event who then needs to carefully consider the nonverbal expressions of feelings to determine the outcome. DeWalt and DeWalt (2002) assert that data collection and interpretation quality can be improved through observation and can help facilitate the development of new research questions or hypotheses.

3.7.2 Documentation

In qualitative research, document analysis can be used to interpret documents by the researcher to give sense and meaning to a topic that is being assessed (Bowen, 2009). In research, documents are used to provide evidence for information and ideas which are borrowed from others. This evidence includes both primary secondary sources. The process of obtaining and analysing documents is often far more cost-efficient and time-efficient than conducting one's own research or experiments (Bowen, 2009). However, to ensure reliable results, before actual document analysis takes place, the researcher must go through a detailed planning process (O'Leary, 2014).

Qualitative data was collected using the interview technique, which was informed by the objectives of the study as presented in a section above.

3.7.3 Interview technique

The *interview technique* is defined as a “method of data collection in which one person (an interviewer) asks questions of another person (a respondent): interviews are conducted either face-to-face or by telephone” (Farooq & de Villiers, 2017). The qualitative research interviews seek to describe the meanings of central themes in the life world of the subjects. “The main task in interviewing is to understand the meaning of what the interviewees say” (Kvale, 1996: 20; Abdou, 2014). There three main types of interviews are unstructured, structured and semi-structured.

Unstructured interview

An *unstructured interview* or non-directive interview means questions asked in the interview are not planned. During an unstructured interview, respondents are asked open-ended questions (Jamshed, 2014). Gubrium and Holstein (2002) point out that the difference between unstructured and structured interview is that unstructured interviews are flexible and thereby ensure freedom to both interviewers and interviewees. Therefore, the interviewer would be more “keen to follow up interesting developments and to let the interviewee elaborate on various issues” (Dörnyei, 2007:136). For example, “with structured interviews, reporting can be done through tables and graphs which may produce numerical data, while the unstructured open-ended interviews would yield word-based accounts, possibly taking up considerably more space for reporting” (Dörnyei, 2007:136).

Structured interview

A *structured interview* is an interview that follows the same pattern when asking questions, a predefined pattern. The questions, then, will follow the same order when asked for all respondents (Zhang & Wildemuth, 2006). Structured interview techniques are mostly used in a quantitative study using a survey research (Breat, 2009). Most questions posed in structured interviews are constrained, requiring a ‘yes’ or ‘no’ type of responses. The interviewer and interviewee have very little freedom during the interview (Berg, 2007). According to Weller (1998), when conducting a structured interview, a researcher needs the acumen to make comparisons across people and groups.

In this present study, qualitative data was collected using the semi-structured interview technique. The selection of this method and technique was based on the objectives of the study as presented in a section above.

Semi-structured interview

The most useful interview format for conducting qualitative research is often *semi-structured* (sometimes called “moderately scheduled”) as compared with the case of an interview that consists of all closed-ended questions, as well as with the structured interview in which the interviewee is simply given a license to talk freely about the topic, meaning the interview is not highly structured. According to Blandford (2013), in the semi-structured interviews, most questions, or at least themes, are planned ahead of time, even though lines of enquiry are only pursued within the interview to follow up on interesting and unexpected avenues that emerge.

The aim is to ensure that interviews are conducted with a fairly open framework which allows for focused, conversational, two-way communication, allowing for both the giving and receiving of information. Semi-structured interviewing is initiated with somewhat general questions or topics, unlike the questionnaire framework for which detailed questions are formulated ahead of time (Pathak & Intratat, 2012). In semi-structured interviews, the possible relationships between these topics become the basis for more specific questions and relevant topics are initially identified which do not need to be prepared in advance. The questions are designed and phrased ahead of time to allow both the interviewer and the person being interviewed the flexibility to probe for details or discuss issues; hence, the majority of questions are created *during* the interview.

For the purpose of this study, both healthcare service providers and community members, organisation stakeholders (literate and illiterate; different age groups; different genders) were interviewed. The number of people interviewed was determined by meeting on the point of saturation.

Interview guidelines

Before the interview:

- a) Permission seeking

Permission was sought from the Chief Operating Officer to use Sweet Love Hospital as the case study of this research. He subsequently requested proof of registration and the permission letter for the research from the University. Upon receipt of these, the Chief Operating Officer granted permission.

b) Venues

Securing a venue for the interviews was yet another factor necessary to consider. The boardroom of Sweet Love Hospital was a chosen venue for the interviews at that hospital because its background noise is minimal. Its tranquil background was sufficient for the production of quality recordings while also a non-threatening environment for the participants. Finally, the boardroom was easily accessible by all the participants in the hospital.

c) The recording machine

The recording machine was checked a day before the actual interview and noted as being in working order. Back up batteries were purchased and packed in a bag to be taken to the interview rooms.

d) Preparation of interview scripts

Because of the unfamiliarity with the interview procedure, a script to guide the process of the interviews was developed in which content and procedure were as follows: testing the 1-2-3 check to ascertain the functionality of the recording; greetings and introductions as a way of warming up participants, creating rapport and building confidence and trust; explaining details about the study and reasons for the study; explaining the consent letter and the signing thereof; and finally, explaining interview procedure and the interview itself.

A request was made for the provision and permission of extra time for the participants in case there would be running over the scheduled time. Then, when all was set, the interviews were conducted in the secured venue.

During the interview

The research followed a semi-structured interview schedule so that the process did not divulge into unnecessary details. Nemutanzhela and Iyamu (2011: 243) assert that "In a semi-structured interview, the interview approach allows the researcher to put questions to a respondent face-to-face". This was advantageous for data collection because it made it possible to explain the questions that were not understood by the respondent and gave a chance to probe further than the interview schedule.

- i. The interviews were conducted in the language of the respondent's choice
- ii. The interviewees were recorded.
- iii. The interviewees were not interrupted during a response to any question.

- iv. To encourage and motivate a response, the interviewer often “nodded” her head in approval of response. Otherwise, the interview could be uncertain of the type of responses that they offered.

Organisation of the data

A handheld audio recording device was used to record the interviews, concurrent to the researcher taking notes during the interviews. The researcher then compared the notes and the voice recording to finalise the interview data and send the transcript to each of the participants for approval. The participants had several days to verify the content of the transcript, which each confirmed before it was finalised. Copies of the interviews were kept as original, while copies of the transcripts were proofread, and language edited for analysis purposes. Both original and edited copies were documented in Microsoft Word. Moreover, the document was page and lined number for citation purposes. A set of copies were stored with the researcher, and another set with the candidate’s supervisor. This was a security measure in case of damage or theft of laptop where the data were stored.

The study intended to establish the following objectives:

- i. From a language semantics perspective, to examine and understand the factors that hamper the service of healthcare in South Africa.
- ii. To examine and establish the factors influencing the selection and use of mobile systems for language semantics for South African healthcare organisations.
- iii. To examine and understand how mobile systems can be employed in multi-language translation to improve the delivery of healthcare services to communities in South Africa.

In order to achieve the research objectives as stated above, questions were formulated, including a main question and sub-questions:

Main question

How can the challenge (s) of semantics and language translation in South African healthcare delivery be addressed using mobile systems? This is intended to improve the services which healthcare organisations provide to communities, particularly in areas where many different languages are spoken, and many of the speakers, including both healthcare recipients and healthcare service providers themselves, do not understand each other.

Sub-questions

The sub-questions include use of mobile systems in healthcare services, and the semantics of language translation:

i. Use of mobile systems in healthcare services

- c. How would mobile systems be employed in multi-language translation in the delivering of healthcare services to communities in South Africa?
- d. What are the factors which influence the selection and use of mobile systems for language semantics for healthcare service delivery in South Africa?

ii. The semantics of language translation

- c. What are the factors of influence in spoken languages, and how can semantics be translated from a local dialect to English by using mobile systems to improve healthcare services in South Africa?
- d. How does the translation of language semantics impact the services that healthcare organisations provide to the communities in South Africa?

Criteria for interviews

Selection of the participants in the three cases was based on certain criteria. The criteria for selecting participants from among members of the community included the following:

1. The participant must have visited the hospital, or any health facilities, at least more than twice in a year.
2. The participant must be interested in sharing personal experience. This was to adhere to ethical code of conduct as outlined in the section below.

The criteria for the two hospitals was as follows:

1. Knowledge of the environment. This means that the participant would have been in the environment for at least two years.
2. Availability and interest in the study. Due to the sensitive nature of the health environment, it was critically essential that participant show interest in the study. Also, it only through genuine interest that participants are able to contribute meaningfully.

After the interview

Immediately following each interview, notes were perused and arranged in an understandable and readable way. These were typed and saved on both a personal

computer and the memory stick for later use. The recordings were listened to intently and transcribed meticulously. These transcriptions were coded for easy access and use. It should be noted that there were some transcribed interviews that were not understandable and hence there was a dire need for a second, shorter interview.

Participants

Each participant in the case studies was labelled: in Tshwane Community, as TC01 to TC18; in Mukhethwa Hospital as MH01 to MH11; and in Sweet Love Healthcare as SLH01 to SLH16. This was to appropriately identify the participants, for citation purposes, during the analysis. These cases are explained in Chapter 4.

Case #1: Tshwane Community

Most of the participants were community members who were found at church in Soshanguve Evangelical Lutheran Church in Southern Africa (ELCSA). The research objective was to interview community members from different demographics and age groups and who speaks multi-languages. Soshanguve ELCSA church has the most dominant number of Tshivenda and Sepedi speaking members as most of their church members speak more than one of South Africa's official languages. It was easier for the research to identify a common place where most of the participants were found; furthermore, it was convenient and profitable environment to conduct interviews using one of the church offices.

For the Tshwane community at Soshanguve, eighteen (18) participants (including male and female, literates and illiterates, at different age groups) were interviewed in the language of their choosing. The longest interview was twenty-four (24) minutes and the shortest interview was thirteen (13) minutes. With the first interview, the research had to go back for follow-up questions to seek clarification on certain points that were not made clear during the first interview as the research neglected to probe enough during the first interview. Therefore, follow-up questions were prepared in advance based on the responses from the first interview.

Case #2: Mukhethwa Hospital

The participants in this case were healthcare workers from a public hospital based in the Tshwane region. This hospital was selected because one of the objectives was to look at hospital that deals with general illnesses while also dealing with patients who

speaks different languages. This hospital is situated in the township of Tshwane and deals with nearly any illness as it renders its services to all genders and races.

A total of eleven (11) participants who work at the hospital were selected for an interview based on the criteria stated above. The participants were spread across units and departments of the hospital, including IT personnel, doctors, nurses, management and administrators. The longest interview lasted thirty-five (35) minutes and shortest interview was fourteen (14) minutes. However, the interviews were not straightforward or as smooth as was expected: there were some challenges.

Challenges

The research had some challenges with setting up sessions for interviews. Because healthcare practitioners are always busy following hectic schedules, the researcher struggled to get hold of many participants because they were always saying they are busy. The challenges were, however, managed successfully with a consistent and gently persistent approach, which was polite in engaging the participants. Thus, the researcher had to meet some of the participants after work at homes or restaurants. Even so, after each interview, data was carefully transcribed word for word.

Case #3: Sweet Love Hospital

Participants from Sweet Love Hospital were healthcare practitioners from a non-government hospital (NGO) that deals with chronic diseases and accommodates multiple language speaking patients. This case study was selected because one of the objectives was to investigate a hospital that deals with chronic illnesses and with patients who speak different languages. Sweet Love Hospital is categorised by different clinics in different townships of Johannesburg. Community members (patients) who receive its healthcare services are from all over the world and speak different languages. It specialises in chronic conditions.

The researcher managed to interview eighteen (16) participants (IT personnel, management, doctors, pharmacists, nurses, researchers and field workers). The longest interview was fifty-nine (59) minutes and the shortest interview was fourteen (14) minutes.

Challenges

Most of the healthcare practitioners at Sweet Love Hospital work out in the fields such as taxi ranks and squatter camps because they engage in health campaigns, HIV and wellness testing. It was extremely difficult to get hold of some of the participants. As in

the case of Mukhethwa Hospital, though, the challenges were well-managed and objectives achieved. For example, the researcher had to wait for a Friday when workers report back to head offices; this was also difficult as workers were normally in a hurry after their Friday meeting.

3.8 Data analysis

Qualitative analysis involves a continual interplay between theory and analysis (Rubin & Babbie, 2016). In analysing qualitative data, we seek to discover patterns such as changes over time or possible causal links between variables.

As stated previously, qualitative data was collected. In analysing the data, the hermeneutic technique was employed from the interpretative approach perspective, and guided by two theories, ANT and DOI. The hermeneutics was selected because of the subjective (of the participants), qualitative nature of the data. According to Rittelmeyer, Parmentier and Klafki (2001), the hermeneutic is originally referred as the interpretation of sense of text. Interpretation is referred as the third crucial element of philosophical hermeneutics in research (McCaffrey, Raffin-Bouchal & Moules, 2012).

The analysis of this data was carried out on two different levels – the first level was macro, and the second level was micro – using the Actor Network Theory (ANT) and Diffusion of Innovation (DOI) as dual lenses. The two theories were combined because of the differences in their focus, as comprehensively discussed in the previous chapter. ANT was used first for a variety of reasons:

- i. To identify the actors that existed from both healthcare providers and recipients' perspectives;
To understand how the various networks of healthcare service providers and recipients were formed;
- ii. To understand the activities of the actors within the various networks, which led to a better understanding of the roles of individuals and groups in the provision and receipt of healthcare services in the community;
- iii. To examine the relationships and interactions that happens between the healthcare service providers and community members; and
- iv. To utilise the relationships formed to establish the languages used to communicate during the interaction.

Thereafter, the DOI was employed in the analysis for several reasons:

- i. To examine and understand the type of knowledge that existed between the patients and practitioners of the health conditions;
- ii. To examine how decisions were made by both healthcare providers and recipients on languages preferences for health services;
- iii. To understand how and why certain meanings were translated, and associated to activities; and
- iv. To understand how mobile systems can be used to address the challenges in the translation of language semantics for healthcare services to the community in South Africa.

Thus, it would have been extremely difficult or near impossible to achieve the aim and objectives of the study should only one theory have been used to guide the analysis of the data. The complementary use of both theories was a major contribution to the study.

3.9 Unit of analysis

A unit of analysis was done based on factors such as age, race, sex and level of education. According to Iyamu (2011), the units of analysis approach allows data to be analysed on unit-by-unit basis. Governments, corporations and non-government organisations utilise demographicsto learn more about a population's characteristics for many purposes, including policy development and economic market research (Hauser & Duncan, 1959).

Should analysis take place at the level of the individual, household, community, organisation or a combination of these? Different aspects of poverty and deprivation are evident at different levels of social organisation. For example, the lack of street-lighting or access to markets may apply predominantly at the level of the settlement or community while food security and income may apply to the household level, or even at an intra-household level due to differentiation based on age, gender or relationship to household head (Gautam & Andersen, 2016).

Focus on a particular level of analysis may reveal important gaps in understanding. Assessment or analysis at different levels would also allow any inter-linkages between levels to be explored (Gautam & Andersen, 2016). Table 3.2 highlights the advantages and disadvantages of different units of assessment.

Table 3. 2: Units of analysis

	Healthcare facility	Community
Category	doctors nurses administrators	literate illiterate
Age group		younger (below 35) older (above 35)
Gender	male female	male female

3.10 Ethical consideration

Cape Peninsula University of Technology (CPUT) Research Code of Ethics was followed; an Ethical Clearance Letter was obtained from the faculty. A consent letter to grant permission to collect data from the organisations was sent to the prospective participants. This letter detailed the research purpose, procedures, objectives, potential benefits and risks of the study. Permission was granted, and a letter of consent was signed and returned to the University.

The following were taken into consideration and addressed with the participants, especially those working in healthcare:

Confidentiality, privacy and anonymity: The Hippocratic Oath contains a promise: 'That whatsoever you shall see or hear of the lives of men or women which are not fitting to be spoken, you will keep inviolably secret'. In this regard, therefore, the following ethical ideals were adhered to:

- At the start of interviews, participants were informed of the purpose of this study.
- Participants had the right to withdraw from the interview at any time.
- Consent was sought prior to recording and making interviews notes.
- The interviews conducted had to adhere to the standards set by the World Health Organization (WHO) for keeping participant information private and confidential
- During recruitment, participants were told the reasons for the study and were informed that their participation was voluntary.
- During the interviews, the participants were treated with respect; when they were unwilling to respond to specific questions, this choice was respected.

3.11 Conclusion

This chapter presented the philosophical assumptions underlying research methodology, data collection and data analysis techniques used in this study. Data was collected by means semi-structured interviews. All the procedures followed

during the interviews were also presented. Appropriate methods and techniques of research methodology were selected in order to answer the research questions that were formulated and presented in Chapter 1 of this study. The concept of this chapter is defined as a plan and structure that enables data to be collected for analysis. Moreover, the reasons for selecting three case studies were delineated. This chapter also covered the concept of ethical considerations which were adequately addressed prior to completing this study. The next chapter presents the overview of the three cases that were used in the study.

CHAPTER 4

CASE STUDIES OVERVIEW

4.1 Introduction

Both businesses (organisations) and individuals are involved in the delivering and accessibility (recipient) of healthcare services at different levels and locations. The languages used within some developing countries because of the diverse tribes make it often difficult to adequately deliver or receive the services which are provided by some healthcare organisations. This is so because a particular language, such as English, as in the case of South Africa, is the prevalent language of communication. This research aimed to develop a framework which could be used to guide the selection and implementation of mobile systems in the translation of language semantics for improved healthcare service delivery.

According to Nemutanzhela and Iyamu (2016:106), "Many of the recipients of healthcare are sometimes hesitant to visit the facilities mainly because of the language barrier". They often feel that they cannot express themselves in the language of their first choice, and therefore limit their interactions with the healthcare service providers. The study, therefore, aims to address the following issues:

- i. From a language semantics perspective, to examine and understand the factors that hamper the services of healthcare in South Africa.
- ii. To establish the factors which influence the selection and use of mobile systems for language semantics for South African healthcare organisations.
- iii. To examine and understand how mobile systems can be employed in multi-language translation to improve the delivery of healthcare services to communities in South Africa.

Within this objective, three case studies were employed as follows: one of the cases is a community, focusing on its members (people who require and receive healthcare services); the second case is a government hospital (rendering services to the community with a mandate to render this service to *all* members of the community); and the third case is a non-government hospital (with a mandate to render services to those who cannot afford healthcare and yet suffer from chronic conditions). Also, five of the nine official languages (English, isiZulu, Sepedi, Tshivenda and Xitsonga) were used in the study. This was to ensure that there was ground for developing a more generalisable theory as it covers all entities involved in the healthcare service.

4.2 Conceptual framework

Figure 4.1 as shown below depicts the conceptual framework. This is a roadmap that elaborates how the study was conducted. The roadmap shows how the researcher carried out the study from articulating the aims and objectives to when the objectives were addressed and achieved through the development of a framework.

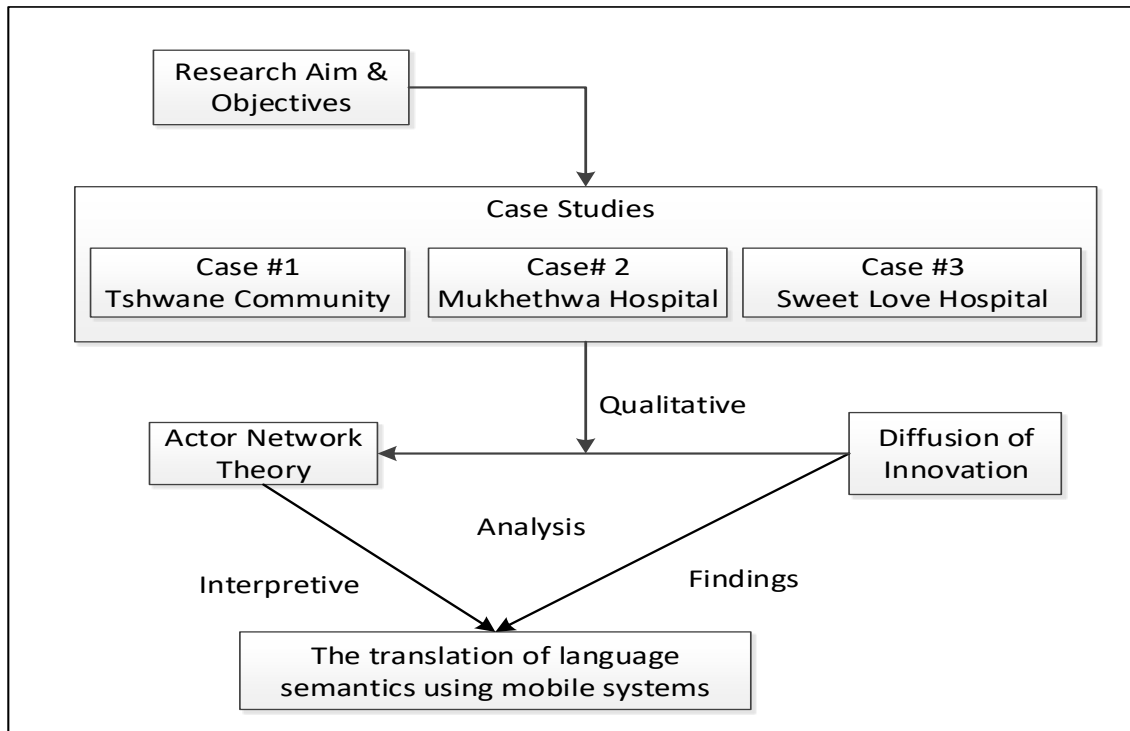


Figure 4. 1: Conceptual Framework

This study was driven from the aim and objectives that the researcher wanted to address. Thus, the aim was to develop a framework that could be used for the selection of mobile systems in translation of language semantics. In order for the aims and objectives of the studies to be achieved, three case studies were identified as elaborated on the framework above to be used as cases of this study. The study followed a qualitative approach as discussed in detail in chapter 3, two theories were used as a lens to analyse the data. The findings from the analysis were interpreted and a framework from the interpretations was introduced for this study.

□ The Cases

- **Case #1: Tshwane (Pretoria)** community was used because the community is dominated by Tshivenda and Sepedi speaking people
 - Why?
 - To explore the language semantics translation, the Tshivenda and Sepedi languages will be used.

- ❑ **Case #2: Mukhethwa Hospital (MH)** was used because they treat and engage with both Tshivenda and Sepedi speaking community members.
 - Why?
 - To explore the language semantics translation when healthcare providers interact with community.
- ❑ **Case #3: Sweet Love Hospital (SLH)** was used because they treat chronic community members who regularly need to be informed of upcoming visits and medication refills.
 - Why?
 - To explore the language semantics translation, they presently receive notifications in only one language.

4.3 Fieldwork

The approach of the fieldwork is based on the research methodology as presented in Chapter 3. This section discusses, separately, the two sites used in the research. The discussion focuses on the processes through which data was gathered in these three case studies.

The fieldwork took place within the premises of the organisations, where semi-structured interviews were used to conduct interviews and gather relevant data. For the healthcare institutions, data was gathered in both the information technology (IT) and business divisions of the organisations. Each of the organisations had a product and service unit on which the data focused. From the community, members (literate and illiterate; different age groups; different genders) were interviewed at different health centres, churches and at schools. The number of people interviewed was met on the point of saturation.

Interviews were conducted with employees at both organisations, Mukhethwa Hospital and Sweet Love Hospital. For the community at Tshwane, individuals from different age groups were interviewed. The interview sessions began with the introduction of the study objectives, including the scope, to avoid distraction and later clarification. Thereafter, the researcher explained the non-disclosure of interviewee personal details. This approach was adopted in the beginning of each interview in order for the interviewee to be comfortable to freely express knowledge and opinions. However, the interview was treated as more of a conversation than a formal, rigid interview.

With the permission of the interviewees, all interviews were tape recorded and later transcribed in a Word processing application. The interviewees were allowed to confirm the transcribed interview. When quoting from individual interviews, the following standard referencing method was employed: an abbreviation of the organisation pseudonym is used in the beginning of the interview as identification, followed by the title of the interviewee, followed by page and line numbers in the transcripts from where the quotation is extracted. Each participant in the case studies was labelled: in the Tshwane community, as TC01 to TC18; in the Mukhethwa Hospital as MH01 to MH11; and in Sweet Love Healthcare as SLH01 to SLH18.

4.4 Case #1: Tshwane Community

4.3.1 Overview

As stated in public domain (<https://en.wikipedia.org/wiki/Pretoria>), "Pretoria is situated the northern part of Gauteng Province, South Africa. It is the capital city of Gauteng, while South Africa has and three capital cities in total, it serves as the executive (administrative) and the national capital; the others are Cape Town, the legislative capital, and Bloemfontein, the judicial capital. Pretoria is divided into three sections: west, east and north, relative to the central business district. Pretoria is contained within the City of Tshwane Metropolitan Municipality as one of several constituent former administrations (among which also Centurion and Soshanguve). Pretoria itself is sometimes referred to as "Tshwane" due to a long-running and controversial proposed change".

Below is the Pretoria (Tshwane) Municipality map:



Figure 4. 2: Soshanguve Municipality Map

Sourced from Tshwane Maps & GIS (2018)

It was named Pretoria after the Voortrekker leader Andries Pretorius and in 2011 as a South Africa's Gauteng provinces. In South Africa, Pretoria is famously known as the Jacaranda City due to the thousands of Jacaranda trees planted in its streets, parks and gardens. As per SABmmC education (2008), the Southern Transvaal Ndebele occupied the river valley, which was to develop the location of the city of Pretoria by around 1600.

This capital city was discovered in 1855 by Marthinus Pretorius, a leader of the Voortrekkers, who named it after his father Andries Pretorius. After his victory over the Zulus in the Battle of Blood River the elder Pretorius had become a national hero of the Voortrekkers. Andries Pretorius also negotiated the Sand River Convention (1852), in which Britain acknowledged the independence of the Transvaal. It became the capital of the South African Republic (ZAR) on 1 May 1860. The founding of Pretoria as the capital of the South African Republic can be seen as marking the end of the Boers' settlement movements of the Great Trek.

Beyond apartheid government

After the creation of new municipal structures across South Africa in 2000, the name 'Tshwane' was adopted for the Metropolitan Municipality that includes Pretoria and surrounding towns (City Press, 2013).

This information was extracted from Wikipedia: (<https://en.wikipedia.org/wiki/Pretoria>) "Pretoria is situated approximately 55 km (34 minutes) north-northeast of Johannesburg in the north-east of South Africa, in a transitional belt between the plateaus of the Highveld to the south and the lower-lying Bushveld to the north. It lies at an altitude of about 1,350 m (4,430 ft) above sea level, in a warm, sheltered, fertile valley, surrounded by the hills of the Magaliesberg range.

Depending on the extent of the area understood to constitute "Pretoria", the population ranges from 500,000 to 2.950 million (Climate Statistics for Pretoria, South Africa, 2012). According to tshwane.gov.za. (2014) the main language spoken in the Pretoria is Afrikaans; also, widely spoken are Pedi, Sotho, Tswana, Tsonga, Tshivenda, Zulu and English. The city of Pretoria has the largest white population of anywhere on the African continent. Since its founding it has been a major Afrikaner population centre, and currently there are roughly 1 000,000 Afrikaners living in or around the city".

Even since the end of apartheid, Pretoria itself still has a white majority, albeit an ever increasing black middle-class. However, in the townships of Soshanguve and Atteridgeville blacks make up close to all of the population. The largest white ethnic groups are the Afrikaners and the largest black ethnic groups are the Northern Sothos.

However, for the purpose of this study the community from which the data will be collected will be the Soshanguve community due to the fact that most of the people who stay there comes from either the Sotho, Shangaan, Venda or Nguni people.

Soshanguve Township

Soshanguve known as a township, is approximately 25 km north of Pretoria in Gauteng, South Africa. In 1974 this township was established on land scheduled to be incorporated into a Bantustan bordering on Mabopane in Bophuthatswana, to Sotho, Shangaan, Nguni and Venda people (thus the name) who were emigrated from Atteridgeville and Mamelodi townships, it was the same region. Aftrewards Soshanguve became part of the City of Tshwane Metropolitan Municipality. The merge made the diversity of spoken language and culture of people who stays at Soshanguve to be big.

Soshanguve is home to the Tshwane University of Technology, previously known as Technikon Northern Gauteng (TNG). The second fab lab in South Africa is located in Soshanguve Block TT where it is operated by a self-organised group of unemployed youth known as the Bright Youth Council. This is how the map of Soshanguve looks:



Figure 4. 3: Soshanguve Township Map

Sourced from Tshwane Maps & GIS (2018)

Table 4. 1: Soshanguve language demographics

Language	People	Percentage
Sepedi	112359	28.20%
Setswana	66518	16.70%
Xitsonga	59976	15.05%
isiZulu	54099	13.58%
Sesotho	31978	8.03%
isiNdebele	26965	6.77%
Tshivenda	10437	2.62%
SiSwati	9446	2.37%
English	8047	2.02%
isiXhosa	7412	1.86%
Other	7338	1.84%
Afrikaans	2438	0.61%
Sign language	1381	0.35%
<i>Not applicable</i>	4769	

This information was extracted from public domain: (<https://ipfs.io/ipfs/.../wiki/Soshanguve.html>) “FaithMed Ambulance Aid head offices are based in Soshanguve 111 block W. The company is owned by Rendani Ralidzhivha, who founded the company at the age of 24 on the 10th August 2016. The main aim for the company is to make sure that those who don't have a Medical Aid will still be able to access the private ambulance service at an affordable cost”.

However, Soshanguve does not have any public hospital; they have big clinics and a private hospital. Those who need major services at Soshanguve need to be transferred to Tshwane City to a different hospital for better care or advanced healthcare services.

The impact of a patient transfer or a referral from clinics to a hospital plays a major role in the spoken language and how semantics are used. The Soshanguve community is facing these challenges when they are referred to a hospital in Tshwane City, were frequently the lingo or the semantics of language translation used by health practitioners in town is not the same as the ones that they use. Hence, this was identified as a case study in order to understand by examining the challenges that this community faces with the translation of language semantics when they engage with different healthcare sectors in South Africa.

4.4 Case #2: Mukhethwa Hospital

South Africa has both private and public hospitals. Public hospitals are funded by the Department of Health funds public hospitals in South Africa. The majority of the SA patients use public hospitals in which a nominal fee is payable by patients, at an average of R45 to R75. The patients' point of entry is usually through primary healthcare (clinics) run by nurses. The next level of care would be district hospitals which have general practitioners and basic radiographs. The next level of care would be regional hospitals which have general practitioners, specialists and ICUs, and CT SCANS. The highest level of care is tertiary which includes super specialists, MRI scans and nuclear medicine scans.

Private patients either have healthcare insurance, known as medical aid, or have to pay the full amount privately if uninsured. However, a public hospital or government hospital is a hospital owned by a government and therefore receives government funding. In some countries, this type of hospital provides medical care free of charge, the cost of which is covered by government reimbursement.

4.4.1 Overview

Mukhethwa, selected for the purpose of this study, is a government/public organisation which provides comprehensive healthcare services, including HIV, AIDS and TB-related treatment, care and support services. Mukhethwa Hospital is an accredited antiretroviral (ARV) treatment initiation and on-going treatment site. They refer patients to Steve Biko Hospital for further treatment. Daily meals are provided to inpatients and always have social worker onsite to assist people in applying for social grants, identity documents and birth certificates. Mukhethwa Hospital runs a weekly support group for TB and HIV-positive patients, as well as providing assessments and referrals for people with mental health issues. They perform medical male circumcisions and also offer youth, men and LGBTI-friendly services. Moreover, they provide maternity services for pregnant women which include short-term admissions for up to 24 hours post-delivery. Counselling is provided before referring survivors of abuse and rape for further assistance. Mukhethwa Hospital operates 24 hours a day, 7 days a week, rendering services for free.

Historical overview

This information about the Mukhethwa hospital was extracted from public domain: (https://wikivisually.com/wiki/Kalafong_Hospital) "Mukhethwa Hospital is a public hospital in Pretoria, Gauteng, serving an estimated 2 million people. The hospital,

built in March 1973 to service the large black population, is situated on the western outskirts of Pretoria in the suburb of Atteridgeville. The University of Pretoria uses the hospital as a training institution for the Faculty of Health Sciences. Construction commenced in 1965, with patient treatment commencing on 1 March 1972. On 9 March 1973, the Honourable Mr Sybrand van Niekerk, then Administrator of the Transvaal, officially opened the hospital.

Atteridgeville is a diverse township with many places of interest and a wide variety of cultures and languages. According to a 2011 census, the most commonly spoken language is Northern Sotho (Sepedi), followed by Tswana and Sesotho:

Table 4. 2: Atteridgeville Demographics (Census, 2011)

Language	People	Percentage
Sepedi	26236	41.38%
Setswana	10566	16.67%
Sesotho	7823	12.34%
isiZulu	4550	7.18%
Xitsonga	4412	6.96%
Tshivenda	2299	3.63%
isiNdebele	2149	3.39%
English	1632	2.57%
isiXhosa	1204	1.90%
SiSwati	896	1.41%
Other	803	1.27%
Afrikaans	438	0.69%
Sign language	390	0.62%
Not applicable	1027	

Mukhethwa Hospital is situated in an area where there is great diversity of language and culture. Therefore, we chose this hospital to explore the language semantics translation when healthcare providers interact with a community”.

4.4.2 Organisational structure

Below is Mukhethwa structure:

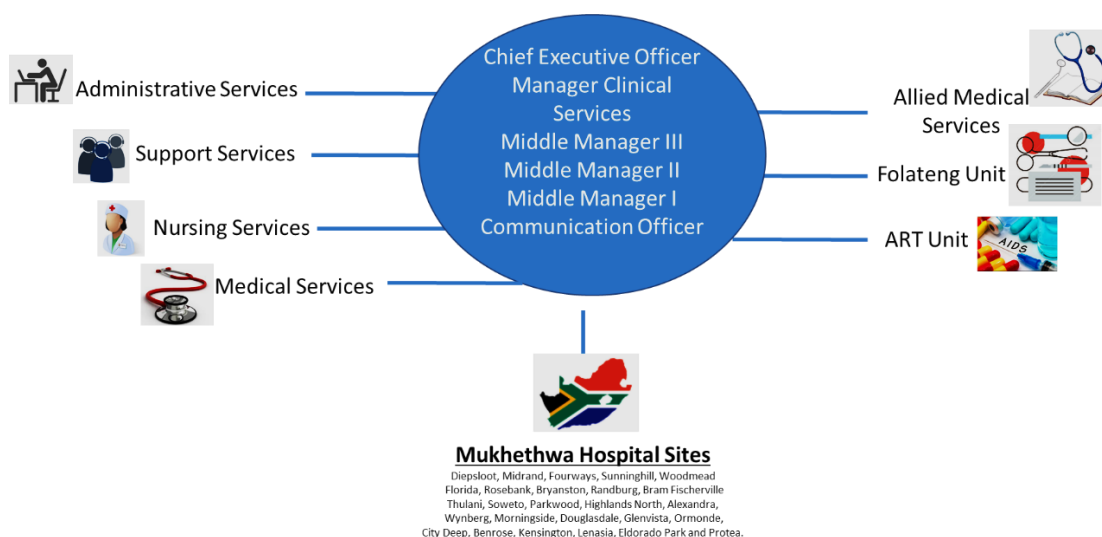


Figure 4. 4: Mukhethwa organogram

Sourced from Mukhethwa Intranet (2017)

Table 4. 3: Mukhethwa workforce demographics

Roles	Staff
Administrators	1653
Doctors	139
Nurses	1236
Pharmacists	24
IT Personnel	38

In low and middle-income countries, a hospital is often the first stop for citizens who experience illness, or the last stop when their health needs aren't met by primary care. And as countries grow economically, the demand for quality health services at all levels will grow.

4.5 Case #3: Sweet Love Hospital

On the organisation's website (<https://masterpublichealth.com/non-government-organizations/>), it is stated as follows: "In the field of public health, the term 'non-government' is frequently used to describe organisations that participate in the delivery of public health services. The acronym NGO (for non-government organisation) was originated in the early days of the United Nations to describe organisations that are funded by a government but maintain a non-government

position. Today, the acronym NGO is used to describe any type of private organisation or charity that is non-profit and free from government control.

Many government services and programmes have been privatized in the past decade, leading to dramatic growth in the size and activity of NGOs. According to the Urban Institute [External link](#), there are currently about 1.5 million non-profit organisations in the United States, an increase of 25% since 2001. Non-profits are a major U.S. employer, accounting for about 10% of all jobs in 2009.

Virtually all community-based health programmes are run as NGOs. These provide a wide range of services including free medical and dental clinics, free immunization programmes and AIDS prevention programmes. There are also NGOs that focus on specific health issues. The American Cancer Society [External link](#) is an example of a national health organisation that educates the public, conducts lobbying efforts and funds research to address a major health problem. Other examples include the American Lung Association (ALA) [External link](#) and the American Diabetes Association (ADA) [External link](#). The American Red Cross [External link](#) performs specific healthcare services including donor blood collection and disaster relief services.

Some NGOs use information technology to provide health data management systems and data analysis that can be used in the formulation of healthcare policy. The Colorado Health Institute [External link](#) (CHI) is an example of an informational NGO that serves state leaders and policymakers. CHI provides publications, satisfies requests for information, and performs policy analysis on topics that include community health, the healthcare workforce, health insurance and the healthcare safety net.

As the cost of healthcare rises, the percentage of the population that is underserved continues to grow. Many MPH graduates find employment with national and international NGOs as advocates who develop healthcare policy and lobby for healthcare reform”.

4.5.1 Overview

Sweet Love Hospital (SLH) is a non-government hospital with the sole key responsibility of providing tertiary healthcare services to the community of Gauteng. In

order to achieve this responsibility, the hospital relies heavily on the commitment and competency of its ethical and naturally caring employees.

As stated on the organisation's website (<http://www.righttocare.org/>), "Sweet Love Hospital, re-named on 1 April 1997, to reflect the transformation in the country since the advent of democracy, is a tertiary hospital, part of the Wits University circuit responsible for teaching healthcare workers and the provision of tertiary health services.

The hospital provides services to a region with a population of about 1 million. Their catchment area is mainly Region B of the Johannesburg Municipality extending to some parts of Region C and D, serving the medium to low income segment of the population.

The SLH consists of a total 21 (twenty-one) in-patient wards, the majority of which are medical wards (eleven including two admission wards), six surgical wards, two of which are orthopaedic wards; a psychiatric unit; a 10-bed ICU, a 12 bed-high care/step down unit; a theatre complex comprising of twelve theatres, nine of which are functional; speciality clinics including a stoma unit, renal dialysis unit, pain clinic, endoscopy unit, breast clinic, the TB focal point and the HIV clinic.

The total number of staff is 1886, with the nurses being the majority at 878 as is the norm for hospital healthcare organisations. Other staff categories are as follows: doctors 220, cleaners 149, and porters 45. They also have allied health and support staff on hand. These staff numbers fluctuate based on new additional staff, resignations and retirements.

Payments

Sweet Love Hospital is a non-government hospital; therefore, services are free to pregnant and breastfeeding women as well as children under the age of six. Other citizens are charged according to government hospital rates.

4.5.2 Services

Sweet Love Hospital, as a non-government hospital, provides a comprehensive healthcare service which includes HIV and TB-related treatment, care and support services. Sweet Love Hospital has a community-oriented primary healthcare programme that monitors and proactively works towards the improved health and

well-being of families in the area. Sweet Love Hospital provides HIV counselling and testing (HCT) and, if necessary, does a further test to determine the patient's CD4 count. Furthermore, Sweet Love Hospital is an accredited antiretroviral (ARV) treatment initiation and on-going treatment site. Sweet Love Hospital refers patients from clinics to the hospital if they require further medical treatment.

Sweet Love Hospital serves daily meals to inpatients and distributes fortified porridge to underweight outpatients. It also runs daily support groups for PMTCT, TB, chronically ill and HIV-positive people. A social worker is available to help people apply for social grants, identity documents and birth certificates. Sweet Love Hospital provides home-based care services for sick people, support for vulnerable family members and assessments and referrals, rehabilitation programmes and therapy for people with mental health issues. On top of this, Sweet Love Hospital offers abuse, rape and domestic violence victim support services, performs medical male circumcisions (MMC), and offers treatment for opportunistic infections and maternity services for pregnant women which include short-term admissions for up to 24 hours post-delivery. Sweet Love Hospital operates 24 hours a day, 7 days a week, with services for free”.

Sweet Love Hospital deals with patients who have chronic conditions and regularly need to be informed of next visits and medication refills. Consequently, communication plays an important role in this type of interaction. This is why the hospital was selected to explore the language semantics of translation they experience in receiving notifications in only one language.

Organisational structure of Sweet Love Hospital

The organisation is structured into divisions and units, as shown in Figure 4.3 below. The discussions that follow the figure provide more information on each of the divisions and units.

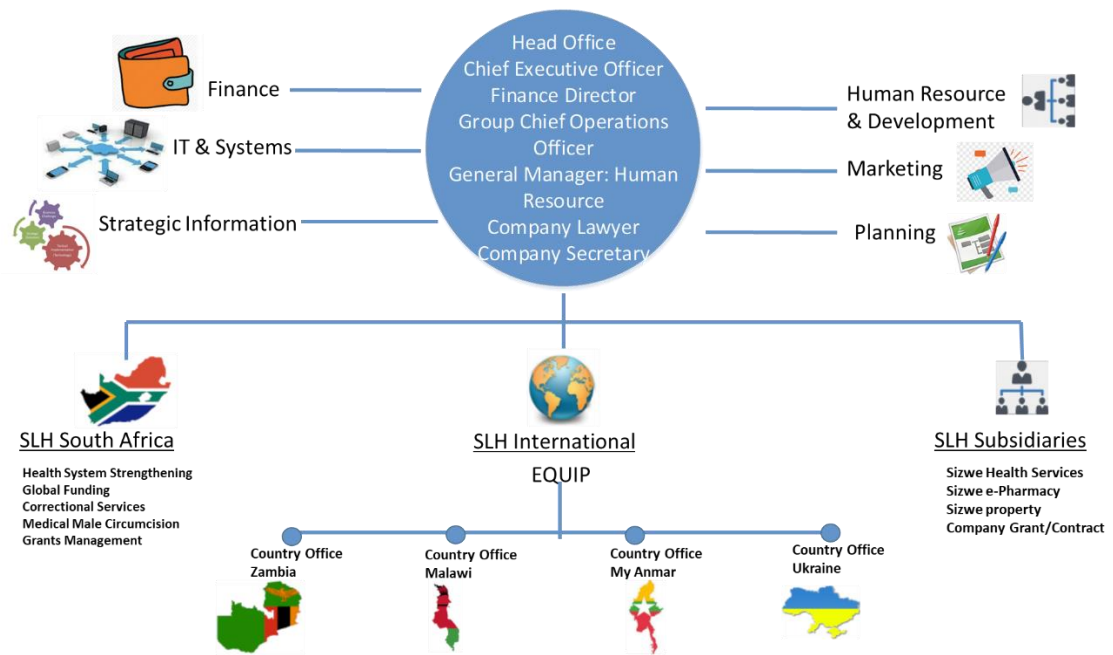


Figure 4. 5: Organisational structure of Sweet Love Hospital

Sourced from Sweet love hospital documentation (2016)

Table 4. 4: Mukhethwa workforce demographics

Roles	Staff
Administrators	1002
Doctors	58
Nurses	764
Pharmacist	16
IT Personnel	24

4.5.3 Organisational structure breakdown

1. Chief Executive Officer

The first building block of Sweet Love Hospital is the Chief Executive Officer (CEO), the most senior position in the organisation. The position is filled by the founder of the organisation. His role is to ensure that the company achieves its strategic objectives and he provides leadership and direction to staff as well as while aiming to develop and deliver on the company's strategic plan in the most effective and efficient manner.

He is accountable for the overall performance of the company and for the day-to-day running and management of the company's business under delegated authority from the board. The CEO reports to the shareholders.

2. Manager Clinical

Even though the hospital has seven components, the component that we are most interested in is the administrative services components as is the one that speaks to all other components of the hospital, as elaborated below.



Figure 4. 6: Administrative services of Sweet Love Hospital

Sourced from Sweet love hospital intranet (2016)

Sweet Love Hospital is committed to the highest ethical principles. Essential to its continued success is its commitment to honesty and integrity. The culture encourages professionalism in all our operations, which have formed the backbone of the corporate governance structures. Sweet Love Hospital applies the King III principles where relevant in order to measure and achieve good governance, with the board and numerous medical and technical sub-committees guiding in sustainability, risk, and future growth.

4.6 Conclusion

So far, this chapter has given the background and overview of the case studies selected for data collection. Now that the background of the two cases has been demonstrated and understanding of how these three cases fit with the study, the next chapter will demonstrate how the data collected from these case studies were analysed.

CHAPTER 5

DATA ANALYSIS

5.1 Introduction

This chapter presents the analysis of data towards achieving the aim of the study, which was to develop a framework that can be used to guide the selection and implementation of mobile technologies in the translation of language semantics for healthcare service delivery. This chapter is divided into five main sections. The first section provides an overview of the analysis. The three sections that follow present the case-by-case analysis of each case study, respectively. The final section draws a conclusion to finish the chapter.

5.2 Overview of the analysis

Based on the aim of the study as stated above, three cases were employed in the study, as shown in Figure 5.1. The cases include: Case #1 (Tshwane Community (TC)); Case #2 (Sweet Love Hospital (SLH)); and Case #3 (Mukhethwa Hospital (MH)). Cases #2 and #3 are health facilities. Case #1 is a community comprised of different ethnic and tribal groups. Case #2 is a public hospital. Case #3 is a non-government organisation (NGO) which provides healthcare services to communities in South Africa. The three cases are discussed in detail in Chapter 3.

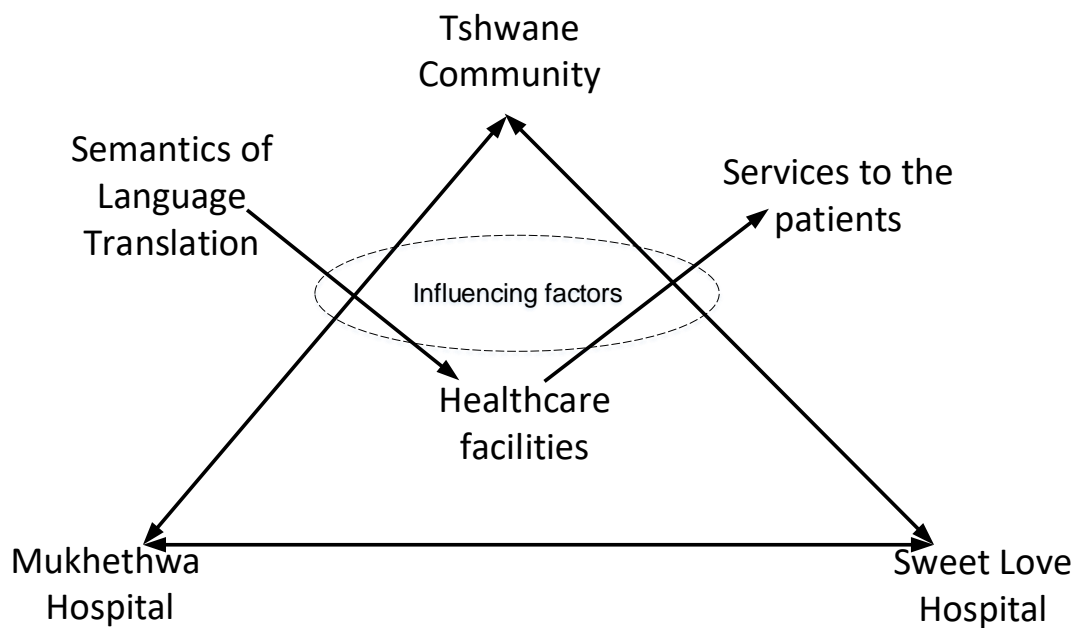


Figure 5. 1: Case study data collection overview structure

As shown in Figure 5.1, the three cases have common goals, to provide and receive healthcare services. However, the ways in which these services are provided and/or received are influenced by various factors. This is the focal point of this study, which is clearly stated in the research objectives, as presented in Chapters One and Three. The analysis was carried out using the hermeneutic approach within the interpretative paradigm, which was guided by two theories ANT and DOI. 76In achieving these objectives, these two theories, Actor Network Theory (ANT) and Diffusion of Innovation (DOI) were employed to guide the analysis of the data retrieved from the cases for the purposes of this study. Both theories, ANT and DOI, are discussed comprehensively Chapter 2.

Two theories were employed to underpin the study mainly because of the vast and comprehensiveness of the study. Realising the objectives of the study was not going to be an easy task is only a single theory was applied. ANT helps to understand how actors operate and how networks are formed, as well as the interaction and relationship of the actors within heterogeneous networks. These factors are critical to gaining better understanding of how healthcare services are provided and received as influenced by semantics of language in the South African context. However, ANT does not focus on diffusing the technology, which is a vital aspect of this study in understanding the role and influence of mobile technologies in the translation of language semantics. Therefore, DOI was deployed to examine how mobile technology solutions could be diffused to address the challenges of translation of language semantics in providing and receiving healthcare services.

Only one theory, ANT, was applied in the analysis of data from Case #1. This is because no diffusion of technology takes place in the case. Both theories, ANT and DOI were applied in the other two cases, SH and SLH. Of the two theories, ANT was applied first, followed by DOI. Iyamu (2013) discusses the criticality of order-of-use when theories are combined in a study, which assists to maintain logical flow and for methodological value. This was mainly because it was critical to establish and understand which actors are involved, including how heterogeneous networks are formulated. This helps with perspectives and relevance in terms of how technology diffused within the environment is providing and receiving healthcare services. It was also crucial to first understand both human and non-human actor interaction, and relationships between the actors involved in all three case studies. A detailed rationale is discussed in Chapter 3.

The analysis was carried out separately, but the findings were combined for interpretation towards the aim of the study, which was to develop a framework for the translation of language semantics using mobile technology with the goal of improving healthcare service delivery. The analysis began with the case of Tshwane community, followed by Mukhethwa Hospital and then Sweet Love Hospital.

As discussed in Chapter 4, there were 18, 10 and 14 participants from Cases #1, #2 and, #3, respectively. The participants were labelled as follows: (i) Case #1: TC01 to TC18; (ii) Case #2: SH01 to SH10; and Case #3: SLH01 to SLH14. It was imperative to ensure anonymity and confidentiality of the participants. Thus, for the purpose of the analysis, each of the participants was labelled, and a referencing format was adhered to as follows: case name, participant label, page number and line number. For example, TC01, 4:15-17 indicates participant number 1, page 4 of the interview transcript, and line numbers 15 to 17 of the document.

5.3 Case #1: Tshwane Community

As established in Chapter 4, for the purpose of the study Tshwane Community members from the Soshanguve Community were involved as participants. For conducting qualitative data analysis of TC case, four moments of translation of the Actor Network Theory were used as a lens. In this case, ANT was the only theory applied because the case did not relate to the diffusing of technology, but rather on the relations formed.

5.3.1 Actor Network Theory

ANT treats both human and non-human actors equally (Tatnall, 2012). Human actors are not necessarily superior to non-human actors just because they are humans. Both human and non-human actors were required in the semantics of language translation using mobile systems in South African Healthcare. ANT has been covered in detail in the literature review (Chapter 2).

Before analysing the network of the Tshwane community, the first question to be addressed was what and who makes up TC. In terms of ANT perspective, it's the inter-definition of actors. Two categories of entities were identified as heterogeneous entities (Actors and Networks). The section below illustrates the human actors as well as the non-human actors as per Tshwane community case study.

Actors at Tshwane community

In Actor Network Theory, actors are both human and non-human (O'Connell, Ciccotosto & De Lange, 2014). Also, the actors are treated equally in ANT. In the community of Tshwane, the actors that existed are discussed as follows:

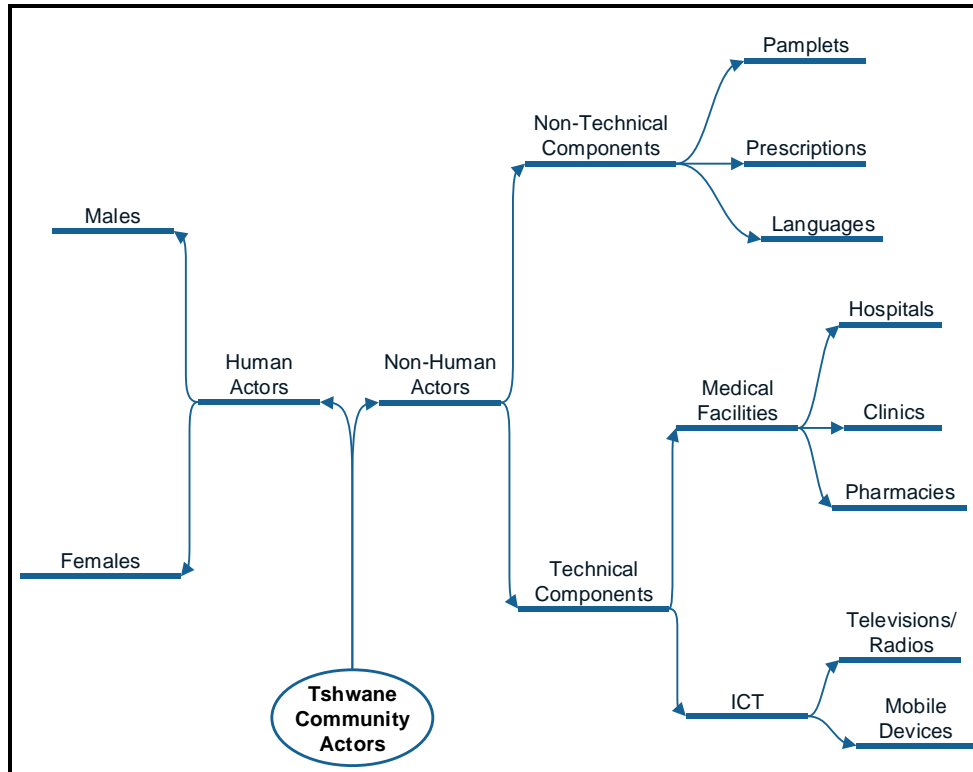


Figure 5. 2: Tshwane Community actors

Human actors

The human actors in the community of Tshwane included both males and females of various age groups. These actors were from different ethnic and cultural backgrounds, and spoke different languages, encompassing of Tshivenda, Xitsonga, Isizulu, Sesotho, Sepedi and Xhosa. The ages of the actors were between twenty-two and sixty-five years.

Non-human actors

Non-human actors do not reason like human actors, but they are able to perform what they are directed to do (Sekgweleo & Iyamu, 2014: 163). The non-human actors include healthcare facilities (hospitals and clinics), pharmacies, mobile phones, pamphlets, billboards, televisions, radios and computers. "With regards to going to the clinic most of the time is that you get pamphlets there or you can ask the information" (TC07, 18:518–519). In recent years, some health facilities have

improved their methods of sharing information and communicating with the patients. According to one of the participants TC07, (18:519– 520), “I was very excited when one of the medical aids service providers announced that video conferencing will henceforth be used for consulting”. This means that the actual physical presence of patients with healthcare providers will no longer be mandatory. This was well-received by many patients, especially for those who are physically challenged or seriously ill, making movement near impossible.

Networks

In ANT network consist of actors, such as people, organisations and standards of the aligned interest (Callon, 1986). Also, networks can be heterogeneous within social systems (Law, 1992). At the Tshwane Community, there were various networks of people, some formed on the basis of spoken language, age group, cultural affiliation, religion affiliation and health challenges.

Several networks of people who spoke the same language, such as Tshivenda, Xitsonga, Isizulu, Sesotho, Sepedi or Xhosa, were unconsciously formed. These people groups shared information and ideas and communicated on matters of common interest using their native language, which encompasses different semantics. Also, they shared information and communicated using technologies such as mobile phone and social media services.

Some of the community members were part of many networks, through which networks were formed within networks, creating heterogeneity of networks. For example, some of those actors who speaks Tshivenda, a network, were part of another network of people with chronic conditions, such as kidney failure. One of the elderly women who participated in the study stated that “in most cases, I share 00 appointment periods with people who speaks Tshivenda, which makes it easy for us to interact and share our health challenges and experiences” (TC15, 39:1142-1143). Similarly, some members of the community were at the same time in three different networks, such as Sepedi-speaking, religious affiliation and medical condition.

Due to the linguistic nature of some of the actors with the ability to speak many languages, these were part of various groups. This creates heterogeneous networks within the community. According to TC08, 21:604-607, “English is often used at most of the hospitals, hence I use it often. But I can also speak Tswana or Sotho are used as medium of communication, which I also speak”. These heterogeneous networks were formed because of the cultural and Christian beliefs shared amongst the

different actors who speak the same language. This heterogeneity of networks increases the semantics of language to be critiqued and was significant to many people within the community.

The importance of the heterogeneity of the networks includes the fact that some actors were able to bridge the communication and language barrier themselves and between other actors through interpretation of the spoken languages of others. From an English language perspective, the actors acted as interpreters to those who were illiterate or were not fluent in the language that was being used as a medium of communication at the time. The scenario is that, "Doctors come with a nurse who speaks the same language as I do, who then interpret my narrative of my circumstances to the doctor" [sic] (TC16, 41:1224-1225). This type of scenario made many patients more comfortable with understanding, removing the fear that they will be misunderstood, which is likely to lead to wrong diagnosis or medications.

Other networks were formed along cultural affiliations. These groups of people were divided along their individual cultural affiliations. This was because they shared common interests in how they adhere to and abide by their culture. Thus, they were guided by their culture on areas such as how they greet, communicate and share information among themselves. For example, it is a cultural belief of the Venda people (Tshivenda) to first consult among themselves and their traditional healers before visitation to health facilities. Two main differing beliefs and religious groups, Christianity and traditionalism, were prevalent in the Tshwane community at the time of this study.

The traditionalists visit the native doctors (Sangoma) for consultations and treatment. This is their belief and tradition to do so. This groups of community members only made use of the health facilities as a last resort, meaning the physical condition has deteriorated, and they basically have no other choice. In some instances, they are taken to the health facilities by relatives or friends due to the worsened condition. According to one of the participants, TC18, 47:1402-1404, "our family believes to first consult native doctors, before visiting the English doctors".

The group of Christians made use of the health facilities either for themselves or to provide support to the patients. This they did by constantly visiting and providing counselling to patients at different hospitals. "I often visit health facilities in support of the sick as is part of our Christian practices to counsel and be with the sick" (TC17, 42:1255-1257). This type of scenario made patients feel loved and supported,

especially those who did not have relatives coming to visit them. The Christian groups also played the role of friend and family for those patients.

Some of community members of Tshwane formed networks in accordance with their health challenges or diagnoses, such as diabetes, kidney failure and high-blood pressure. These health relationship groups happened whether consciously or unconsciously. The conscious group contained those patients who enrolled themselves in support groups relating to the illnesses, while unconscious groups contained those patients who started mingling and interacting because they had to attend check-ups of treatments at the same time due to their similar illnesses. “My regular visits to hospital makes me interact with those who are suffering from kidney failure as we go for dialysis on the same slot” (TC15, 38:1103-1104).

The community members were divided into different groups: literate and illiterate, male and female, old and young. These groupings happened both consciously and unconsciously among the members of the community. Groups of literate people, consisting of both males and females, made use of the internet facility to access medication information. According to one of the participants, “I use the internet first to consult before seeking clarity, which I rely on my relatives who work and health facilities to elaborate further” [sic] (TC10, 25:726-727).

Moments of translation

Translation is described by Callon (1986) as a process of alignment, where diverse interests of actors are channelled towards a common goal through negotiation. The process includes the following four stages: problematisation, interessement, enrolment and mobilisation (see Figure 5.3):

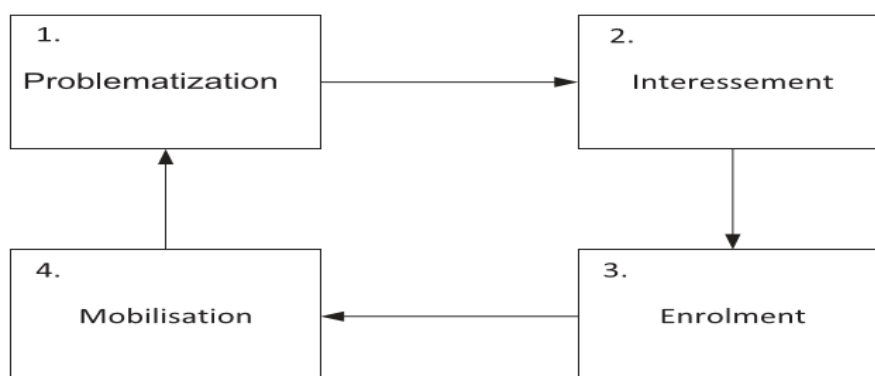


Figure 5. 3: Moments of translation adopted from Callon (1986)

Table 5. 1: Moments of translation

Problematisation	Interessement
<p>Tshwane community members have problematised healthcare services. Members of the community went to healthcare facilities seeking various services depending on an individual's need. Some of the community members only started requesting healthcare services after they were diagnosed, while others were just accompanying their relatives or friends. Also, some sought healthcare information on certain health related matters.</p>	<p>All members of Tshwane community were interested in the types of healthcare services that were provided to them, but from different perspectives. Some of the community members were directly affected. Others' interest was based on their relatives' needs. Also, interest of some members was influenced the types of information that they could access.</p>
Mobilisation	Enrolment
<p>Some of those members who participated in health-related activities of the community started making it their task to make sure other community members got the service. Those who are multilingual or understand the language better spoke on behalf of those who couldn't. Also, members who take chronic medications started supporting groups to make sure other community members were able to share their experience.</p>	<p>It was clear that not all members of the community who were interested in the healthcare services did receive or participate in health-related activities in the community. Community members who have chronic conditions participated. Those who needed normal or regular medical check-up also enrolled.</p>

Moments of translation: problematisation

Problematisation is the first stage of translation. At the Tshwane community, healthcare services were problematised. The problematisation of the healthcare included how the services were delivered and received and the manner in which they were delivered, such as attention to patients, nature of facilities, distribution of medication and the use of language for communication. One of the elderly men in the community who participated in the study asserted as follows: *“I have experienced a situation where I just felt the healthcare practitioners did not understand my health challenges, even though I tried to explain it several times”* (TC02, 3:81:82). Such misunderstanding could be attributed to various factors, which include language barriers as well lack of interest from the practitioner's perspective. The question was how did the patient know that he was not being understood? According to one patient (TC02, 4:85-87), *“I always suffer from ulcers and at times some healthcare practitioners even when you told them your health background, they just ignore that information and diagnose you for something totally different”*. These are some of scenarios where we find that patients end up being given wrong prescriptions. Some

of elderly participants referred to *cancer* as a wound when translated to their native languages; however, those who are in their youth and speak the same language as the elderly participants referred to an *ulcer* as a wound when translated into their spoken language. *“This names like cancer when you come to Tshivenda they are very difficult, because most of the time in our language cancer gets associated with a “wound” that does not heal”* [sic] (TC16, 41:1233-1236). The question will then be, what did the patient do after realising there was the problem? *“When it comes to issues like this, that’s when I go to my private doctor who always know my health condition”* (TC02, 4:87-88).

From different perspectives, actors within the community problematised the services which were provided to them by healthcare service providers. Some of the actors did so for themselves, and others did so on behalf of their families and relatives. The actors did so on behalf of their families and relatives for various reasons: (i) some of the patients were either too old or ill to speak for themselves; (ii) some were children who needed representation; and (iii) there was barrier in the spoken language that caused some patients and health practitioners to not understand themselves well enough, which impacted health services. Some of the participants briefly explained as follows: *“Most of the times I am not the one going for medical attention, I go there because I have a small child that I sometimes take to the clinics”* (TC16, 42:1252-1253). *“There are certain things that am unable to express them in other languages but can only express in my language”* (TC04, 13:36-37).

At Tshwane community, many of the participants emphasised the need for healthcare services. The actors do need and request for different types of healthcare services from the available healthcare facilities. According to one of the participants, *“I always visit a particular healthcare clinic in Tshwane on regular basis for my prescriptions Seven years ago, I was diagnosed with diabetes, a chronic condition”* [sic] (TC16, 40:1192-1193). The request for healthcare services was either for individual participants or their families. One of the community members explains how they normally visit the healthcare facility. According to one of the participants, TC17, 43:1292-1293, *“I normally take my little child to the clinic for various reasons, such as vaccination and flu”*.

There were different reasons why the community requested healthcare services. Some of the community members request for healthcare services only became a need when they were diagnosed with different infirmities, and others through regular visitation to healthcare facilities for routine check-ups. One of the participants said: *“I*

normally go for gynaecological consultations or taking my children” (TC03, 10:267-269). Few community members visited the healthcare facilities for religious purpose, to visit and pray for the patients. *“My Christian religious group and I do visit hospitals, to console and pray for patients”* (TC17, 43:1294).

Within the community of Tshwane, different actors had different types of needs for healthcare services, with most of the community members requesting the services because they were either diagnosed with a chronic condition or they needed general routine medical check-ups. According to TC02, 4:107-108, *“at the hospital you have to be diagnosed and they will also prescribe the medications for you, you don’t prescribe for yourself”* [sic]. Those actors who are part of the Christianity network visited the healthcare facilities as a means to fulfil some of their religious goals that comes with being part of that network, while for others, it was more about accessing information and gaining more knowledge about health-related activities.

In Tshwane community some actors required healthcare services after they were either diagnosed or went for regular check-ups or others for just seeking general healthcare knowledge and information. According to TC14 (34:974-977), *“I prefer to do my own research first of my diagnosis before consulting”*. The need for healthcare services was demonstrated by actors who stay in Tshwane. It was interesting to note that irrespective of where the actor stays or originates from, their healthcare needs were more or less the same.

Some of the Tshwane community human actors faced challenges due to difficulty understanding the language spoken by healthcare practitioners; for those who can only speak one language it becomes a mounting challenge as they will have to either depend on the healthcare practitioners to come with someone who can translate for them or bring a relative or friend along to the consultation. According to TC16 (42:1253-1256), *“We have a lot of uneducated people around our area, using language that they don’t understand, will require ways or tools to address it”*.

During this translation, some of the community members felt that the information, its meaning and importance, got lost in the translation process; the information they intend to communicate to the doctor and vice versa is not exactly translated or shared precisely as they intended. According to TC03 (11:301), *“The explanation of some terms are not translated correctly”*.

However, those actors who are bilingual share the same sentiments that because they understand both English and their own home language, they have realised that some of the words or terms once translated to their native language don't carry the same meaning as what they would in English language. According to TC16 (42:1268–1270), "*For example we have Tuberculosis (TB) in English, however when it's translated to Tshivenda it's called 'Lufhiya' or 'Luhotola' from semantics perspective, they mean different thing, in that if translated back to English they mean 'Flu' [sic].* The participants also showed the element of uncertainty where a doctor will require a nurse to translate, they are not certain if the information is being translated correctly as the patient would be someone who don't understand the spoken language and their semantics. "*We cannot really say, because the patient who need that translation doesn't understand English, so one will never know if it was translated properly or no*". (TC16, 42:1264-1266). From experience, another elderly male patient explained: "*The use of nurses as translators helps as those are people who have a knowledge and understand the medical terms*" (TC16, 42:1266-1268). This does not necessarily address the challenge as the impact continues to be detrimental to many patients.

Even though medical practitioners act as interpreters in most cases when the need arises, some of the Tshwane community actors still felt uncertain about the translation of language semantics. According to TC16 (42:1269), "*Just not sure if they also understand the semantics of those terms in their patient's language*".

Many of the challenges revealed above are primarily influenced by lack of interest. The challenges worsen in that the interests of practitioners are not measured or there are no guidelines to manage and monitor practitioners' responses to issues that are problematised by patients; even though there are codes of conduct, these do not cover or explicitly address interest, or lack thereof. In this context, *interest* can be considered as passionate expression of feeling towards execution of duty, for a favourable outcome. This is instrumental to relationship between practitioners and patients. Relationship enacts interaction, which in turn fosters understanding.

Moments of translation: *interessement*

The second stage in the ANT translation process is *interessement*. At this stage, the focal actor tries to impose its identity on other actors who have become part of the alliance thus far (Callon, 1986). Some of interests of community members from

Tshwane community were influenced by relationships they have with patients, their cultural and religious beliefs. Actors such as those who were diagnosed with chronic disease and are either literate or illiterate, not surprisingly became more interested in how the service was delivered by healthcare sectors. These actors were exposed to the interestment strategies, which can involve some compromise, persuasion and seduction in order to get actors interested in the roles proposed to them (Harry, Sewchurran & Brown, 2014).

The relationship between the community of Tshwane and healthcare facilities was defined by their types of interactions, communication and association. Different actors were involved and influenced the relationship between the community members and healthcare practitioners. The actors included illiterate and literate patients, patients' relatives and associates, religious groups and the devices that were used for communication and information searches. Some of the patients had direct, and others had indirect relationships with the healthcare practitioners. The relationship defines the various interest, which was based on the services that the healthcare facilities provides to the community.

Also, the interest informed how some members of the Tshwane community contacted and interacted with the healthcare facilities or accessed health information. Many of the patients visit the facilities only when they are critically ill; otherwise, they have no interest in the healthcare services that are available. Community members who have chronic conditions are interested in the services that healthcare facilities provides to them. Thus, they show interest in the communication that they get from healthcare provides concerning their medications and check-ups. According to TC11 (28:818-820), *“cellular phone text messaging helps me a lot as I sometimes forget that I need to collect my medication and I only remember when I get the text message to remind me for collection”*.

Interest of some community members was based on their relatives who had to access the services of health facilities. This was due to the fact that they had to act as language interpreters between patients and healthcare practitioners who could not speak or understand the same spoken languages. Other people were interested in how the medical practitioners communicate with their parents and grandparents, especially those who are illiterate. One of the community members explains: *“Most of the times if I have surgery appointment for an operation, I go with my daughter who have to experience (as a witness) and act as a language interpreter between me and the medical practitioners who speak different languages”* [sic] (TC16, 38:1107-1109).

Another type of interest was based on the fact that some of the people had to take their children (or other minors) or aged parents, who cannot speak or express themselves, to the facilities. Some parents are interested on the healthcare services on behalf of their children, to ensure that their children receive deserving care. *“I make myself informed through search engines of the information that is out there relating to children infections, because I have a small baby”* (TC06, 16:457-459).

Also, some of the community members were illiterate, meaning that they could neither write nor speak the facility’s official language, English. As a result, they needed assistance from relatives or associates to complete medical record forms on their behalf. According to one participant, *“I sometimes use sign language to demonstrate to the health practitioners what the problem is if I feel that I am failing to express myself”* (TC15, 37:1095-1096).

Moments of translation: enrolment

Enrolment is the third stage of the translation phase (Callon, 1986), requiring actors to participate (enrol) in an activity. At this stage, the actors accept the roles and responsibilities that were proposed or assigned to them by the focal actor. It is within this frame that many medical practitioners, such as nurses, carry out their tasks in addressing patients’ needs. Also, patients are expected to fulfil their prescriptive measure in the course of their illnesses.

Not everyone who is or was interested in patient well-being or improved healthcare participates in finding a solution. This is attributed to different factors, both conscious and unconscious nature. Also, participation was influenced factors such as lack of know-how and lack of facility. For example, there were no facilities which could enable improved distribution of chronic medications to patients in their various geographical locations, or technologies that could translate semantics in the languages that were spoken by many Tshwane community members.

Many community members participate in their own healthy well-being as prescribed by medical practitioners. For example, community members who are diagnosed with chronic diseases visit healthcare facilities regularly for follow-ups to renew prescriptions and collect new medications. According to one of the participants, TC16 (40:1196-1199), *“I always go for my follow-up visit, were they first check me, and then they write a prescription which it’s sent to a medical for my medications”*. The participants further indicated that they get informed once the medications have been

dispatched and they need to collect the medication. *“Once I receive a text message for my prescriptions, I then go and collect the medications at the nearest pharmacy or clinic that they have sent the medications to”* (TC16, 40:1178–1181). Other people go to quite an extent of researching about the symptoms before visiting the healthcare facilities: *“I usually first do my research, before I go see the doctor about what might be the problem I am having”* (TC01, 1:28-29).

Community members on chronic medications were required to repeat their scripts (medical prescriptions) on a regular basis, periodically, every month, three months or six months, depending on terms prescribed by the medical practitioners. Most importantly, it was vital for this group of people to understand how to read the communications, often sent to them via cellular phones.

In response and follow-up to the prescriptions, hospital visitation by appointment become very important in that the patients required medical check-up before the next monthly scripts could be issued. *“Depending on how you are responding to treatment, even chronic medications can be changed, visitations to hospital is required often for scripts renewal”* (TC02, 4:98-101).

The issue of culture plays a significant role in the Tshwane community because of the degree of understanding and compliance with treatment options recommended by healthcare providers who do not share their cultural beliefs. Some patients believe that a practitioner who doesn't give an injection may not be taking their symptoms seriously and some patients also retain their own perceptions of how some chronic diseases should be treated that is not necessarily how healthcare providers treat the diseases. According to TC15 (41:1213-1215), *“the times and my cultural background plays a big role when it comes to understanding or accepting diagnosis”*. The participant further stated that, *“Our culture some of things like depression or stress we don't as illness”* (TC15, 41:1216-1218).

Some community members often carry out a slow and deliberate search on health-related conditions and matters. This type of interest was drawn from previous unpleasant healthcare experiences. Some community members also carry out such research by attending information briefings and centres on behalf of their children and elderly parents. *“My passion for healthcare related matters drives me to acquire more knowledge about matters from healthcare practitioners”* (TC10, 26:736-737).

Based on the various types of interest, information was accessed and facilities were contacted through which interaction takes place and relationships were established among both human and non-human actors. Information was accessed through internet, radio and television channels, including pamphlets. The internet was accessed using mobile cellular phone and personal computers. *“I don’t follow one media channel, I prefer listening to the radio, or search on the internet”* (TC17, 46:1378-1377). This person also asserted that *“most of the time I prefer reading pamphlets and watching television to keep myself informed”* (TC17, 46:1378-1379).

Moments of translation: mobilisation

Mobilisation is the fourth and a final stage of translation. Here, the focal actor needs to continually convince the actors that their interests are still the same. At this stage, controversy no longer exists if there is support from the actors (Harry, Sewchurran & Brown, 2014).

Tshwane community members have established different spokespersons with the various healthcare facilities; these spokespersons differ depending on the case of each patient. Some of the patients are spokespersons themselves because they can understand and speak the language of communication, while other patients nominate their own spokesperson because of the language barriers (illiterates and old people); and still others rely on a spokesperson because they are minors and therefore need a parent or guardian to speak on their behalf.

As these spokespersons act on the interest of both the patient and the healthcare practitioners, they must make sure that the confidentiality between the patients and the healthcare practitioner is kept intact. The interest of both parties must be respected. According to TC15 (38:1110-1112), *“the health practitioner always emphasize on the part that we must come with someone we trust for translation if we have communication challenges due to languages used”*. In order for the patients to get the best services from their healthcare practitioners, it is required that their chosen spokespersons are properly able to represent them and will neither betray them nor breach their trust.

In some cases, spokespersons are nominated due to their ability to communicate or express matters better. In the case of the Tshwane community, some of the spokespersons were chosen because of language barriers between the patient and the health practitioners, even when this was not an ideal situation: “It is not

comfortable to consult in front of your daughter, however circumstances due force us to accept that it's the only better option" (TC15, 38:1117–1121).

Once the needs of the different actors are met, it is possible for some actors to speak on behalf of the focal actor. Some of the Tshwane community showed that as much as healthcare facilities are trying their best to accommodate everyone when it comes to delivering best healthcare services, the challenges still remain in terms of the method of communication used to receive reminders of prescriptions and repeats: the reminder language is the same for everyone irrespective of whether or not they understand the language spoken. According to TC16 (41:1235-1237), *"I like the reminder sent via text messages on my cellular phone as it reminds me of the dates to fetch my medications or to go for repeats"*. When a patient is on chronic medications and requires routine check-ups, collecting the medications on time is imperative to avoid patients skipping their dose and defaulting. Irrespective of understanding the spoken languages, there are other patients who cannot both speak and read the language. *"But my concern is on those who can't read or understand the language used as to how does this affect their response rate, as I see the need of those reminders"* (TC16, 41:1237-1238).

5.4 Case #2: Mukhethwa Hospital

This section presents the analysis of Case #2 Mukhethwa Hospital. As established in Chapter 4, Mukhethwa Hospital (MH) is a public hospital in South Africa. More details about the hospital have been provided in Chapter 4. For this case study, similarly to the first case, Mukhethwa Hospital, Actor Network Theory (ANT) was employed. In addition to ANT, the Diffusion of Innovation (DOI) from the perspective of Innovation-Decision Process (Rogers, 2003b) was used as a lens to guide the analysis of data. As explained in Chapters One and Three, the analysis focuses on an understanding of how mobile systems can be diffused to improve healthcare service delivery in the country.

5.4.1 Actor Network Theory

ANT has been covered in detail in the literature review (Chapter 2).

The first set of data that was analysed come from how the human and non-human actor's network of Mukhethwa Hospital were involved. Two categories of entities were identified as heterogeneous entities (actors and networks) in terms of ANT

perspective: the inter definition of actors. The below section illustrates Mukhethwa Hospital's human and non-human actors.

Actors at Mukhethwa Hospital

The human and non-human actors within the healthcare facility, Mukhethwa Hospital that participated in the study are covered in the following subsections:

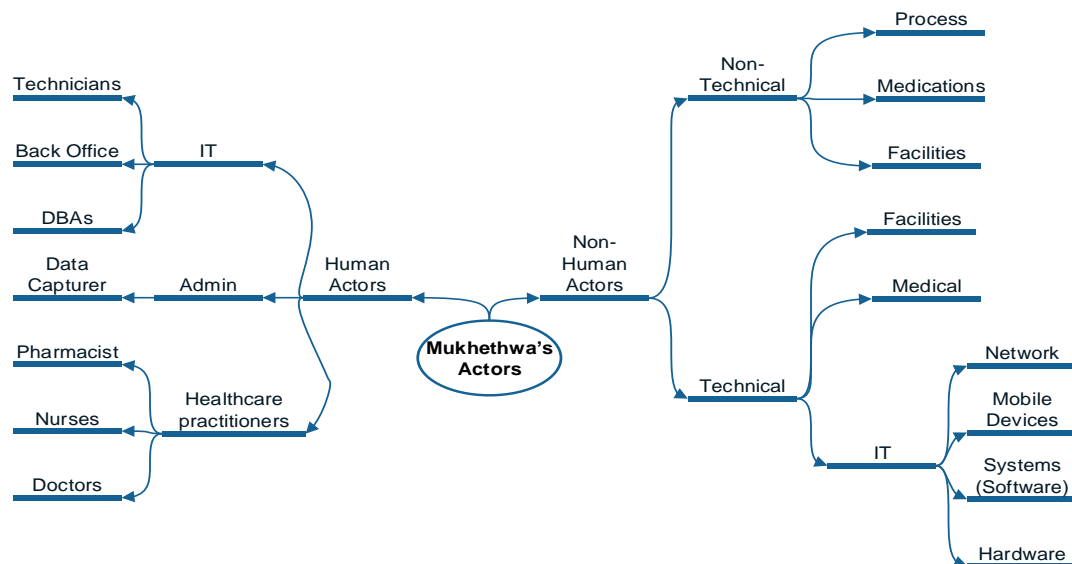


Figure 5. 4: Mukhethwa Hospital human and non-human actors

Human actors

At Mukhethwa Hospital, the various human actors were categorised into three groups: healthcare practitioners, administrators and IT personnel.

The health practitioners included the following: doctors (general practitioners, gynaecologists and neurosurgeons), nurses and pharmacists. According to one of the nurse participants, *“we don't only rely on the nurses alone to translate, any staff members for example, clerks, secretary, pharmacist and data capturers also assists”* (MH01, 3:79-81). The administrative personnel consist of managers, clerical assistants, human resources and IT personnel (IT manager, technicians and database administrators).

Non-human actors

The non-human actors at Mukhethwa Hospital were identified using two categories: technical and non-technical actors. The non-technical actors included the process, medications and facilities, while the technical actors included the facilities, medical and information technology. Information technology (IT) is comprised of network,

mobile devices, systems (software) and hardware. One of the doctor participants asserted that *“patients who are using mobile device applications to get the healthcare reminders, they actually love it”* [sic] (MH06, 25: 775-776).

The actors presented above are identified through interviews conducted and transcribed data of Mukhethwa Hospital. Once we accept that Mukhethwa Hospital is constructed from this range of heterogeneous elements, the next question to ask is how we can describe its construction.

Networks

There were different networks of people from the MH case study. These networks were divided into two main groups: technical and non-technical networks. In these cases, technical referred to healthcare practitioners, admin, IT and patients while non-technical referred to the hospital, systems used and languages spoken. Within the main networks, other networks existed, which ANT refers to as *heterogeneity*. In ANT, an actor can join more than one network simultaneously, manifesting itself differently in each particular network (Iyamu & Tatnall, 2009). As in the previous case, the networks were formed both consciously and sub-consciously.

Each of these networks played a role in the delivery of healthcare services. They were influenced by various factors such as chronic condition, spoken language, culture, diagnoses, support groups, family, friends, designated area and systems used.

Several networks of people who work within the same specialisations, such as doctors, nurses, pharmacists, administrators and IT personnel, were unconsciously formed. These groups of people with the same specialisations shared common interests: they helped the same patients and communicated using different native languages, which encompasses different semantics. According to one of the nurse participant, *“at the hospital even though media of exchange is English, we have healthcare practitioners who speaks different languages, such as Zulu, Sotho, Tsonga, Northern Sotho”* (MH01, 1:18-20). The challenge is that it's not only the nurses who speaks the South African official languages, as they also cater to those who come from countries outside South Africa and speak languages foreign to South Africa. Besides communicating verbally, this network also used technologies, such as mobile phones and social media services, to communicate and monitor a patient's health while at home. *“We have introduced the use of medical devices for patients’*

self-measurements at home, which can be accessed via cellular phone or laptops or any kind of devices that can take the application” (MH02, 5:148-150).

Some of the healthcare workers in different specialisations were part of many networks, through which networks were formed within networks, creating heterogeneity of networks. For example, some of those actors who are doctors in a doctor network were also part of another network of nurses and also patients. During patient visitations to the doctors, most doctors occasionally needed nurse assistance. It's just a general assistance or language translation if the doctor doesn't speak the same language as the patients. According to MH01 (3:86-88) *“If we encounter languages issues during consultation with a patient, we are able to resolve that through different staff members that we have irrespective of their occupation, if they speak the language, we ask them to assist as translators”*. This does not only happen with doctors, but even with nurses and pharmacists. It happens as nurses communicate with doctors and patients and sometimes also with pharmacists to arrange for a patient's treatments to go accordingly.

During the interaction between all these different networks, there is an element of communication that happens; this communication can be in a language that both actors understand. However, what about instances in which both actors are found not understanding each other? Due to the linguistic nature of some of the actors, unable to communicate to each other, different healthcare providers used different solutions to address this: some used each other as interpreters and other healthcare providers used appointed interpreters to address this issue. *“Our hospital always has an interpreter on standby who we can use if we experience language barriers with our patients” (MH05, 18:561-562)*. This heterogeneity of the networks increases the semantics of language to be critiqued and significant to many people who visit or work at the hospital.

The importance of the heterogeneity of the networks in these cases include the fact that some actors (healthcare practitioners) were able to assist patients with their healthcare needs without any fear of being misunderstood as they could either use each other or professional appointed interpreters to bridge a communication gap.

Mukhethwa Hospital was categorised into different groups of patients, those who were patients who came for general consultations or regularly for check-up and renewal of scripts and to also collect medications, and these who were patients who have been diagnosed with a chronic condition. In this regard, one of the nurse

participants asserted that *“We usual use appointments cards, for patient on chronic medications to remind them of the next visitation dates to the hospital”* (MH05, 20:613-615), even though this patient will come to hospital for the same reasons. However, they come from various designated areas. Due to the designation areas that the patients come from, different networks existed, and those who emerged from the same ethnicities ended up forming their networks. *“We have patients who stays at squatter camps (non-remote areas)”* [sic] (MH05, 21:638). The actors in those networks spoke various languages such as Tshivenda, Xitsonga, Isizulu, Sesotho, Sepedi and Xhosa. The actors relied on their individual languages to access medical information and receive medications. However, these actors had to interact with healthcare practitioners such as doctors, nurses and pharmacists who speak different languages.

In order for the hospital to keep their patients informed and give moral support, all the patients of Mukhethwa Hospital who had chronic conditions were grouped and placed in different support groups according to their illnesses and designations areas. These patients had common experiences or concerns and encouraged each other with comfort and advice. These meetings were held in a common area, and each member was requested to attend on a regular basis. According to one of the participants (MH05, 21:654), *“We have support groups were people move from one area to the other having group meetings and motivate each other”*. The designated area where a hospital is situated have a great deal of influence according to how things are done, which language is used and so forth.

Within the healthcare providers and among patients themselves, there was a group of people who could speak more than one language. They acted as interpreter to those who were either illiterates or could only speak their mother tongue language. According to one doctor participant, MH06 (23:717-718), *“I communicate with my patients using a language that they speak”*.

Moments of translation

The below table shows how Mukhethwa data was analysed using four moments of translation:

Table 5. 2: Moments of translation: activities of Mukhethwa Hospital

Problematisation	Interessement
Mukhethwa Hospital healthcare practitioners have problematised language barriers.	All healthcare practitioners of Mukhethwa Hospital are interested

<p>Communication was problematised between one healthcare practitioner to another or other employees, and healthcare practitioners and patients. MH became aware of communication challenges after some of the patients visited the hospital. Different patients visit hospitals for different reasons: some patients go to consult on their health, while others go because they were diagnosed. Therefore, they realise that translators were required in order for them to render a good service to all their customers (patients/ community), while others had a communication problem when they requested IT for assistance with their laptops of operating Health Information Systems.</p>	<p>in delivering the best healthcare services to their patients through clear communication. Some of the healthcare practitioners dealt with patients directly while others were working in a support function to make sure patients got the best service. The interest of MH was based on delivering the best healthcare services to all who come to their premises irrespective of the language they speak.</p>
Mobilisation	Enrolment
<p>Some of those actors who participated as interpreters between the practitioner and the patients made it their task for both actors to understand each other. This was influenced by the relationship they have with either the patient or healthcare practitioners or the interest in the health development of these patients. Other healthcare practitioners, hospital interpreters and also family members of the patients made it their task to break down the communication barriers.</p>	<p>Not all the healthcare practitioners who were interested in the healthcare services managed to fully address these needs on their own. Some of the healthcare practitioners who were unable to communicate with the patients had to ask for assistance from either their colleagues or from the hospital interpreters. Some of the patients even brought in their own interpreters.</p>

Moments of translation: problematisation

As previously stated, *problematisation* is the first stage of translation. At Mukhethwa Hospital (MH), healthcare services were problematised. The problematisation of the healthcare includes how the services were delivered to the public in general (community or patients). This includes the manner in which MH hospital delivered the services to the community, interaction and communication between healthcare practitioners with patients, how medications were distributed, and the scheduling of patients' normal consultations, scripts renewal and scheduled visitations. The relationship between MH healthcare practitioners and patients was formed for different reasons. For MH to deliver the best service, they needed also to have a good relationship among themselves, willingly assisting each other in meeting patients' needs. According to one nurse from the participants, MH01, 3:78-80, "*We always assist each other, irrespective of your position in the hospital to make sure the patient understand what is needed*". How to do demonstrate that a patient is understood? The same participant asserted that "*When we get communication barriers, we look for any MH healthcare practitioner who speaks the language and use them as our translators*" (MH01, 3:80-81).

From different perspectives, actors within the MH hospital problematised the services, depending on their roles and responsibilities. MH is obligated to provide tools that healthcare practitioners must use to deliver the services to its patients. However, some of the tools, like computers and laptops, require a bit of training for some practitioners. Therefore, they end up working hand-in-hand with their Information Technology department to resolve these barriers. One IT technician (MH07, 27:844-845) said that *“as IT we are responsible to provide users (nurse, doctors, pharmacist and data capturers) with a laptop and set them up to the network”*. Even though IT actors are providing the equipment and tools to the healthcare practitioners, they still face communication challenges as some work onsite where they require support via phone. *“It’s difficult for me to support healthcare practitioners on site as I can only speak English and you find that they want to explain the problem using their spoken languages”* (MH07, 34:1100-1102). These technicians are foreign and therefore unable to communicate; consequently, they need to provide ways to communicate with the healthcare practitioners irrespective of language barriers.

Once these practitioners are ready to deliver the services, they have to deliver it to different patients who visit the MH hospital for extremely different reasons. Some of these patients just required a health consult, while others go because they were diagnosed with something. During these interactions between patients and healthcare providers, relationships are formed: a relationship formed through a patient visiting the hospital; a relationship based on the diagnosis that a patient has received; or a relationship formed because a patient needs to return to the hospital regularly for check-ups. These check-ups frequently require reminders on a regular basis where healthcare practitioners must make a point of contacting these patients on a regular basis. According to one participant, MH02, 4:122, *“We send our patients reminders using text messages two days before their visit”*.

At MH hospital, most of the healthcare practitioners’ participants emphasised the need for language translators as one of healthcare services desperately needing attention. The healthcare providers specified that most of the challenges faced are in regard to the language spoken. *“Language barriers is a serious problem in our hospital, we have lot of foreign patients”* [sic] (MH01, 1:22-23). However, some of the participants argued that it is not just the language, but the semantics of the medical terms used: *“The direct translation alone doesn’t necessarily give meaning to words, even if you borrow it in English”* (MH02, 6:183-184).

There are different reasons why the MH healthcare requested translators. Some of the practitioners requested translators because they couldn't speak the same language as their patients; others were needed because their healthcare practitioners, mostly doctors, were not South Africans, while even some of the patients were foreigners. One of the barriers is that South Africa has eleven official languages, not including sign language, which presents serious challenges for a healthcare worker to be able to speak several if not all these languages. *"Even for us South Africans we don't know all the eleven official languages"* (MH05, 22:670-674). This presents a seemingly insurmountable challenge for communication, especially when the patient is a foreigner. Some of these patients who are linguistic minority migrants end up relying on sign languages during their healthcare encounters or rely on the availability and accuracy of an interpreter. *"This other time one of the patients from Angola came for an operation and she brought through her translator"* (MH03, 12:370-371). The challenge with translators is that they must understand perfectly the language that the patients speak fluently so that they are able to translate it in a way that the healthcare practitioners will not be misinformed. Participant (MH06, 23:725-727) said that *"Translators they don't have to come from the healthcare field, they just need to know the spoken language of the patient perfectly"*.

During this translation, some of the healthcare practitioners felt that the patients were not free, and they think this might have compromised the information they provided to them. Most of this hospital resorts to using the nurses and administrative staff whom they have around the hospital who can speak the patient's language as they thereby act as a translator. One of the doctors (MH06, 25:791-793) asserted that *"We work with nurses, if a patient don't understand you simply call a nurse who would understand the language and translate for you"*. When you communicate with the patient in a language they understand, you form a relationship with them; they become comfortable and can express themselves. Another doctor asserted, *"I am lucky because most of my patients I can communicate with them with their own language"* (MH06, 23:718-72).

Many of the challenges revealed above are primarily influenced by lack of a system in place. These challenges affect both the practitioners and the patients. If the healthcare practitioners and patients are unable to communicate, practitioners cannot complete or fulfil their daily tasks. However, patients end up fighting delays to receive important medical attention, a risk that can potentially result in a fatality. Even though they have translators or try to find the next available person who knows the language and is able to translate, this raises another concern of compromising the practitioner-

to-patient confidentiality. Some patients are reluctant to be totally honest, which then compromise their health. Technologies or systems need to be introduced that can be effectively address these issues.

Moments of translation: intersement

Once problematisation is in process, the next phase in the ANT translation process is intersement. Intersegment locks those actors into alignment with approaches that we called device of intersement.

The relationship between the Mukhethwa Hospital healthcare practitioners and their patients was defined by their types of interactions, communication and association. For some of the healthcare practitioners from Mukhethwa Hospital, interests were influenced by different factors; for others it was because they dealt with patients directly; others just worked in a supportive function to make sure patients got the best service. The interest of Mukhethwa healthcare was based on delivering the best healthcare services to all who come with sick needs to their premises, irrespective of the language they speak. In this regard, one of the nurse participants (MH01, 2:57) expressed that *“As a nurse I must be able to communicate with my patients”*.

Different actors were involved and influenced the relationships between healthcare practitioners and patients. The actors included South Africans and non-South African (foreign) healthcare practitioners, patients, patients’ relatives and associates, support groups and the systems or applications that were used for communication and information sharing. *“We communicate in eleven South African official languages. But we also have patients who are from outside the country, such as from Zimbabwe and Pakistan”* (MH05, 18:552-553). Some of the healthcare practitioners had direct, and others had indirect relationships with the patients; others were able to communicate with the patients through the help of translators and other healthcare workers. Therefore, the healthcare practitioners must be able to accommodate all the patients, irrespective of the language each one speaks. According to one of the head nurses (MH05, 18:560-561, *“There is always an interpreter on standby at the hospital who can speak foreign languages”*). The relationship defines the various interest which was based on the services that the healthcare facilities provided to the patients.

Also, the interest informed how some healthcare practitioners contacted and interacted with the patients or help the patient. Many healthcare practitioners strived to communicate with the patients in the way that they would understand: *“When I encounter a situation where my patients seemed to be lost, I quickly revert to their*

mother tongue" (MH03, 11:326-327). This is a challenge in healthcare as one will ask how some practitioners manage to speak or communicate in all these diverse languages. However, they have those practitioners who could speak different languages as opposed to the ones who will depend on the assistance of colleagues or interpreters. *"I am comfortable with most of the South African official languages"* (MH03, 11:328).

For these reasons, most of the healthcare practitioners were interested in speaking the language that the patients understand so that they can create a solid relationship while also making patients comfortable: *"I communicate with the language that they use, so that I can get the real story"* (MH06, 23:725-726). However, those who couldn't understand the language or were unable to communicate with the patients didn't just leave it as is, they tried to find other ways to make sure that their patients end up understanding them. According to MH01 (1:47), *"this matter is being addressed by the supervisors"*. Matters like this need intervention; they cannot just be escalated without any proper solution proposed for handling such issues. According to one of the participants, MH01 (1:50-51), *"It was suggested that nurses would go on a course where will learn different languages including the sign language"*.

Mukhethwa Hospital still strives to make sure that they assist those who are not English speaking and who must use their mother tongue language. Those healthcare practitioners who can't assist the patient often feel burdened, like they are failing the patients and feel they cannot perform their duties well: *"I feel very bad, because it impacts on my nursing care. I cannot nurse a patient for whom I don't know what the problem is"* (MH01, 2: 55-56).

The love of nursing or care for patients is what generates the interest of Mukhethwa Hospital to act the way they act. These actors extend themselves to be certain that the needs of the patients are being addressed irrespective of faulty communication or difficult language barriers they are faced with.

Moments of translation: enrolment

This third stage of the translation phase requires actors to participate in an activity. At this stage, the actors from Mukhethwa Hospital accept the roles and responsibilities that were proposed or assigned to them by the focal actor. It is within this frame that most of the healthcare practitioners, such as doctors and nurses, carry out their tasks in addressing healthcare services requirements. They depend on their colleagues in

admin for capturing the patient's data and IT personnel to assist them in effectively utilising the current technologies.

Not all the healthcare practitioners who were interested in the healthcare services managed to fully address these needs on their own, a situation attributable to different factors which are either of conscious or unconscious in nature. Some of the healthcare practitioners were unable to communicate with patients due to different factors. For example, some healthcare practitioners were unfamiliar with the languages spoken by the patients; in some case it was the translation of semantics in the languages that were spoken. Other patients were foreigners speaking a language that the healthcare practitioners didn't understand at all. One of the nurse participants, MH01, 1:22-23, stated that *"the language barriers is a serious problem in our clinic, I remember that we do have patients that are coming from Zimbabwe with a serious communication barrier"* [sic].

Both the healthcare workers and patients take these issues seriously in terms of attempting to find a pragmatic solution to these barriers. By doing so, they are both confirming and enrolling into the duties imposed on them to make sure that at the end of the day the necessary services are delivered, and the patient has received the best possible treatment. For example, patients from outside South Africa who cannot understand South African languages sometimes decided to bring their own translators to speed up the process of healthcare delivery without the delays prolonged by language challenges. According to one of the doctor participants, MH03, 12:369-370, *"one of the patients from Angola came for an operation and she brought through her translator"*. The participants further indicated that this doesn't necessarily address the challenge, as sometimes the translator they bring still struggles translating the semantics of what the doctor is saying. *"I could see that the translator was not comfortable and reading so fast and explaining a little bit, like two sentences for a paragraph"* [sic] (MH03, 12:370-373).

Not only do patients bring in translators, healthcare workers also call upon families or buddies of the patient if need be to assist the patient with ease; this reveals that they are committed to the well-being of the patient and they are willing to go an extra mile to minimise the strain of the experience of a patient: *"We go to an extent of even calling the husband, because most of our patients who cannot speak English their husband understand English"* (MH01, 2:33-35). Moreover, another participant (MH03, 12:357-358) asserted that *"some people come with their kids who speak English who then translate to them"*. The issue of culture plays a big role where other patients

were not helped on time due to their cultural beliefs. Some female patients, for example, refused to allow the male health practitioners to treat them. A male nurse participant MH05 (22:677-679) expressed that *“culture plays a big hindrance to what we have to do, I once had a women patient who refused to be assisted by me, because I am a male healthcare practitioner”*.

Also, some healthcare practitioners end up engaging visuals such as pictures on walls or from books or off the internet to attempt to communicate with the patients on a level that allows them to understand each other. *“In case of communication barriers with my patients, I use a computer to show them graphic images”* (MH03, 11:345-356). The participant further asserted that this assisted with communication barriers as they will just nod or shake their heads if they agree or disagree, they don't have to really verbally express themselves: *“My patients will just nod the head to agree if that's what they are talking about”* (MH03, 12:349-351). Furthermore, some patients were even willing to try to speak in the healthcare practitioner's spoken language in order to enhance the possibility of communication. According to one of the doctor participants, MH06 (25:781-783), *“I assisted patients who will use English instead of their spoken language to accommodate me, because they knew I couldn't speak their languages”*.

Based on the various types of interest, everyone became involved in solving the problem: patients were assisted; patients visited the facilities through which interaction takes place and relationships were established among both human and non-human actors; patient Information was captured in different systems; medications were dispensed using mobile technologies; patients on chronic medications were reminded of their follow-up and script renewal through text messages. *“We have built in intelligence to remind the patients through a text messages of their appointments”* (MH46, 30:968-969).

Moments of translation: mobilisation

Mobilisation is the fourth and final stage of translation. In mobilisation the focal actor needs to continually convince the actors that their interests are still the same. At Mukhethwa Hospital, for example, different spokespersons have been established with different interests; the spokespersons differ depending on the role or position they hold at Mukhethwa Hospital. Some of the actors participated as interpreters between the practitioner and the patients, making it their task that both actors can understand each other. This was influenced by the relationship they have with either the patient or healthcare practitioner or the interest they developed in the health of

these patients. Other healthcare practitioners, hospital interpreters and also family members of the patients made it their task to eliminate communication barriers.

The objective of these actors was to stabilise the network and maintain relationships. The focal actor needs to continually convince the actors that their interests are still the same. Controversy, at this stage, no longer exists if there is support from the actors (Mähring *et al.*, 2004).

At Mukhethwa Hospital, different spokespersons were established accordingly as per specific circumstances. For those patients who are from outside South Africa and unable to speak the language spoken by the healthcare practitioners they had different spokespersons available as interpreters, family, and even health practitioners themselves acting as spokespersons, while those in chronic medical conditions had buddies and themselves in this regard. *"We got to an extent of even calling the husband of the patient to come and translate for us"* (MH01, 2:34).

This spokesperson needs to act on the interest of both the patient and the healthcare practitioners, ensuring that the confidentiality of the patient to healthcare practitioner is kept intact. The interest of both parties must be respected. According to MH15 (31:1110-1112), *"even though I am allowed to bring a friend or relative in the consultation room to assist me with the language, the health practitioner always emphasize on the part that I must bring someone I trust so the confidentiality of my medical records can be maintained"*.

In order for patients to get best services from their healthcare practitioners, this requires that their chosen spokespersons are properly able to represent them and will neither betray them nor be betrayed by them. In some cases, spokespersons are nominated due to their communication capabilities or abilities to express matters better. In the case of Mukhethwa Hospital, some of the spokespersons were selected because they have easy access to the patient. *"We make sure that all our chronic patients have a buddy who can be able to check on them all the time, also check their medications intake"* (MH06, 20:616-617).

Healthcare workers cannot assist a patient if they don't understand the problem or they cannot communicate in a language that they both understand. Both the healthcare workers and patients take these issues seriously such that they both search for a solution to these barriers. By doing so they are both confirming and enrolling into the duties imposed on them to make sure that at the end of the day the

services are delivered, and the patient has received the best possible treatment. Patients from outside South Africa who couldn't understand African languages often choose to bring their own translators to speed up the process of healthcare delivery without the delays resulting from language challenges. According to MH03 (12:370-373), for example, *“one of the patients from Angola came for an operation and she brought through her translator”*. But in some cases, it was determined that the translator was not professional and therefore this did not effectively address the issue of language barriers.

Not only do patients bring in translators, healthcare workers also call the families or buddies of the patient if need be to more readily assist the patient; this demonstrates that they are truly committed to the well-being of the patient as they are willing to go an extra mile to make the experience for the patient less strenuous. *“Some of the patients come with their kids who speak English who then translated to them”* (MH03, 12:357-358).

This problem goes beyond just language translation: even though some of the participants agreed that the issue concerns language barriers, most of them admitted that the most substantial challenge is with the semantics of languages that are used to communicate at the hospital. Others talk mostly around the translation of medical terms to their language being a big challenge.

5.4.2 Diffusion of innovation

Diffusion of Innovations (DOI) theory is one of the oldest theories, developed by Rogers in 1962. It originated in communication to explain how, over time, an idea or product gains momentum and diffuses through a specific population or social system (Dutta, 2014). An innovation can be things such as: idea, knowledge, a belief or social norm, a product or service, a technology or process, even a culture, as long as it is perceived to be new (Striphas, 2006).

Therefore, the DOI was used to examine how technology solutions can be diffused in private hospitals, using mobile devices: addressing (i) the challenges of language translation for healthcare service purposes; and (ii) translation of the semantics in the languages. The stages of a decision process, from the perspective of the DOI theory (Roger, 2003) were employed in the analysis of the data from the case study. The interviewees included many healthcare workers such as doctors, physicians, nurses,

neurologists, hospital managers and hospital administrative staff. The analysis begins and ends with the knowledge and confirmation components, respectively.

Innovation decision process

According to Scott and McGuire (2017), *knowledge* is the initial awareness potential users have about the innovation as well as the understanding of how the innovation operates. It was very interesting to interact with healthcare practitioners of Mukhethwa Hospital because through this interaction with them, it was realised that some practitioners were aware of the technologies that are used (such as mobile systems, mobile applications like mum connect, software technologies such as TIER 3, TherapyEdge) to enhance the communication between healthcare providers and patients, while others were not aware of those advanced ways for making communication better. Mukhethwa Hospital practitioners found themselves engaging with patients in both verbal and non-verbal communications. Non-verbal communication at Mukhethwa Hospital happens during the time when patients are either in a critical stage or don't understand the language that is used as a medium of exchange. Some of the practitioners said they use things like images or sign language or just pointing or demonstrating what they want to say. According to MH03 (11:345-347), *"I found myself in most of the times having to use visuals graphs, images and so forth, to try to explain to my patients what am trying to say"*.

Innovation decision process: knowledge

Healthcare personnel at Mukhethwa were no different to other health professionals. At the time of this study, we observed that they were driven by the urgent, daunting task of trying to save their patients' lives. Some of the practices that were noticed at the hospital were based on knowledge of experience that was gathered over a period of time. The knowledge covers both cultural practices and technological know-how. For example, at the time of this study, the hospital received a patient who was critically ill and could not communicate, a patient of Pakistani origin. The healthcare personnel who were on duty were not knowledgeable of the fact that female patients from Pakistan do not accept care from male practitioners. As a result, the patient fell into a state of depression when she discovered that male healthcare personnel attended to her, which was yet another critical condition. This type of situation explains the critical influence of knowledge within the healthcare environment, which is often very sensitive.

Another important arena where knowledge is important in terms of healthcare services is with technology. At Mukhethwa, some of the healthcare practitioners lack knowledge of some technologies that were at their disposal, which they could have possibly employed to improve the services provided. One such technology is a mobile application called Mum Connect. According to one of the participants, *“each time a pregnant woman visits the hospital for the first time, we give her access to the mum connect application, which allows us to record her activities in a doctor’s profile”* (MH01, 2:28-30).

Other usage of technology at Mukhethwa Hospital is mobile technologies as they use text messages as a way of communicating back to their patients. Even though they have this functionality in place, most of their patients are not knowledgeable about this. Some of the healthcare practitioners feel that the reason why some of the patients are not aware of this functionality is because the process is not interactive. These means that they cannot respond to this text messages being sent. So even when they know about it, many do not actually know how to use the application, or they are not given enough information around the application that they would even elect to use it. *“Not really, because most of the times they don’t even respond to our messages”* (MH05, 6:89-90). It’s not that everyone is technologically disadvantaged; there are various reasons why some people don’t use this application. According to one of the nurse participants MH02 (3:35-36), *“But I think it’s due of the fact that sometimes patients neglect their own health”*. Messages sent by service providers are in English and not all recipients are fluent in the English language, while some are unable to read. As pointed out by one astute participant, MH01 (4:97), *“we do have an ‘SMS’ short text messages facility, but some of the patients can’t even read English”*. However, some of those who understand are still not able to translate the words accurately into medical dialect. It is critical that patients be aware of the communication channels available to them and how they can use them accordingly to benefit their health. Without the knowledge of these communication channels, hospitals won’t be able to progress, to advance in the way they communicate or deliver services to the patients.

At Mukhethwa Hospital, most healthcare personnel focus on improving communication between themselves, their care teams and their patients. With regards to healthcare personnel, they engage with each other using different languages. The challenge that some of the healthcare practitioners at Mukhethwa Hospital were currently facing had to do with language lingo. The community around Soshaguve has its own way of speaking; they have created a lingo that, for those

who grow up there, becomes easy to identify. This challenge of communication due to language lingos was realised when a new healthcare practitioner who was not from the area began working at Mukhethwa Hospital. During the interaction with a patient, the local language lingo was used which then generated a bit of misunderstanding between the two as the healthcare practitioner missed what the patient wanted to say. According to one of the nurse participants, MH03 (10: 312-313), at Soshanguve, ladies like to use the word *isibabo*. *“When we say ‘isibabo’ we are referring to a discharge that is itching that’s one of the lingos we use around here”*.

Clearly, it is necessary to educate, to create awareness, for both healthcare practitioners and patients on things that can be of good use during their interaction. When two people are not on the same page or view things from differing perspectives due to lack of knowledge, a great deal of confusion can result, with delays for people needing to be persuaded to make a decision.

Innovation decision process: persuasion

At Mukhethwa Hospital when the healthcare practitioners and patients are interacting, there are certain things that lead to them being persuaded. In the case of patients, for example, some of the patients are persuaded when they have a prescription that they need filled to get medications. When a patient has a prescription, they start feeling a sense of urgency to collect their medications. According to MH08 (31:1000-1002), *“Even though pharmacy have an electronic copy of patient’s prescription, due to the legislations you have to give the patient a copy of prescription on hand”*. However, some of the patients feel persuaded when they discover that the healthcare practitioners with whom they are communicating are able to communicate with them in the language they understand. According to one of the doctors (MH06, 26:716-717), *“to be able to get the real story or correct diagnoses you have to try and communicate in a language that the patients understand”*. Some of the patients are persuaded at home by their family members through support and sharing of healthcare knowledge. Some are even persuaded by being advised on how to take their medications effectively and on how to respond to certain medical conditions, especially those patients who are on chronic medications. One reason why most people feel persuaded from someone they know, such as family members, is that people often feel it’s not necessary to take medications or keep on to their medical follow-up, so they need that push from someone closer to them.

In most circumstances, people don’t always like or want to examine themselves, so in such cases they appreciate support from them with application. There are those patients

who have to check their health status regularly, such as patients with diabetics or high blood pressure. Most of them they are persuaded with the use of health monitors suitable for use in the comfort of their own homes. After checking the monitor, they send the results to their healthcare practitioners or consult if need be. *“Patients who are on ARV or diabetic they can have their own app which they use for communicating with those that share the same sentiments”* (MH05, 21:649-650). Other patients, however, are persuaded through communication: when the healthcare practitioners speak the language that they understand, they feel comfortable and this boosts a positive response to that consultation or interaction. Other patients need to be educated on different diseases, in terms of how to take medications and how to use technologies to communicate. This knowledge can entice them to maintain their relationship with their healthcare service providers. *“We require a course or training that will learn different languages including the sign language* (MH01, 2:49-50).

On the other hand, the work of healthcare practitioners at Mukhethwa Hospital elevates the practitioners to desire to deliver the best services as well as to adhere to the privacy, confidentiality and security standards of protecting the patient’s healthcare information as they must sign an ethic code of conduct. According to participant MH01 (2:43-45), *“there are other matters that as a healthcare practitioner we can see that its sensitive and confidential in that way we cannot communicate to another patient therefore we resort to calling the husbands”*. Not only does an ethical code of conduct but their employment contract as well bind them to close care and careful observation of how they render their services. Therefore, these people are persuaded to act accordingly, within the agreed upon codes of conduct. They strive to deliver the best services to the clients who are, in this particular case, patients. According to one of the nurse participants, MH02 (2:216-218), *“we do everything in compliance to the POPI act were we even have to sign up a contract that abides us to this act”*. In order for Mukhethwa healthcare to deliver good services, technology is required to increase efficiency and eliminate the possibility of loss of patient data and health records. IT personnel have critical roles in making sure that support is provided to healthcare practitioners and patients whenever the need arises for utilising the various technologies available. This user requires a higher level of persuasion as most of the time they are unfamiliar with the technologies at their disposal.

Technologies are required during the interaction of healthcare service providers and patients, as sometimes the communication can be a barrier. If healthcare services providers are educated on the use of technologies, it becomes easier to convince them to adopt this technology. Mukhethwa healthcare practitioners and patients need

to be educated on the use of different technologies to avoid using a third person, a middleman so to speak, as that compromises the privacy and confidentiality which then affects the signed ethical code of conduct. Therefore, it is important to have technologies that can translate or interpret for them instead of relying on another infallible human being. According to MH05 (19:585-586), "*Interpreters are not healthcare practitioners so it's a bonus when you find one who's a healthcare practitioner, although there is ethical code of conduct of privacy and confidentiality*". This demoralises the patients, deterring them from returning if they feel they were not treated in a manner that kept their information confidential.

In order to persuade patients and healthcare practitioners, many factors need to be considered. Otherwise both will be frustrated, resulting in incorrect diagnoses and poor service delivery.

Innovation decision process: decision

Most of Mukhethwa Hospital's health-related decisions occur in a context of scientific uncertainty, the 'grey zone' of decision making. These include things like the nature of the diagnosis and treatment of many health problems and also choosing the best course of action. During this process, communication becomes a vital tool in helping healthcare practitioners understand their patients' needs for making a confident decision regarding the diagnosis or treatment they must give. According to MH01 (2:55-56), "*I feel very bad, because it impacts on my nursing care. I cannot nurse a patient whom I don't know what the problem is*". She further expressed that they need to be able to communicate in order to reach some kind of consensus or agreeable decision on what needs to be done next: "*before you help a patient as a nurse there must be a communication*" (MH01, 2:57).

At Mukhethwa Hospital, there are times of critical situations where they must make decisions on behalf of the patients for several reasons. In other circumstances, a patient arrives at the hospital in a critical condition in which they are unable to communicate, while others are able to communicate but only in a language that the health practitioners do not understand. These communication barriers end up causing delays in the delivery of often critical services. "*We have healthcare practitioners shortages, because of the delays caused when trying to address a communication issues, as this increases the amount of time people spent in the queue*" (MH03, 14:433-:434).

The role of Mukhethwa Hospital is to provide healthcare services to community members, irrespective of culture, language and origin. Mukhethwa Hospital is characterised by patients who speak more than one of eleven official languages in South Africa, and in addition to that, some of the patients speak languages foreign to South Africa. This presents a unique challenge when they have to decide upon which language to be used as a medium of exchange. Therefore, in most of their clinics, interpreters are regarded as the solution to this challenge. However, this decision poses still further challenges such as delays, breaches of patient confidentiality and a breakdown of trust from a patient who is being assisted. According to MH05 (19:590-591), *“There is an ethical code of conduct that they have to enter into and sign as they have to acknowledge that the patient’s confidentiality at all times should be respected.”* In some sections, such as the maternity section, they have already started using technology such as a mobile app called ‘mum connect’. This application could improve timely access to emergency and general health services and information, as well as better manage patient care, reduce pregnancy complications and alleviate unnecessary miscarriages. There are numerous available applications, so it is the decision of Mukhethwa Hospital as to which they choose to use. But this decision also needs to be supported by the patients’ needs as well, as they also have to use the technology and, in many cases, must spend a bit of money to benefit from these technologies. According to one of the health practitioners, MH02 (5:149-150), *“they buy the tools and what we provide is the network between the tools that they have and their cellular phone or laptops or any kind of devices that can take the application”.*

Even though these technologies are being used to a certain extent, such as mum connect, text messages reminders, and so forth, decisions pertaining to applications needing to be implemented across the board is required, as now each hospital is using its own apps according to who comes up with the idea, or what app or technology needs to be adopted to suit the hospital’s needs. This can certainly be confusing for the patients and nurses to manage. All hospitals which are offering the same services must be in this together, so that when patients or health practitioners’ move to other hospitals they must not feel lost. *“The use of technology is starting to happen in our facilities, but I don’t think it’s there in all the hospitals”* (MH04, 25:767-768). However, other people believe that a little bit of awareness is required, so that people can be aware of what is available and can therefore make informed decisions: *“Awareness or knowledge of available technologies influence a lot on how things are done, it impacts decisions that are being taken on the day to day running of the hospital”* (MH03, 14:433-434).

At Mukhethwa Hospital, there are times when decisions are made to use their own staff members as interpreters, a decision forced by circumstances they find themselves in. Dealing with technologies to compensate can impose financial challenges. While Mukhethwa Hospital uses its own staff as interpreters, other healthcare providers do not provide adequate interpreting services because of the financial burden such services impose. However, these providers fail to take into account both the consequences of not providing the services and the potential cost benefits of improving communication with their patients. Occasionally they admit that the challenge is not necessarily with the language per se, but with terminology used on the devices that are provided. According to MH02 (9:261), *“at times the barrier it’s on the terminology being used”*. Healthcare providers need to come to a decision on which terminology must be used, as this becomes an issue to both healthcare practitioners and patients. *“If you don’t understand the healthcare terminology you will still not understand the medical terms”* (MH02, 9:272).

Mukhethwa Hospital must not consider taking decisions related to all the tasks mentioned above; in order to address the issue of language semantics translation they must make the appropriate decisions and implement these decisions.

Innovation decision process: implementation

Mukhethwa Hospital is currently implementing mobile health in various aspects of their care, even though, in regard to communication, they occasionally rely on individuals such as staff, patients, patients’ relatives and even their own trained interpreters to assume the role of interpreting. Mukhethwa Hospital has started using different technologies in attempting to address this issue of language barriers between healthcare practitioners and patients. According to one of the participants, MH01 (3:90), *“every time we have a communication barrier, it becomes a problem of a clinic”*.

However, although the implementation of technologies is not yet fully utilised or accessible by every patient who needs to rely on the technology, some have already started using these technologies. The implementation of ‘mum connect’ was influenced by a large number of pregnant women who will may suffer from complications during their pregnancy that could have been prevented if only there had been a way to communicate with others about their challenges. However, the implementation of solutions to challenges is still required in terms of language that an application uses: English. MH01 (5:157-159) said that, *“Currently the applications are*

developed in English, it has been realised that once we go mass market we may need to create the applications in the language that the patients understands, the South African official languages”.

The implementation of mobile health technologies at Mukhethwa Hospital is influenced by many factors including the following: language barriers between healthcare practitioners and patients; monitoring of a patient’s health progress; reminders for a patient’s hospital visitations; increase healthcare quality; expanding access to services; cost reductions; and improved personal wellness and public health: *“patients will start being the key players in the management of their own health so telemedicine as part of that it’s going to be a key, and there is no way we are going back, so is an area that South African need to start catching up on it”* (MH02, 9:278-280).

For Mukhethwa Hospital, the implementation of mobile health is undeniably a challenge attributable to the broad scope of services that mobile health needs to address such as the factors mentioned above, the lack of resources such as infrastructure, and the very limited cost. According one of the participants, MH05 (35: 1142-1143), *“we only have apps that are using English; we have to start looking at bringing other languages in”*. However, some participants still feel that this will not address the challenges per se, as the issue is not necessarily the English language but the difficulty of specific healthcare terminology: *“If you don’t understand the healthcare terminology you will still not understand the medical terms”* (MH02, 9:272-273).

The implementation of monitoring tools at Mukhethwa Hospital is based on the needs of the hospital for using mobile health to deliver a better service. Mukhethwa Hospital seeks to take full advantage of the capabilities of handheld communication devices and their owners’ predilection for focusing on them. Often mobile health assumes the form of reminders, transmitted by text messages or secure Web sessions, designed to encourage patients to take their medication, check their blood sugar or carry out some other part of a medical or wellness regimen. *“We design tools now that adheres to patients taking charge of their own health outcome”* (MH02, 5:142-143).

Advanced systems allow patients to enter data or ask and answer questions in response to such messages and compile these interactions into dashboards and charts for use by care managers and physicians. *“The application is user friendly, able to interact and allow user to just populate the health info, and after a while they*

get the results in terms their health well-being” (MH02, 5:153-154). However, depending on where the application will be used, different implementation approaches are required. According to MH02 (5:149-150), “Patients buy the tools and what we provide is the network between the tools that they have and their cellular phone or laptops or any kind of devices that can take the application”.

Meeting customer expectations requires clarity of thought and persuasiveness during implementation. Effective implementation will enable Mukhethwa Hospital to deliver best service to the patients and community at large. However, the implementation of these technologies needs to be acknowledged and confirmed as meeting patient and organisation needs and purposes.

Innovation decision process: confirmation

Mukhethwa Hospital is using different systems that connect with mobile technologies. Such mobile health provides multiple tangible and intangible benefits. In Mukhethwa Hospital, the tangible benefits refer to less administration for doctors, better patient care and tele-diagnostics or faster diagnosis. The use of ambulatory electronic health records (EHRs) at Mukhethwa Hospital offers an opportunity to monitor and improve clinical quality. Moreover, the use of EHRs at Mukhethwa Hospital is improving information access and reducing duplicative documentation, accomplished through “e-prescription” tools which improve the efficiency and safety of prescribing practices in the outpatient setting just as they have done in the hospital setting. *“The use of electronic record it’s always covered by an agreement, patient information is only shared with the healthcare providers” (MH02, 8:225-226).*

However, as much as this is beneficial for less administration of doctors and better care of patients, the issue of privacy remains central, as people question the privacy and security of using these technologies. According to one of the participants, MH02 (8:227), *“everything is done according POPI act compliance”*. Mukhethwa Hospital is in process of trying to assure their patients by complying with the protection of the patient’s information act.

The use of mobile technology at Mukhethwa Hospital is not yet fully realised: some use this technology in part, while others don’t even know about the existence of these technologies. Those who are using the technology confirmed that it is working fine, but most are not utilising the short text messages (SMS) part of functionality. While the short text message functionality is available, some participants struggle to use it

because of language barriers. According to one of the participants, *“Some of the patients can’t even read English but we do have a ‘sms’ text message facility”* (MH01, 3:77). Mukhethwa Hospital sends short text messages to everyone, irrespective of whether or not they understand English. However, language is not the only issue. A lack of interaction and difficulty responding on the short text messages sent are two other reasons why patients end up avoiding this technology. *“Most of the times they don’t even respond to our messages”* (MH02, 5:105).

Mukhethwa Hospital has educated patients who have attended school. Hence, those who are using the short text message technology will likely find it easy and comfortable to use this tools and application. *“You know they are teachers, nurses, lawyers, doctors and all other different academics, you know education is all over”* (MH06, 25:783-784). Some of the short text messages includes sending reminders of hospital visitations to patients, while other benefits include the ability for patients to check their cholesterol and BP in the comfort of the homes. According to one of participants (MH06, 21:653-655), *“cellular phones it will save a lot of time and a lot of movements you know, and also with the crime in our area it also eliminates things like those as they will do everything at the comfort of their own homes”*. The challenge for some patients is that they cannot afford to have cellular phones as they reside in areas of high crime such as squatter camps, for example at Olivenbosch.

At Mukhethwa Hospital, the intangible benefits of going electronic include enhanced patient safety, enhanced quality of care, better provider-patient relationships and improved communication. According to one of the participants, MH06 (22:692-694), *“it can also save time and at the same time the won’t be an invasion of privacy because some people feel free only when they are with the healthcare practitioner but when the interpreter or a family member is there then they feel somehow”*. Finally, the widespread adoption of mobile technologies at Mukhethwa Hospital will allow the achievement of system connectivity and information exchange among practitioners at the same hospitals, among healthcare organisations, and ultimately among the patients and community. However, the realisation of these benefits depends on how Mukhethwa Hospital has implemented and deployed the different mobile technologies. Thus far, the responses have been positive: *“Patients actually love it, those who are using this facility of mobile device reminders they actually love it”* (MH06, 25:774-775).

5.5 Case #3: Sweet Love Hospital

This section presents the analysis of Case #3 Sweet Love Hospital. As established in Chapter 4, Sweet Love Hospital (SLH) is non-government organisation (NGO) providing healthcare services to communities within South Africa. For more information on the background of this hospital, refer to Chapter 4. Both ANT and DOI theories have been applied in this case.

5.5.1 Actor Network Theory

From the data collected at Sweet Love Hospital, the first data analysed concerned the question of how the human and non-human actor networks were involved. Actors and networks were identified as the two categories of heterogeneous entities in terms of ANT perspective: the inter-definition of actors. The below section illustrates Sweet Love Hospital's human and non-human actors.

Actors at Sweet Love Hospital

For Sweet Love Hospital participants, both human and non-human actors are as follows:

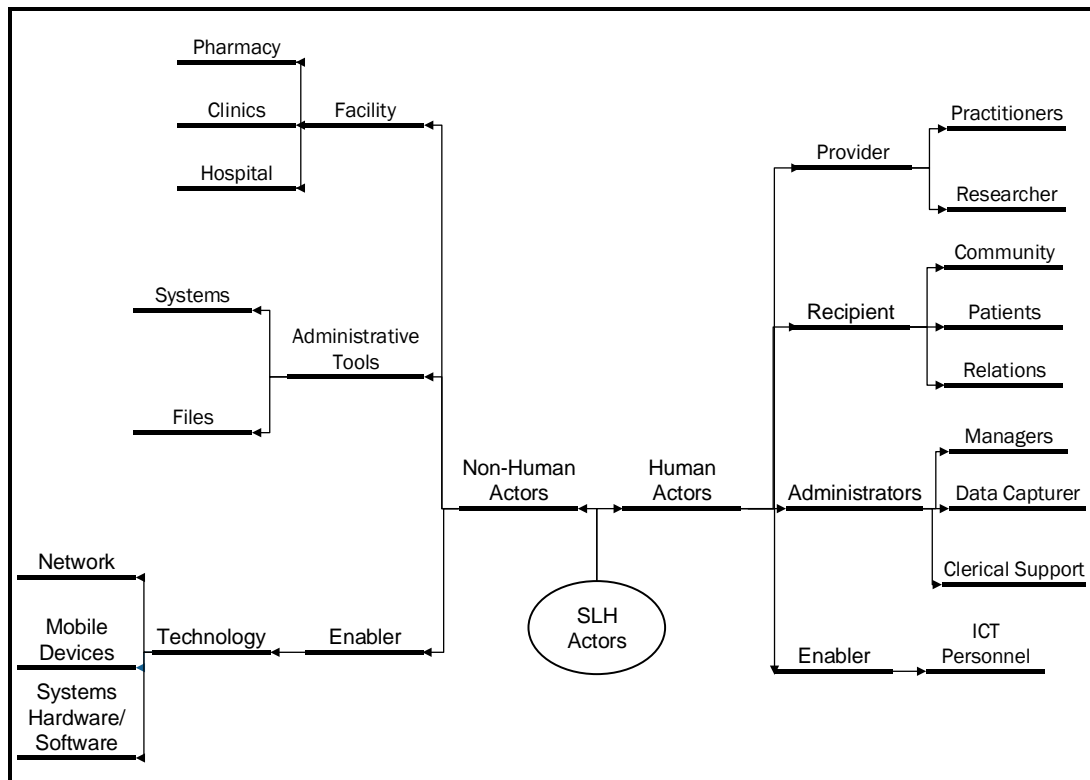


Figure 5. 5: Sweet Love Hospital human and non-human actors

From Sweet Love Hospital, both human and non-human actors were categorised into four phases: (1) provider, (2) recipient, (3) administrator and (4) enabler. The first

three elements are healthcare services components and the last one, the enabler, is the healthcare support, where IT is the tool to enable healthcare service delivery.

Human actors

During the data collection, Sweet Love Hospital had various human actors categorised into four groups: provider, recipient, administrator and enabler.

The healthcare service providers of Sweet Love Hospital are the researcher and practitioners (doctors, nurses, counsellors and pharmacists). The recipients include patients, community and relations (patients' next of kin). The administrative element of Sweet Love Hospital consists of those actors who do not do operational activities. The administrative actors do not necessarily have to interact with healthcare practitioners but with patients on a minimal basis. However, they are responsible for the capturing of a patient's data and communicating with patients on an assistance level or sending communication emails or reminders via short text messages. This process requires some sort of communication. One of the participants stated that "*the communication team always translate the patient's messages into vernacular or local or the spoken languages*" (SLH04, 10:406-407). The controller consists of managers and executives who oversee and gives the go-ahead for all plans and processes of the hospital.

Non-human actors

The non-human actors at Sweet Love Hospital were also identified and categorised into three elements: facility, administrative tools and enabler. The facility includes pharmacies, clinics and hospital; administrative tools are systems and files; while the enabler is technology. Technology, the enabler of healthcare systems, is comprised of network, mobile devices and systems (hardware or software). Sweet Love Hospital uses different systems to manage and capture patient information. Some use systems that monitor the progression of a patient's HIV status. "*We are using TherapyEdge which is one of the patient's management systems to check patient's status using CD4 count, the treatment of the patients from the initial day a patient comes to see a doctor and it shows progress all throughout*" (SLH03, 7:258-260).

There are other healthcare practitioners at Sweet Love Hospital who use other systems or applications to send out reminders to patients. One doctor participant asserted that "*We are using Medication Adherence App to send reminders to patients; the App is useful in tracking patient's medication intake and also reminding them about their appointments*" (SLH03, 9:324-326). Delivery of healthcare is the

responsibility of provincial government; at Sweet Love Hospital government and health authorities are the non-human actors who determine that whatever Sweet Love Hospital does is in alignment with the mandate of the health regulations as viewed by state.

These actors were identified through interviews conducted at Sweet Love Hospital; the data was collected using semi-structured interviews and then transcribed. The researcher accepted that Sweet Love Hospital is constructed from this range of heterogeneous elements; therefore, the heterogeneity construction needs to be described.

Networks

The different networks of people from the SLH case study are formed for various social structures made of individuals and organisations associated with one or more types of interdependence (providers, recipients, administrator and enabler) which are the “nodes” of the network. These networks were divided into two main groups: technical and non-technical networks. In these cases, by *technical* we refer to healthcare practitioners, other healthcare staff, funders, government and patients, while *non-technical* refers to healthcare facilities, systems used, medical equipment and spoken languages. Within the main networks, other networks existed, which ANT refers to as heterogeneity. Assumptions of ANT are that if any actor, irrespective of its position, is removed from or added to the network (for example, if technology is introduced into an organisation) then the functioning of the whole network will be affected (Cresswell, Worth & Sheikh, 2010). In SLH, some of the networks were consciously formed, while other networks were formed sub-consciously, all playing a role in the delivery of healthcare services.

Heterogeneous networks are of aligned interests, including people, organisations and standards. According to Callon (1986), a network is built through a four-step process: problematisation, interessement, enrolment and mobilisation.

At Sweet Love Hospital, those networks which are unconsciously formed were influenced by various factors such as relations, spoken language, technical support, chronic condition, culture, diagnoses, support groups, work role and systems used. Desktop support or any IT technical support is the service that is given to the user in

terms of connectivity, software and use of applications. *“We provide support for government hospital and external clients, we have people working at the clinics, but what we do here we provide support for all SLH users”* (SLH02, 3:111-112).

For the actors who work in the same specialisations or departments such as doctors, nurses, pharmacists, administrators and IT personnel, networks were unconsciously formed. Different jobs specialisations have their own unique jargon, terms used which, if a person is not familiar with, they might not understand what is being communicated. Depending on who is translating these terms or jargon, an entirely erroneous meaning might be delivered. One of the IT personnel participants stated that *“these are guys that we speak the same IT language, so they understand the IT jargon there is no need for me to try and simplify it for them”* (SLH01, 2:56-57). The challenge is that IT personnel work with other people on different specialisation who then might not understand this IT jargon that they use. According to SLH0 (5:182), *“the most challenges we get is when user we are dealing with user who are not IT and also not computer literate”*.

Besides the verbal communication that the networks use, they also utilise technologies such as mobile phones and social media services to communicate and monitoring a patient's health while at home. Patients also receive scripts for medication repeats to be used for a specific period. *“We are using TherapyEdge which is one of the patient's management systems, what it does it check the patient's status using CD4 count”* (SLH03, 7:258 -259).

Through support that the IT personnel have to give to the healthcare practitioners (doctors, nurses and pharmacists), other healthcare staff (administrators, managers and researchers) and patients, networks were formed within networks, creating heterogeneity of networks. For example, for some of those actors who are doctors, a network where part of another network of nurses, pharmacists, patients and sometimes even researchers formed if the condition the doctor was dealing with needed further research. According to SLH02 (4:127-128), *“We have doctors, nurses, counsellors, field workers (works as counsellors and others are called linkage to K-Officers)”*. Communication relations happens almost everywhere at Sweet Love Hospital, for example, nurses and pharmacists, doctors and researchers, pharmacists and doctors, and pharmacists and patients. Sometimes, for example, a nurse needs to communicate with doctors and patients and sometimes also with pharmacists to nd arrange for patient's treatments to go accordingly.

The importance of the heterogeneity of networks at SLH is the fact that patients don't have to understand the language spoken by the pharmacist, as all the information of their prescriptions is sent electronically by the doctors to the pharmacy. Patients just carry a copy of the prescription for regulations compliance.

Sweet Love Hospital operates in different facilities categorised of different structures: hospitals where patients can see a doctor and be admitted; clinics where patients can go for general consultations or regularly for check-ups and renewals of scripts and also to collect medications; and pharmacies where patients go to collect their medications. According to SLH0 (25:1056-1058), *"We have patients called "club" this are patients who are on chronic medication, but they are stable, there is no need for them to come every time to the clinic, therefore we dispatch their medications"*. Whether patients go to hospital or clinic or just to the pharmacy, they are all being serviced by SLH and came for very same reason – to receive a service from healthcare. However, these patients come from different designated areas. And due to the designation areas from which the patients come, different networks existed. Those who come from the same ethnicity background, for example, formed their own networks. *"We have patients who stay at squatter camps (non-remote areas)"* [sic] (SLH05, 21:638). The actors on those networks, speaking different language such as Tshivenda, Xitsonga, Isizulu, Sesotho, Sepedi and Xhosa, relied on their individual languages to access medical information and receive medications. However, this actor had to interact with healthcare practitioners such as doctors, nurses and pharmacists who speak different languages.

Moments of translation

ANT is the concept of translation in which innovators attempt to create a *forum*, a central network in which all the actors agree that the network is worth building and defending. Callon (1986) has defined four moments of translation which the researcher has applied as the lenses of analysis for the study data. The below table shows how Sweet Love Hospital data was analysed using four moments of translation:

Table 5. 3: Moments of translation: activities of Sweet Love Hospital

Problematization	Interessement
<p>Healthcare practitioners and other healthcare staff of Sweet Love Hospital have problematised communication. Communication with regards to spoken languages and ways of communication has been problematised between SLH healthcare facilities and between healthcare practitioners, other staff to another one or between healthcare practitioners and patients. SLH healthcare became aware of communication challenges during patient visitation at the hospital. Other communication challenges were realised when IT personnel were helping healthcare practitioners or patients. SLH patients visit the hospital for different reasons: some go to collect medications or prescriptions, while others go because they need to consult with doctors. On the other hand, IT personnel assist healthcare practitioners and patients in different things. They set and connect practitioner's computers; they provide support to both practitioners and patients with the use of technologies offered by SLH. During, this process of interaction, they realise that systems or applications to translate were required in order for them to render a good service to all their patients.</p>	<p>Sweet Love Hospital are interested in the improved health of their patients and open and clear communication with their patients as they deal with people who have chronic conditions. Not everyone was interested; however, those interested such as data capturers and IT personnel played a role in making sure the services were delivered accordingly. Data capturers were interested in the systems provided for them to capture data so that the data can be accurate, while some IT personnel showed interest when engaging with the users. The SLH providers started being interested when one of the patients was given wrong medications. Some of the healthcare practitioners dealt with patients directly while others were just working in a support function to make sure patients get the best service and receive correct medications as prescribed. The interest of SLH was based on making sure that all the chronic condition patients receive their medications on time and get correct prescriptions.</p>
Mobilisation	Enrolment
<p>Some healthcare practitioners started to learn spoken languages at their designations of work. Those who knew the languages were more than keen to assist those who couldn't communicate, while others volunteered to become interpreters</p>	<p>Not all the healthcare practitioners who were interested in the SLH healthcare services managed to fully address this need on their own. Some of the healthcare practitioners who were unable to communicate with the patients</p>

without being appointed or paid for it.	depended on their colleagues to assist them. Some healthcare practitioners used graphs and pictures in order to communicate better with the patients.
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Moments of translation: problematisation

Healthcare practitioners and other healthcare staff of Sweet Love Hospital have problematised communication. Communication with regards to spoken languages and ways of communication has been problematised between SLH healthcare facilities, and between healthcare practitioners and other staff to another one or and healthcare practitioners and patients. SLH healthcare became aware of communication challenges during patients’ visitations to the hospital. When patients come to the hospital, they must be able to communicate with healthcare practitioners. SLH03 (7:276-278) explained that *“Most of our lost to follow-up patients is due to language barriers experienced when they visited the clinics”*. This worsens as SLH sends their patients short text messages as reminders to return for their medications or consultations. This becomes challenging because the hospital needs someone to integrate and interpret the system in terms of what the patients understand because in most cases, SLH sends text messages to remind patients of their appointments, and sometimes the patients cannot understand what they are receiving in English.

Other communication challenges were realised when IT personnel were helping healthcare practitioners or patients. SLH patients visit hospitals for different reasons: some go to collect medications or prescriptions, while others go because they need to consult with doctors. On the other hand, IT personnel assist healthcare practitioners and patients in different things. For example, they connect practitioner’s computers and they provide support to both practitioners and patients with the use of technologies offered by SLH. During this process of interaction, they realise that systems or applications were necessary to translate in order for them to render a good service to all patients.

Due to the element of communication that exists during the interaction between all these different networks, the reliance on defined language for communication is required. Most of actors stick to English as it becomes the common used language. However, SLH also has patients who are foreigners or those who are completely illiterate and most of the time, do not understand other languages. As the linguistic nature of some of the actors rendered them unable to communicate with each other, different healthcares resort to different solutions to address this: some used each other as interpreters and other healthcare providers used graphs and pictures to

address this issue. These challenges make the semantics of language critical and thus significant to countless people who visit or work at the hospital.

One challenge occurs when a language barrier already exists and the user is based in the field or out in offices, so a call would have to be made in order to assist the user. This call typically takes longer than a face-to-face or remote access of the user screen, which then impacts on the turnaround of an IT technician's time of resolving a problem. Sometimes the difficulty arises from either a communication barrier or a person being unable to understand the IT language used. For example, participant SLH02 (4:153-155) asserted that *"You will sometimes spend an hour with an outpatient or user trying to explain, with something that would normal take you five to ten minutes"*. It is sometimes assumed that because we are dealing with professionals, the issue of language will not be a factor, but it seems like any where two people are talking about areas of specialisations there are bound to be certain terms or jargon employed that only those in that profession would be able to understand. This leads to some technicians falling back into the language that they *think* the user will understand better: *"I address my users in their relevant language because I can speak Sotho, Zulu and English"* (SLH02, 5:186-187).

The diversity of South African healthcare is accentuated because many of the people working in this field are not even South Africans. Therefore, those who are not South African are disadvantage with regard to communication; they end up feeling inclined or obliged to learn all these official spoken languages in South Africa. According to one of the participants, SLH01 (2:42-43), *"For me because I am a Zimbabwean, I normal use English because I am not familiar with a lot of languages over here"*.

More and more, healthcare providers are using *Health IT* to improve patient care. But health IT isn't just for healthcare providers, it can be of use for health patients to better communicate with a doctor, learn and share information about health, and take actions that will improve quality of life. Health IT lets the patient be a key part of the team for keeping healthy. *"Technology can help minimizing time, more especially with the issues of languages barriers between practitioners and patients"* (SLH03, 8:299-300).

Sweet Love Hospital has advances a great deal in the way that they use different applications to remind their patients of their health: *"Medication Adherence App is designed to serve as a reminder for your medications and appointments. The App is useful in tracking your medication intake and also reminding patients about their*

appointments” (SLH06, 24:977-979). However, the healthcare practitioners and users are still struggling to utilise this application. Participant SLH03 (6:230-231) asserted that *“if we send reminders to our patients through text messages, only few patients responded and most of them did not, and we got lost in trying to follow-up with them”*.

Even though language barriers can be regarded as a bigger part of the problem, at Sweet Love Hospital it seems that the use of technology or the knowledge around technologies being used still needs attention, as far too many potential users are still unaware that the technologies even exists.

Moments of translation: interessement

Interessement means getting the actors interested and negotiating the terms of their involvement. The primary actor works to convince the other actors that the defined roles are acceptable. The SLH providers started being interested when one of the patients was given wrong medications. Some of the healthcare practitioners dealt with patients directly while others were just working in a support function to make sure patients got the best service and receive correct medications as prescribed. The interest of SLH was based on making sure that all the chronic condition patients received their medications on time with correct prescription refills.

Information and communication technologies used in the healthcare sector have well-known advantages: they can promote patient-centred healthcare, improve quality of care, and educate health professionals and patients. However, implementation of ICTs remains difficult and involves changes at different levels: patients, healthcare providers and healthcare organisations. For SLH’s IT Department to achieve their goal of implementing these technologies, the support of the users, who in this case are healthcare practitioners (physicians, nurses, councillors, researchers, fieldworkers, pharmacists, management and executives) is essential. Especially seeing that communication or language frequently becomes an issue, IT personnel have shown that they are interested by accommodating the users when they interact with them. As asserted by one of the participant, SLH01 (2:52-54), *“IT personnel we speak technical language, however we try to narrow the language to common spoken language when communicating with users”*.

It is the duty of SLH IT Department to confirm that all systems are up and running and the users are able to use their computers and access the applications. According to participant SLH03 (6:212-213), *“I make sure that the systems are running just to immunise the treatments of patients and support in terms of our systems”*. Physicians,
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nurses, pharmacists and other types of healthcare providers all need to become more involved in advocating the integration of IT in healthcare and the use of advanced technologies in the hospital, even though it is admittedly difficult to actually convince the healthcare practitioners to use these systems because most of them are used to old ways of doing things and hence tend to resist in accepting new technologies: *“People have this attitude of sticking to what they are comfortable with, but with time they get used”* (SLH03, 8:323).

ICT is transforming our life, our ways of interacting with each other, and our day-to-day life and work. According to SLH001 (70-74), *“Given a situation that nowadays everyone uses cellular phone it is not that difficult for them to adopt, they will grasp the concepts regarding those applications”*.

Users such as doctors are interested in the use of different applications because they need to know how to use these systems to be able to deliver the work perfectly. They need this technology to access patients’ medical records, MRC scans and so forth. According to SLH02 (4:135-136), *“Doctors will have a problem if the internet is not connecting, if they can’t download patient’s statistical data and reports”*. Doctors are aware that the use of technology betters their services; hence, most of them, perhaps with the practical knowledge of various apps on their mobile phones, find it simpler to use these applications that are on mobile phones. *“Most of the doctors are fine with adapting as they want advance ways to lighten or fasten up their jobs”* (SLH03, 8:321-322).

Moments of translation: enrolment

Here, actors accept the roles that have been defined for them during interessement. Not all healthcare practitioners who were interested in the SLH healthcare services managed to fully adhere to this need on their own. Some of the healthcare practitioners who were unable to communicate with the patients depended on their colleagues’ assistance. Some healthcare practitioners used graphs and pictures in to facilitate more effective communication with the patients. Communication at SLH didn’t necessarily mean that the actors had to communicate verbally; in other situations, the actors communicated through interactions between them.

Because of the interest that the actors have, they end up interacting with each other without realising they were intentionally interacting. Patients went for consultations at the doctor’s room, the doctor gave a patient a prescription while the system sent the copy of the prescription automatically to the pharmacy. When the patient arrived at

the pharmacy, they must have their prescription for validation and the pharmacist will conduct a small counselling session depending on the condition of the patients before dispensing the medications. During patient visitations to the doctors, if they receive a prescription, they need to take it to a pharmacy, where a pharmacist must be able to understand what is being communicated by the doctor on the script prior to dispensing the necessary medication. According to SLH03 (8:299-300), *“We have a little bit of counselling communication with patients at the pharmacy before dispensing the medications”*.

SLH patients use ICT at home as a tool for communication with healthcare professionals. As SLH deals with chronic diseases that require patients to access medications, the IT Department, in cooperation with the healthcare providers of SLH, have made it a point that their patients are able to have access to these medications: *“Sweet Love Hospital has designed and prototyped an ATM-like device to dispense medications”* (SLH07, 26:1071-1072).

These actors are involved in an unknown relationship which is influenced by the decisions that they have consciously or unconsciously made. Depending on the decisions that the actors have made, they either conduct the process in a formal or informal way, even though both processes can be either good or bad, depending on the perspective of the person looking.

With the informal way, one can receive a service quickly without having to go through all those validations. However, the challenges that arise when proceeding with the informal process is that the actors might skip the crucial process that needed to be validated, potentially leading to a fatal situation or loss of life, particularly risky as Sweet Love Hospital specialises in patients with chronic conditions. According to one of the participants, *“as I told you we deal with chronic diseases like HIV were skipping a treatment it can be a serious health challenge”* [sic] (SLH03, 7:254-255). However, if the actors decide to proceed via the formal route, this can trigger a process of validation that can also require full implementation. This is where the language semantics issues come in: because the providers were not able to explain the process semantically, actors end with a lack of understanding of the semantics used in the system.

Even with the effort of IT to develop different systems that healthcare practitioners can utilise to stay in touch with patients and make sure that patients' needs are put first at all times, hospitals are still facing critical challenges of loss of follow-up. *“I think*

most of it like I said is just lost to follow up” (SLH03, 7:252). Sweet Love Hospital doesn’t just leave this in the hands of technology, they are all involved in making sure that either through technology or by relying on old ways, patients’ needs are appropriately addressed. One participant (SLH03, 7:253-255) admitted that “We are building a team of people just to go follow up on those people as I told you we deal with chronic diseases like HIV were skipping a treatment it can be a serious health challenge”.

The healthcare sector is a busy environment and a critical one as it deals with things that concern people’s lives. IT staff from outside South Africa find it difficult to communicate with users due to language barriers; however, due to the sturdy commitment to their work and understanding of the environment that the healthcare practitioners need to be assisted as quickly as possible, so they have adequate time to assist those who are physically sick, they end up trying to communicate with the users in languages they will quickly understand. *“As someone who’s eager to learn and to try other languages, when I try IsiZulu, I see people get happy” [sic] (SLH01, 2:47-50).*

These challenges that IT staff are facing when they support healthcare users end up strengthening the relationship between healthcare practitioners and IT staff, as one way or the other these two people must find a quicker and surer way to communicate with clarity and certainly of understanding. According to one of the participants, (SLH02, 4-5:16-162), *“As times goes by the more you get to deal with these challenges you also start learning better ways of explaining it to the user, because you get to learn that the person on the other side is not knowledgeable as you are”.* Another of the participants (SLH02, 5:193-194) explained that *“like on your far right at the corner you can find that people not even know what is far right in English but if it’s their language they will understand you”.*

Moments of translation: mobilisation

Do the delegate actors in the network adequately represent the masses? If so, enrolment becomes active support. Some healthcare practitioners started to learn to spoken languages at the designations of work. Those who knew the languages were more than keen to assist those who couldn’t communicate, while others selflessly volunteered to become interpreters without being appointed or paid for this work.

At Sweet Love Hospital, IT personnel becomes spokespersons on behalf of the patients as they have to keep the patients’ needs at heart when they implement new

technologies such as software and applications that both healthcare practitioners and patients will need to use. *"We are sending messages to the patients in the language that we think we know best, but we don't get the feedback because the language doesn't get understood by those we are trying to communicate to"* (SLH03, 9:345-347).

As Sweet Love Hospital is a hectic environment dealing with life-threatening situations, technology emerges as the best tool to be adapted to connect the healthcare practitioners and IT staff when it comes to IT issues that healthcare users are faced with daily. Technology is therefore used to resolve technological issues. One of the participants (SLH01, 1:35-37) mentioned that *"we use a skype for business solution where you can ask a user to share their screen irrespective of their location"*. There are times that explaining on Skype or over the telephone is not viable; however, they just don't leave healthcare practitioners hanging, they mobilise the technicians' onsite to help resolve the problem. *"If it needs me to be on site, normally for site which are very far like KZN and Free State they are some front office technician which are close to there, then we just give them instructions of what they need to do"* (SLH01, 2:37-40).

Technology is quickly advancing the way things are done in the healthcare sector. To communicate all these challenges and the implementation of new applications and systems that IT needs to develop and test for healthcare practitioners as well as patients becomes challenging. There are numerous aspects that come into play when we talk about healthcare, such as privacy, security and confidentiality of patient healthcare records. Therefore, not everyone can just decide what needs to be implemented and when and how: certain protocols and various stakeholders must be involved. *"Sweet Love Hospital is at the vanguard in supporting and delivering prevention, care, and treatment services for HIV and associated diseases"* (SLH06, 22:923-924). However, these SLH couldn't have managed to deliver these services on their own. According to SLH06 (22:923-924), *"We work with government and communities to find pioneering solutions to build and strengthening public healthcare"*. Through mobilisation, they are able to embrace a strong entrepreneurial culture which focuses on technological innovation to enhance services, address skills shortages, and deliver quality healthcare outcomes. It was also mentioned that Sweet Love Hospital's goal is to comply with all applicable legal and regulatory requirements relating to healthcare and business processes.

In summary:

The methods of problematising the relationship between IT personnel and healthcare providers are diverse, so are interests and participations. However, relationships in this case are influenced by various factors such as technical support, spoken language, culture and bilingualism. For example, most patients who are not from South Africa find it difficult to communicate with the healthcare practitioners in the language with which they will both be comfortable. While at the hospitals, if the person who is in charge of the hospital speaks a specific language, this language appears to arise in dominance: *“We use mostly English, because even the superintendence who are on call around the hospital, you find that most of them are from other African countries and only comfortable in English”* (SLH05, 14:556-558).

It is imperative that healthcare providers be more aware that attaching ethical and humanist values to their daily practice allows them to incorporate patients' expectations and needs and helps provide high quality services, regardless of the patient's social, cultural and economic background. The medical conversation is the major medium of healthcare. The majority of the medical encounter is spent in discussion between practitioner and patients. The relationship, therefore, directly determines the quality and completeness of information elicited and understood. The relationship is the major influence on both practitioner and patient satisfaction, thereby contributing to practice maintenance and prevention of practitioner burnout and turnover. Moreover, relationships are the major determinant of compliance.

5.5.2 Diffusion of Innovation theory

Diffusion of Innovation (DOI) theory, developed by Rogers in 1962, is one of the oldest social science theories. It originated in communication to explain how, over time, an idea or product gains momentum and diffuses through a specific population or social system (Dutta, 2014). An innovation can be an idea, knowledge, a belief or social norm, a product or services, a technology or process, even a culture, as long as it is perceived as being new (Striphas, 2006). For Rogers (2003a), the innovation-decision process involves five steps: (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation. These stages typically follow each other in a time-ordered manner, as applied below:

Innovation decision process: knowledge

The innovation-decision process starts with the knowledge stage. In this step, an individual learns about the existence of innovation and seeks information concerning that innovation. “What?” “How?” and “Why?” are critical questions in the knowledge phase. Also during this phase, the individual attempts to determine “what the innovation is and how and why it works” (Rogers, 2003a:21). According to Rogers, the questions form three types of knowledge: (1) awareness-knowledge, (2) how-to-knowledge, and (3) principles-knowledge.

ICT is providing opportunities for SLH staff, health practitioners and management to obtain information, communicate with other healthcare professionals and patients, offer primary healthcare support and promote preventive healthcare programmes. However, it becomes challenging for IT staff to communicate or support the innovation if the healthcare practitioners who are users are not aware of how to utilise the applications and software that are on offer by IT on behalf of the hospital. According to SLH01 (2:66-67), *“sometimes it comes a challenge if it’s a user’s problem where you find that the user is not knowledgeable how to use excel or word, or they don’t know how to go to google or hoe to open this website and so forth”*. The emerging and changing technological development has led to a rethinking in the way technology can be effectively used in healthcare delivery. Technology-enabled systems allow healthcare providers to deliver better support at lower cost as well as contribute to quality health services. Therefore, healthcare practitioners must have a thorough knowledge of how different technologies in their environment work.

Technology certainly plays a part in the success or failure of these operations at SLH. Without a robust IT infrastructure, SLH would not be able to deliver the promised benefits of integration. This may not be immediately obvious to people in the healthcare industry, which is near the bottom of the ladder in terms of IT spending and uniform data standards. *“Employees they are aware of the technology and any app that can be developed I am sure they will grasp the concepts regarding those applications”* (SLH01, 2:72-73). The challenge that SLH is facing is that of the language which is used to communicate, as not everyone is South African, and even among those who are South African, not everyone is able to speak all eleven official languages of this country. Furthermore, other people are not educated or knowledgeable enough to be able to understand these communications. According to SLH03 (9:344-345), *“Because we are sending messages to the patients in the language that we think we know best but we don’t get the feedback because the language doesn’t get understood by those we are trying to communicate”*.

The SLH has many stakeholders, each with an agenda. Often these actors have resources and power to influence opinion and public policy by helping or hindering an innovator. For example, healthcare providers and practitioners sometimes have a tendency of blaming technology-driven product innovators for the healthcare system's high costs because they lack the knowledge of what has caused the problem. *"They will never acknowledge that they don't know how to use the application"* (SLH02, 5:180).

Many SLH clinics are situated in remote villages lacking easy access to hospitals and advanced medical facilities. However, the village inhabitants are now being educated through telemedicine and digitalised health information. This initiative is helping millions of citizens improve their daily lives. This will address the knowledge and skill transfer of how to use mobile devices. But the knowledge of healthcare workers about the use of computers and mobile devices still remains challenge everywhere, still needs to be addressed with some urgency. This challenge is cause by the technology know-how from the users (patients, managers and practitioners). According to SLH01 (2:64-66), *"sometimes it comes a challenge if it's a user's problem where you find that the user is not knowledgeable how to use excel or word, or they don't know how to go to google or how to open this website and so forth"*.

As medical technology evolves, the determination of how and when to adopt or invest in this technology increases in importance. Move too early, and the infrastructure needed to support the innovation may not yet be in place; wait too long, most of the SLH users are not using the technologies available them because they are not fully aware of them. While some are aware, they often lack the knowledge of language semantics used as part of the application. *"We try to understand why they didn't respond, and you find that most of the time is language, they didn't understand what we have sent to them"* (SLH01, 6:233-234).

Innovation decision process: persuasion

The persuasion step occurs when the individual has a negative or positive attitude toward the innovation, but "the formation of a favourable or unfavourable attitude toward an innovation does not always lead directly or indirectly to an adoption or rejection" (Rogers, 2003b:176). The individual shapes his attitude after learning about the innovation, so the persuasion stage follows the knowledge stage in the innovation-decision process. Unfortunately, most adults at SLH, age 55 and over, did not grow up with a heavy presence of ICT in their lives and are, accordingly, less likely to naturally use ICT in association with healthcare. This is presenting a

challenge to SLH as this is an age group of people who tend to suffer from chronic conditions. The impact is not only from the use of technology but also the language that is used as part of these technologies. People, therefore, are more inclined to recognise ICT usefulness in healthcare, especially if they have had exposure to the topic.

SLH has resorted to awareness campaigns, educating these elderly to accept the use of these different technologies. According to SLH03 (9:332-333), *“we always educate the users and make them know the benefits, for example we talked about the pharmacy automation system”*. At SLH it was definitely challenging to persuade the user to accept systems before they could visibly see the functionality; some were persuaded while others waited for full implementation. For example, *“the pharmacists only accepted magafour the time when they understand the benefits and seeing that time it takes now using the machine, they started buying into using it and start supporting the vision of the company”* (SLH03,9:332-333). Persuasion becomes difficult because a number of patients are illiterate, escalating the difficulties for the healthcare provider.

Furthermore, Rogers states that while the knowledge stage is more cognitive (or knowing) centred, the persuasion stage is more affective (or feeling) centred. Thus, the individual is involved more sensitively with the innovation at the persuasion stage. Therefore, at SLH, for those who work in the same jobs, communication becomes easier and they are eventually able to interact with more ease: *“Because these are guys that we speak the same IT language, so they understand the IT jargon there is no need for me to try and simplify it for them, therefore English becomes more comfortable for us and it’s easy for us to understand what we are trying to resolve”*.

The degree of uncertainty about an innovation’s functioning and the social reinforcement from others (colleagues and peers, for instance) affect the individual’s opinions and beliefs about the innovation, to an extent that IT personnel have to devise ways of making the user understand how this innovation works. According to SLH01 (4-5:160-162), *“As times goes by the more you get to deal with these challenges you also start learning better ways of explaining it to the user, because you get to learn that the person on the other side is not knowledgeable as you are”*. In most instances, they are just not communicating the innovation; therefore patients and practitioners won’t be able to know that something like that exists, or if they do know, they won’t use it as there is no one imprinting on them the need for utilising such technology. *“Even though we know that there is an obstacle, but we get to a*

point of where we think the application or systems is just not working” (SLH03, (7:240-241).

Technologies are required during the interaction of healthcare service providers and patients, as sometimes the communication can be a barrier. If healthcare service providers are educated on the use of technologies, it becomes easier to convince them to adopt the technology. Both SLH healthcare practitioners and patients need to be educated regarding the use of different technologies to avoid the need for a third person, as the involvement of such a third person compromises privacy and confidentiality, which in turn affects the signed ethical code of conduct. Therefore, it is important to develop technologies that can translate and interpret for patients rather than involving another human being. According to SLH04 (10:406-407), *“The communication team that always translate the messages into vernacular or local or the spoken languages, are they professional interpreters or translators”*. This can demoralise the patients from returning if they feel they were not treated in a manner that kept their information confidential.

Although it is acknowledged that the benefits of ICT will not be realised without considerable changes in work processes and structures, SLH has to realise the technologies presently available and begin making patients aware of them. It is only through awareness and utilisation that the benefits of an ICT innovation can be realised and then appreciated to its fullest. *“I don’t think all of them are doing it, hence we still sit with a big number of patients who don’t even respond to those text messages, I think awareness is needed” (SLH04, 7:247-248)*. Persuasion from the healthcare providers to patients at SLH is still a concern, so individuals continue to search for innovative evaluation information and messages through the decision stage.

Innovation decision process: decision

At the decision stage in the innovation-decision process, the individual chooses to adopt or reject the innovation. While *adoption* refers to “full use of an innovation as the best course of action available,” *rejection* means “not to adopt an innovation” (Rogers, 2003a:177). If an innovation has a partial trial basis, it is usually adopted more quickly, as most individuals first want to try the innovation in their personal situation before arriving at an adoption decision. Healthcare providers in SLH were faced with a number of challenges, which included the increasing size of the aging population, a shortage of healthcare workers, patient demands for increased access to health information and participation in healthcare decision making, and rising

healthcare costs. According to SLH03 (9:333-335), *“it was very challenging for the pharmacists to accept the magfour when we said this is the application that is going to run and pick up the medications to dispense to the patients”*. The vicarious trial can speed up the innovation-decision process.

However, rejection is possible in every stage of the innovation-decision process. Most of the doctors are fine with adapting, as they want advance ways to lighten or hasten their jobs, but the nurses find it difficult as they are used to old ways of manual systems. People carry this attitude of sticking to what they are comfortable with, but with time, they will become accustomed to new ways. When looking to increase productivity, healthcare leaders and decision-makers tend to focus on short-term financial gains. However, short-term gains derived from rash and quick decisions to solve a big problem can result in communication breakdowns that produce higher overall healthcare costs, such as inaccurate diagnoses that prompt unnecessary tests and services. As per SLH11 (32:1269-1271), *“Working across South Africa we work directly with healthcare practitioners and government to identify facilities, sub-districts, districts and provinces where we can put forward unique models to address their individual needs”*.

Dealing with technologies can incur heavy financial challenges. There are times when decisions are made to rely on their own staff as interpreters forced by circumstances they found themselves in. They don't have full-time interpreters on the premises, so if they need a professional interpreter, they must request this from public hospitals for assistance, cause critical delays. However, these providers fail to take into account both the consequences of not providing the services and the potential cost benefits of improving communication with their patients. Sometimes, they claim the challenge rests not necessarily with the language per say, but on the terminology used on the devices that are provided. According to SLH04 (12:454-455), *“I think the issue of semantics is, one of the challenges it depends on the kind of messages you are trying to send out”*. Sweet Love Hospital must not consider taking decisions related to all the tasks mentioned above; to address the issue of language semantics translation, they need to make decisions and follow this with the implementation of the decision that has been taken.

Innovation decision process: implementation

At the implementation stage, an innovation is put into practice. However, an innovation brings the newness in which “some degree of uncertainty is involved in diffusion” (6). Uncertainty about the outcomes of the innovation can still be a problem

at this stage. Thus, the implementer may need technical assistance from change agents and others to reduce the degree of uncertainty surrounding the consequences. SLH has partnered with the Department of Health in terms of some implementation to eradicate the uncertainty of users: *“Working with the Department of Health and our global donors we have secured funding to roll pharmacy automation. Beginning of 2016 SLH ePharmacy spearhead projects to implement this proven technology into four hospitals around Gauteng”* (SLH08, 27:1096-1097). Moreover, the innovation-decision process will end, since “the innovation loses its distinctive quality as the separate identity of the new idea disappears” (Rogers, 2003a:180).

ICT used in the SLH healthcare sector has well-known advantages: promoting patient-centred healthcare, improving quality of care, and educating both health professionals and patients. However, implementation of ICTs remains difficult and involves changes at a variety of levels: patients, healthcare providers, and healthcare organisations. In order for SLH’s IT Department to achieve their goal of implementing these technologies, they require the support of the users, who in this case are healthcare practitioners (physicians, nurses, councillors, researchers, fieldworkers, pharmacists, management and executives). Seeing that communication or language in many instances becomes an issue, IT personnel have demonstrated interest by accommodating the users as they interact with them. The implementation of computer-aided detection for Tuberculosis at SLH, for example, was the result of the fact that radiologists are scarce in South Africa and to review each digital x-ray would have been time-consuming and costly. SLH looked into available technologies being used abroad to see if this challenge could be overcome: *“We settled on Computer-aided detection for Tuberculosis (CAD4TB™) developed by Delft Imaging Systems which designed to help expert readers in the diagnosis of TB”* (SLH02, 28:1138-1139).

In SLH, the implementation of mobile health is a significant challenge, a challenge attributed to the broad scope of services that mobile health need to address such as factors mentioned above; a lack of resources such as infrastructure; and a lack of funds. In 2014, SLH identified the need to methodically document, evaluate, and share best practices, clinical principles, and innovations arising from the organisation’s programmes. The organisation established a dedicated operational research unit to meet these needs. Many of unit’s solutions have resulted in significant positive changes to clinic functioning and consequently in the lives of patients. SLH managed to implement systems such as *“An interface between TherapyEdge® and Trimed® eliminated the need for the pharmacist to recapture*

prescription data" (SLH07, 25:1020-1021). From the implementation, the transfer of data is managed via HL7 messaging (an industry standard messaging system). This ensures up-to-date flow of patient demographic and prescription data between the systems, each system receiving and sending information.

Innovation decision process: confirmation

The innovation-decision has already been made, but at the confirmation stage the individual looks for support for his decision. According to Rogers (2003a), this decision can be reversed if the individual is "exposed to conflicting messages about the innovation" (189). However, the individual tends to stay away from these messages and seeks supportive messages that confirm his decision. Thus, attitudes become more crucial at the confirmation stage. In this case, SLH accepted the innovation: *"The response was very positive, automated pharmacy dispensing unit made our life easy because we use to go till 8pm dispensing medications before using this machine, but now that we are using this technology by 3pm they are done dispensing medications for the day and you find the pharmacy is empty everyone has collected their medications and have left the hospital"* (SLH-003: 338-340).

SLH have a customer relationship management (CRM) application which is efficient and user-friendly that speeds up the efficiency of wellness testing, HIV counselling and testing, SLH uses a LoveHealth Mobile system that enables staff members to synchronise data seamlessly from a central database with mobile data capture devices, as a result the HIV counselling and testing process happens faster, while capturing accurate test information. According to one of the participants (SLH06, 22:929-931), *"it can also save time and at the same time the won't be an invasion of privacy because some people feel free only when they are with the healthcare practitioner but when the interpreter or a family member is there then they feel somehow"*.

Finally, the widespread adoption of mobile technologies at SLH will allow for system connectivity and information exchange to be achieved among practitioners at the same hospitals, among healthcare organisations, and ultimately among the patients and community. However, the actual realisation of these benefits depends on how Sweet Love Hospital implements and deploys the various mobile technologies.

5.6 Conclusion

This chapter presented the analysis of data of the three cases, respectively, using two theories. Case #1 was analysed using only ANT, while Case #2 and Case #3 were analysed using both ANT and DOI.

The subsequent chapter presents the findings drawn from this analysis; therefore the interpretation of the findings are presented in Chapter 6.

CHAPTER 6

RESULTS AND INTEPRETATION

6.1 Introduction

As explained in Chapter 3 and presented in Chapter 5, three cases – Tshwane Community, Mukhethwa Hospital and Sweet Love Hospital – were studied. The empirical data from the three cases were analysed using Actor Network Theory (ANT) and Diffusion of Innovation (DOI) theories as presented in the previous chapter (Chapter 5). This present chapter consist of two main parts, namely results and interpretation. The results from analysis of the three cases are discussed and presented separately. Then the results were combined and interpreted as presented in the later part of this chapter.

The chapter is divided into five main parts. The first part introduces the chapter. The second, third and fourth parts present the results from the three cases, respectively. The fifth part discusses the interpretation of the results. Finally, the conclusion of the chapter is drawn.

6.2 Case #1: Tshwane Community

From the data analysis using ANT and DOI as presented in Chapter 5, some factors were determined as critical in influencing in the translation of language semantics in the delivery and receiving of healthcare services. These results were reached from a community perspective. As shown in Figure 6.1, the factors include heterogeneity of networks, bilingualism, healthcare facility and information engine. These factors were interconnected and based on interaction, communication and relationship.

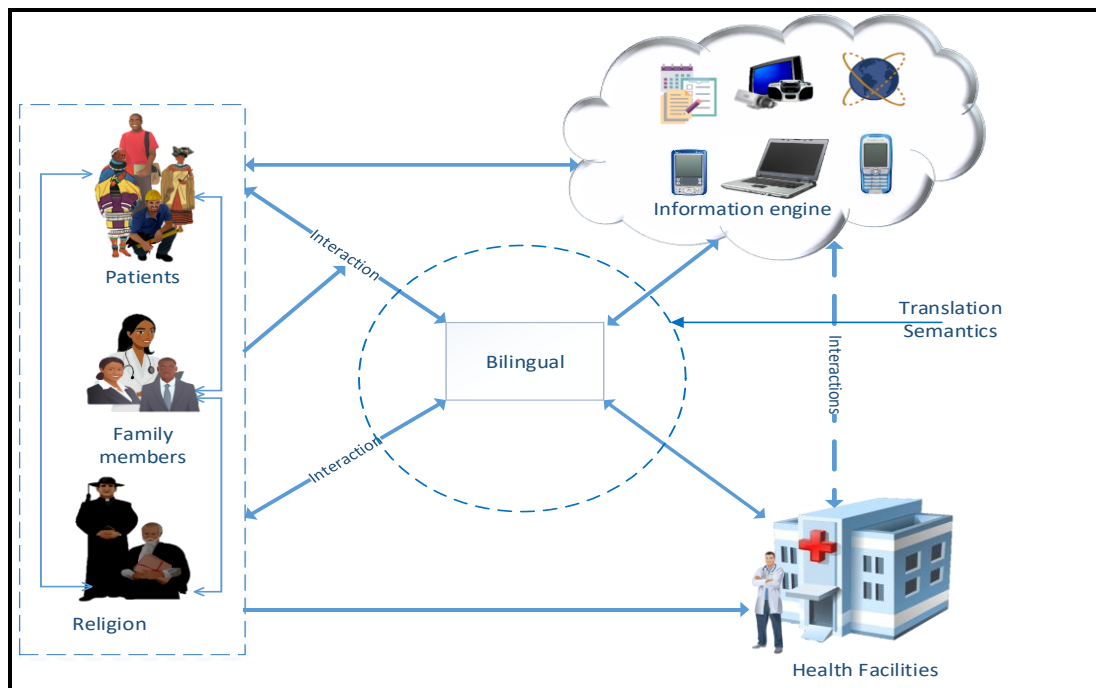


Figure 6. 1: Stakeholder interaction

6.2.1 Heterogeneity of human networks

Within the heterogeneous networks, members of the Tshwane community had to interact with healthcare service providers for a variety of reasons such as visitation to hospital, collection of scripts or medications, or simply accompanying family members or friends. During these different interactions, there were semantics in their spoken languages which influenced meanings associated with wording and tenses. Due to the various semantics, different meanings and interpretations were reached, which sometimes affected the type and effectiveness of services provided and received. For example, when directly translating “ibhande” in Isizulu to English, this word means ‘belt’, which is incorrect for medical translation. The patient was actually trying to communicate that she is suffering from shingles.

Through misinterpretations from language translation of semantics, healthcare practitioners were able to ‘make or break’ the relationship they have with their patients. Relationship between some community members and healthcare practitioners were unconsciously affected as they continue to struggle with different meanings surrounding certain issues, due to semantics of words in the languages that they spoke. As it was revealed in the data analysis, some words like ‘tuberculosis’ (TB) mean a totally different thing when translated. For example, if translated in Tshivenda it ends up meaning ‘flu’. Due to this misinterpretation, some of the community members began to avoid certain health practitioners. As a result, they did not receive attention for their health challenges, which allowed their condition

to worsen. Also, the feeble relationship led to some patients having to visit alternative healthcare facilities for medical attention. Additionally, some of the community members felt uncomfortable expressing themselves, which led to low self-esteem.

However, if technology would be developed and relied upon to translate these meanings into different language semantics, the meaning across all the South African languages would be accurate.

6.2.2 Information engine

There are several ways in which Tshwane community members received healthcare information from the healthcare providers which included but were not limited to pamphlets, radio or television, search engines and on mobile cellular phones as a text message. With pamphlets, several community members were able to confirm that depending on the dominant language used in that community, those would be the languages of pamphlets. However, with a medium of communication such as radio, television, engine searches and text messages, members of Tshwane community stated that most of the times the messages were rendered in English.

Through the use of information searches, some community members solicited information from search engines, and drew meaning and conclusion out of it on their own, and interpreted those meanings predicated on their own understanding. This led to inaccurate self-diagnosis, a trend which can result into dire consequences. Most medical terms, when translated into native languages, don't carry precisely the same semantics. Other terms do not even exist in other languages. For example, with 'cancer' as stated in Tshivenda and Pedi language semantics, this word does not even exist: Tshivenda-speaking community members referred it as a 'wound'. In the Sepedi language, they call it 'kanker', which is an Afrikaans meaning. Therefore, these examples demonstrate just how easily it would be for people to not give this condition the attention it deserves by assuming it is just a minor ailment.

When community members are unable to receive proper healthcare information, they fail to react on time to certain health issues that need quick responses; this can lead to relapse or loss of lives. Community members are deprived of the right to accurate information which, according to our constitution, is a right of every South African.

Language translation of semantics needs to be built into this system (i.e. search engines) in an effort to deliver a better, more accurate healthcare information and

services to all people, irrespective of the languages they speak. As it was revealed from the data analysis, even though healthcare facilities are trying their best to accommodate everyone, when it comes to delivering the best healthcare services, the challenges still remain in the methods of communication for receiving reminders for repeat prescriptions. The language conveying these reminders is the same, irrespective of whether or not the recipients understand the language.

Some other healthcare facilities are worse as they don't even have systems in place to remind the patients about their upcoming visit. This they still do it manually by writing the next appointment date on a file. This is challenging for those community members who don't set reminders on their own, and then they frequently miss their appointments. Some of those community members relapsed because of this.

6.2.3 Healthcare facilities

Healthcare facilities are extremely important to each community as that is where community members are able to interact face-to-face with their healthcare practitioners. Healthcare facilities need to render services to the community; healthcare facilities at Tshwane Community assist community members who speak different languages, who have cultural sensitivities, and who have different religions beliefs. These differences can be a burden to healthcare service providers when attempting to accommodate all these languages, cultures and religions.

Other healthcare institutions have employed interpreters or use staff members as interpreters to manage the challenge of communication barriers from language translation of semantics, as well as trying to provide another way of bridging a cultural and communication gap. Interpreters are still human beings so sometimes the way they speak or do things can be influenced by their background. Therefore, relying totally on the interpreters might not necessarily solve this problem.

Community members have highlighted a few words that, when translated to their language, lose accuracy of meaning. For example, it was revealed in the data analysis that some conditions, like 'kidney failure' are referred to 'Tswio' which in the Tshivenda language just mean kidneys. These semantics can cause confusion in a patient's life, as other patients asserted that there are even other things they are unable to express in other languages but can only express in their own language.

Also, there are no accessible facilities which could enable improved distribution of chronic medications to patients in their various geographical locations, and technologies that could translate semantics in the languages that were spoken by many Tshwane community members. These issues require a standardised system that can be programmed for a host of languages and interpret the semantics into the correct meanings of each programmed word.

6.2.4 Bilingualism

The majority of the Tshwane community members speak more than one language; however, those who are unable to speak any other language accept their mother tongue it difficult to communicate. South Africa is a very diverse country in which almost 11 official languages are used with regularity. Healthcare providers are challenged with issue of language essential to assessing a patient's problem and determining the appropriate care and treatment. To combat these issues, they rely on other healthcare workers to function as interpreters for people who brought in patients.

Because of this issue, hospital visitation becomes a nightmare. Some people spend unnecessary hours at the hospital trying to secure an interpreter, while others end up with a negative perception of the service being rendered. Having interpreters does not necessarily solve the problem, as some of the problems are more to do with the language semantics, not necessarily the translation, so technologies need to be put in place to ease the burden of healthcare practitioners and limit patients' frustrations with the situation.

As revealed with the data analysis, some of community members showed some elements of uncertainty when a doctor uses a nurse to translate, because they were not certain the information is being translated correctly as the patient might be someone who doesn't understand the spoken language and its semantics.

6.3 Case #2: Mukhethwa Hospital

From the data analysis using ANT and DOI as presented in the above section, some critical factors were found to be influencing the translation of language semantics in the delivery and receiving of healthcare services at Mukhethwa Hospital. Before the discussion on the results, first, a diagrammatical representation of the Mukhethwa Hospital is presented in Figure 6.2. The purpose of the figure is to draw attention and gain reflection how the networks existed, and the types of actors were in the

networks, including the types of knowledge the actors had in making certain decision that they did make. Another important factor about Figure 6.2 is that it shows how the various constituents connect towards influencing language translation at the hospital.

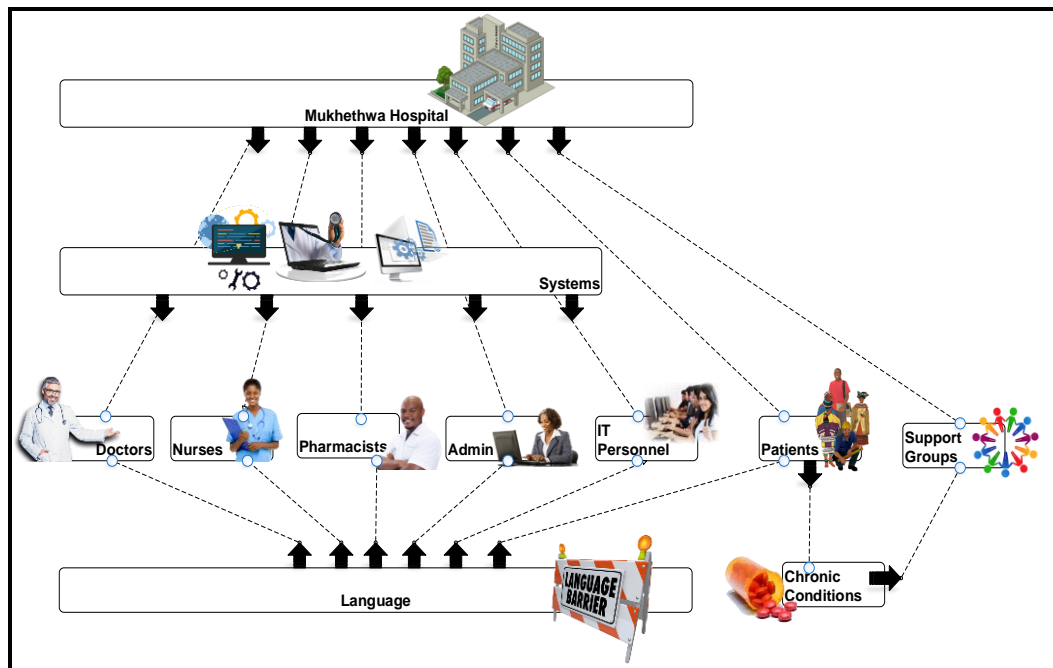


Figure 6. 2: Mukhethwa Hospital networks

As shown in Figure 6.3, six main factors were identified as critical to the translation of language at the Mukhethwa Hospital. The results include hospital management and structure, interactive systems, language barrier, support groups, technological know-how, cultural and traditional affiliation. The discussion below should be read with the Figure 6.3 in order to gain a better understanding of the results.

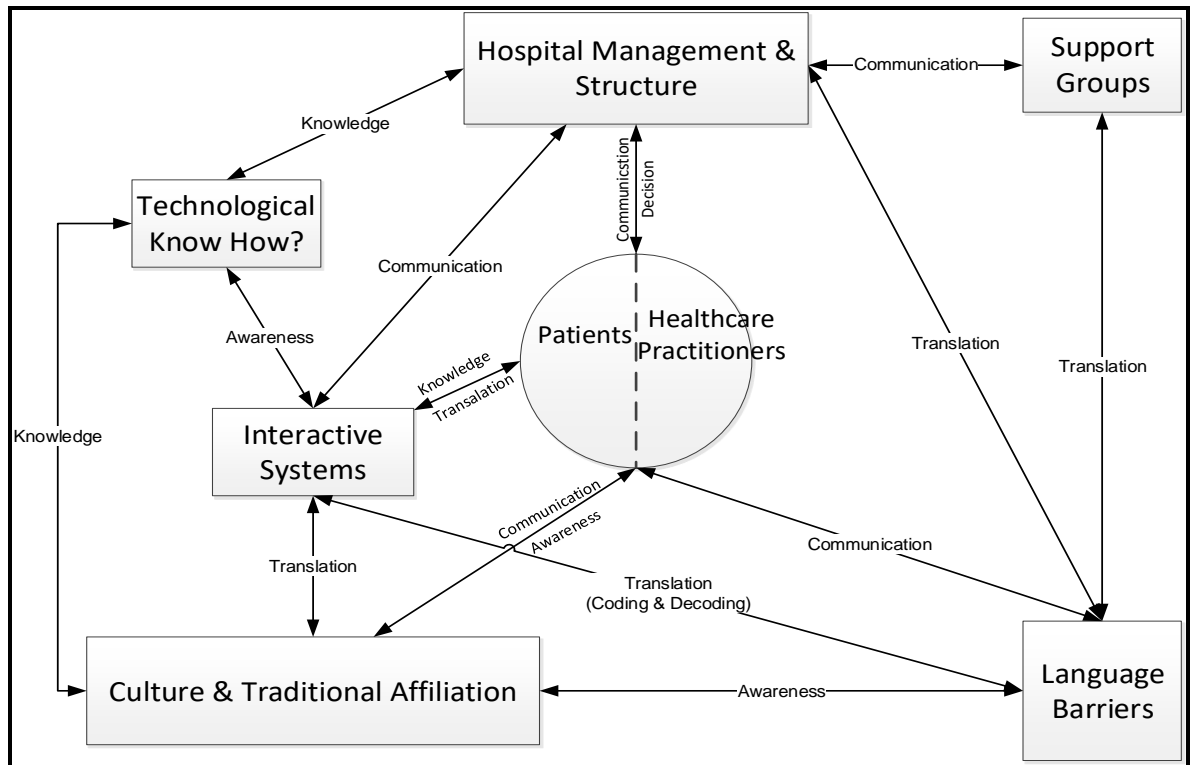


Figure 6. 3: Interaction between public healthcare practitioners and patients

6.3.1 Hospital management and structure

Mukhethwa Hospital can be considered a conservative hospital because of its rigid and formal structure within which strict processes are followed. Based on its conservative approach, it has been difficult for the hospital management to decide to migrate and employ automation for its processes. The hospital has manual processes, from when the patients come in for consultation with a nurse, to when they receive medication or prescriptions. As revealed from the analysis, the manual process allows the management structure of the hospital to have complete control and power over the activities of the health practitioners and the general events of the hospital. The structure gives the management the ability to track and measure performances through transparency of all roles and responsibilities. However, the rigid management sometimes thwarted innovations attempts.

The structure and style of management affected the innovations, knowledge sharing and skills transfer, which had impact on translation of language, in that certain information or practices were not allowed to be shared freely and willingly. As a result, some of the health practitioners were short of know-how on the use of technology artefacts. Also, those who tried to be innovative couldn't share their thoughts, knowledge or the concept they had in mind based on the management rules that

guided them. This either prevented or limited some health practitioners from the use of technology and prolonged their traditional ways of doing things. Such limitations had a definite impact on how the information was translated, as the semantics around the meanings of words differs according to background and place of origin.

Another effect of the rigidity of the management structure was that the experiences and knowledge gained from practices and activities were not documented; this information stayed with the managers. Such knowledge was barely shared or communicated with those groups which were tasked with supporting the activities of the health practitioners. This caused mistakes that often had consequences for the patients.

6.3.2 Support groups

As revealed from the analysis, there were different groups of patients who received support from Mukhethwa Hospital. The groups were consciously and unconsciously formed based on health conditions and language of communication. The groups were linked to the hospital management based on their relationship, which was to provide and receive healthcare services and each group had their distinct relationship with the hospital management. Also, the groups had neither relationships nor communications with each other. Even when some members of one group wanted to converse with other groups' members, the spoken languages that were used for communication were not only different, the semantics were difficult to translate.

The lack of communication between the groups and the inability of the hospital management to link the groups together occasionally led to duplication of efforts and services to the individual groups. Also, some groups favoured certain health practitioners to provide service to them, primarily based on the fact that they spoke in the same language, in which they felt comfortable and understood by these healthcare practitioners. Even when they were offered interpreters, they insisted on their preferred health practitioners because some of the patients didn't know that the translation could be accurate owing to some semantics in their languages.

The duplication of effort that was encountered impacted how hospital management rendered their services. A process such as capturing a patient's demographics contains information that doesn't change and can be carried across. They had to do the process twice or more, generating unproductivity of practitioners and wasting of time and resources due to these non-interactive systems. The practitioners ended up

spending more time doing one task over and over again, affected their progress and wasting time that could have spent learning other skills. Therefore, the work load increased and as a result, there was no time for skills or knowledge transfer.

6.3.3 Technological know-how

There were issues of technological (information systems) know-how from both patients and health practitioners' perspectives. The hospital had systems which were intended to enhance the services provided to the patients. However, many of the patients could not make use of some of these available systems. For example, some patients could not schedule appointments via self-management care systems, which allows taking daily wellness measurements, and send the result to the practitioners. Therefore, by not able to do these, the patients had no choice but to physically visit the hospital, even as their condition was worsening. With some patients, their conditions worsened at the time they arrived at the hospital, and yet they were unable to communicate this with practitioners, resulting in delayed medical processes and procedures and inadequate diagnoses.

Also, some healthcare practitioners at Mukhethwa Hospital were not familiar or did not know how to make use of some systems that were available and accessible to them. As a result, in some instances, some of those practitioners who were technically challenged referred patients to colleagues who were knowledge about the systems. As a result of this, they failed to document some patients' cases accurately, by unknowingly omitting information. This was not a deliberate action by the health practitioners, but resulted because they lacked know-how, and did not know how to document patient's information using the hospital system. Such action has consequences, impacting on the kind of prescriptions, medications and overall services that are provided to hospital patients.

There are many patients who have suffered as the results of this type of actions, as revealed from the data analysis. An example is the case of Life Esidimeni: some health practitioners did not know how the systems work in terms of the relationship between the patients-and-facility; patients-and-patient-conditions; and facility-and-patients-condition (Ferlito & Dhai, 2018). As a result of the lack of know-how, patients were moved out of the facility, leading to the death of 144 patients. Also, the lack of know-how affected the use of interactive systems which were intended to enhance communication between patients and healthcare practitioners, including pharmacists and Mukhethwa Hospital management.

6.3.4 Interactive systems

The challenges with technological know-how made many of the employees at the Mukhethwa Hospital rely heavily on a manual system. This type of system was unilaterality and unconsciously adopted by the patients, healthcare practitioners and pharmacists. This type of adoption – which Actor Network Theory refers to as *enrolment* – made things difficult, creating little or no room for diffusion of automated systems. Also, the longevity of the manual system meant that it was the *norm*, which made it difficult for interaction where different languages were spoken by both patients and healthcare providers. Thus, human translators were sometimes employed, but this often did not help as it was difficult to find those who could interpret the semantics accurately from various African languages into English. For example, in the Tshivenda language, they don't have correct semantics or a word for 'cancer', as the natives generally referred to it 'Tshilonda' which means 'wound' when translated literally into English.

The use of an automated interactive system could capture and translate such critical semantics once, and then continuously, without an interpreter who risks not providing the correct meaning. Also, an automated system could be used to protect individual privacy and enhance free communication. This was because some of the patients, particularly those who were not educated, were too shy or scared to express themselves on critical health conditions such as tuberculosis and AIDS/HIV. An interactive system can enable faceless interaction, while simultaneously and importantly protecting the privacy of individuals. Such systems can be enabled and supported by mobile systems, thereby limiting or eradicating language barriers between patients and healthcare service providers.

6.3.5 Language barriers

As revealed in the analysis, there was a serious language barrier between patients and health practitioners, including pharmacists, in the provision of healthcare, primarily due to the reliance on many different languages for communication and interaction for providing and receiving healthcare services. As a result of the barrier, some health activities were not accurately or thoroughly documented as they could not translate some of the semantics. Therefore, gaps were left, significant enough to sometimes impact the prescriptions and dispensing of medications that patients received.

The language barrier also caused delays in carrying out services by health practitioners. For example, many of the healthcare practitioners at Mukhethwa Hospital depended on their colleagues for translation when they did not understand or speak the same language as the patient to whom they were intending to provide services. As revealed from the analysis, this situation sometimes worsened when colleagues were, as well, not fluent in the spoken language of the patients. These types of situation forged unfortunate room for misinterpretation that led to wrong prescriptions at times. Therefore, there is a clear need for direct automatic translation for correctness, for completeness, and for accuracy. This translation can be enabled and supported by mobile systems to ensure consistency and avoid problematic repetitions. Also, language barriers influence divides that are already in place because of cultural and traditional affiliation, which can then also be addressed through the use of mobile systems.

6.3.6 Culture and traditional affiliation

At Mukhethwa Hospital there were patients who refused to interact with people, including practitioners, of opposite gender based on their culture and traditional affiliations. The analysis, for example, showed a woman who was in a coma when she was initially brought into the hospital. She was treated and brought to stable condition. But when she realised that she was treated by a male practitioner, she became unwell and depressed, because her culture does not allow a man who is not her husband to touch her.

Most of the time, the issue is more about communication. The factors about culture and tradition are often not properly communicated to the nurses and doctors, because such patients can be treated for their health conditions without touching them. But the semantics in the way it is said, it comes across differently such that it is almost an abomination, but it's not an abomination. It's almost saying that certain parts of a woman cannot be touched by another male. However, this part of the process is missing and needs to be addressed. Also, proper communication can allow an appropriate arrangement in anticipation of receiving patients who are guided by culture and tradition.

6.4 Case #3: Sweet Love Hospital

Based on the analysis of the data, six critical factors were identified for the translation of semantics in languages in the providing and receiving healthcare services in South Africa. As shown in Figure 6.4, the six factors – confidentiality, translation,

interpretation, synchronisation, spoken language and integration – were categorised into three groups, namely ethics, services and systems, a grouping based on the closeness of the factors in the provision and receipts of healthcare services. The three groupings are discussed below.

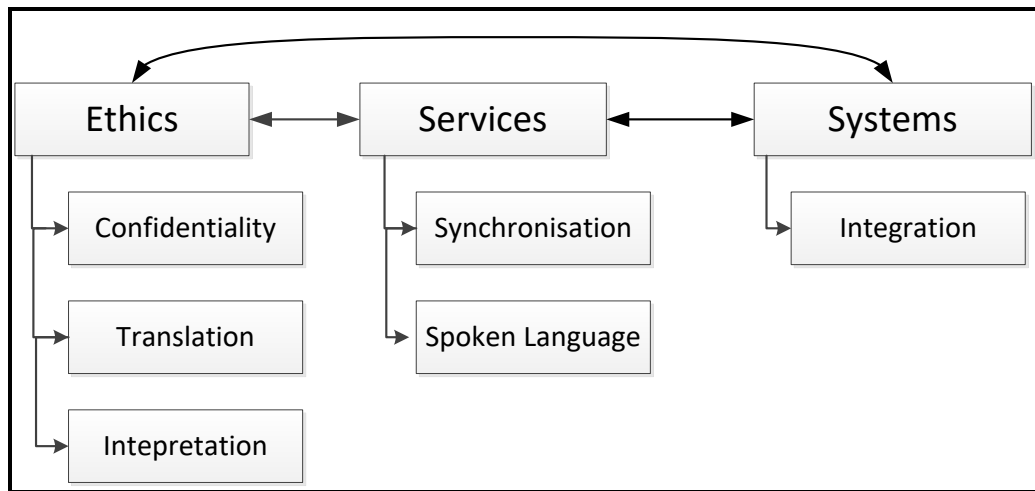


Figure 6. 4: Interaction between non-government practitioners and patients

6.4.1 Ethics of health information

Healthcare practitioners are governed by code of conduct for keeping patients' information confidential. Sweet Love Hospital (SLH) focuses on chronic conditions which include HIV/AIDS and tuberculosis. In the provision and receipt of service for these and other chronic conditions and the general healthcare, ethics are required to guide the activities of translation of semantics in languages. Chronic conditions are considered very sensitive, for a host of apparent reasons. Thus, confidentiality was high in the ethical code of conduct of the SLH. In addition, translation and interpretation were critical from the viewpoint of semantics, which must prioritise ethical behaviour. These factors – confidentiality, translation and interpretation – were challenging for both patients and health practitioners, as they could hardly be separated.

Due to these challenges, and lack of knowledge of the practitioners for handling these challenges, some of the health practitioners formed different groupings (networks), along spoken languages and area of specialisations. These networks were formed with the intention of addressing practitioners and patients' communication barriers. As a result, some of the practitioners decided to use actors in their networks as interpreters of semantics that they themselves were unable to translate in some of the languages. Lack of knowledge of the spoken language led them to make these decisions, which then became the norm and culture of the hospital, irrespective of the

fact that this culture or norm was unethical, in that the informal interpreters were not trained to do so. As a result, some of the interpreters did not have deep enough understanding of the languages to carry out semantics translation. Translation of semantics in languages requires a precise standard that can be followed for accuracy of meanings. For example, as expressed by one of the nurses, in Tshivenda, “*Ndi tshitamba tshifhinga tshothe nowa yanga iya luma*”, which means “*I suffer from period pain every time I menstruate*”. But when translated into English, it means “*every time when I bathe my snake bites*”.

As a result of inaccuracy in some translations of semantics in some of the languages, patients experienced a loss of trust and confidence in the healthcare practitioners. Thus, some patients begin to involve their family members or friends to help them with translation during their consultations with health practitioners. This approach breaches practitioner-to-patient confidentiality, which compromises ethical behaviour. Also, there was no proper documentation on how translation was carried out at the SLH. This could have informed the creation of a repository, where reuse of translation can be enabled for accuracy and consistency purposes.

As some patients involved their families and friends in their consultation process, they feared a lack of confidentiality. The fear of information leakage, sometimes causing a patient to lie about their actual health conditions, often resulted to wrong diagnoses and medications. The code of conduct doesn't only apply to healthcare practitioners, even patients need to be knowledgeable of ethical practices and behaviours when dealing with healthcare. There is a clear need for education and awareness for practitioners concerning the issues of the code of conduct. This will minimise legal suits and prevent loss of lives as a result of misconduct.

i. Confidentiality

The SLH employs a dual confidentiality approach, a two-way approach of confidentiality of information in the interaction that happens between healthcare practitioners and patients. However, the involvement of a translator, a third party, weakens this approach, and makes the goal of confidentiality less achievable. But all hopes are not lost as the use of a mobile system for translation of semantics in languages can reinforce security and privacy of information. The mobile system solution for semantics translation can instil trust and confidence in both practitioners and the patients. Thus, patients do not have to choose which practitioners they need to consult with because they were scared that privacy is at risk.

From two main perspectives, the mobile systems solution can be of critical importance for confidentiality in the translations of semantics, as follows: (1) the solution enables and support reuse, which can be efficient in the storage and retrieval of translated semantics in the languages that are prevalent for communication at SLH; and (2) the mobile system solution allows for validation of information at various levels, and grants various levels of access of both practitioners and patients to information. This improves manageability and confidentiality of patients' information. Also, this approach enhances compliance to health ethics within SLH. Most importantly, the mobile system solution approach can improve health service delivery.

ii. Translation

Translation of healthcare terminology to any language, especially South African languages, can be very difficult to virtually impossible. As revealed in the analysis, many meanings get lost when translated from English to some South African languages such as Tshivenda, Sepedi, Xitsonga and IsiZulu. Even so, community member and patients are faced with the challenge of having to translate these words at critical times in their life. For example, if a Xitonga-speaking patient says to the health practitioner at SLH: "*ndzi twa ndzi hlamba timbilu*", the English translation means "*I feel like my hearts are washing*". However, what the patient was trying to say is that "*I feel nauseous*".

More often than not, patients and community members source health-related information from media such as radios, television and the internet. Some of the information gets confusing instead of clarifying to gain an understanding of their health conditions. The confusion is often caused by challenges in attempts to translate certain words and phrases that were used in the content of the information. In some cases, in attempts to address the confusion, networks of interested members are unconsciously formed. Yet accurate meanings of some words are not realised because of semantics. Thus, the closest meanings are accepted, sometimes based on assumptions, as language translation of semantics is sometimes based on assumptions and the little knowledge some members of the network have. This challenge is mostly with illiterate patients.

The ones who might have an advantage are the literate patients or relations of illiterate patients who further carry out searches on relevant topics and hope for better translation by using applying approaches, such as this translation-triangulation one: (1) first, accurate translation to a language such as Sepedi; (2) thereafter, translation from Sepedi to Xitsonga; and (3) finally, double checking a word's meaning in

English. However, the triangular approach does not necessarily accurately resolve the problem, for two main reasons: (1) first, it is not common to have interpreters who are deeply fluent in two or more South African languages; and (2) secondly, some semantics do not exist in or cannot be translated to other languages. Wrong or inaccurate translations can be dangerous in that it leads to wrong medical decisions that can seriously impact patient's health in the long run or fail to prevent an illness that could have been otherwise prevented if identified earlier.

iii. Interpretation

Within healthcare ethics, interpretation of semantics in languages is vitally important. During consultation with patients, either the patients themselves or practitioners get an interpreter if they realise that there is a communication challenge. Although this often solves the immediate problem, it is unethical for healthcare practitioners or patients to choose anyone as an interpreter. Also, it is ethically wrong for health practitioners to allow themselves to be influenced by a patient, to make use of their next of kin as an interpreter. This is mainly because it is highly unlikely that nonprofessional interpreters will adhere to health ethics code of conduct. Those people might have not signed the ethic code of conduct because they might just have been chosen based on availability to interpret. The nonprofessional interpreters might not even understand the details and implications of breaching the code of ethics within the sensitive health environment. Also, there is no guarantee that some interpreters will be accurate in their interpretation of some semantics in some languages.

As a result, some of the things patients had to say or tried to explain might be 'lost in translation' in that some semantics in some languages cannot be easily translated. Despite the risk of miscommunication, there is no standard method of translating semantics of languages. Some of the languages cannot appropriately address some of the terms. In some instances, the interpreter is not appropriately trained to understand the semantics of the languages. Due to lack of knowledge and faulty understanding of the semantics of language, the words lose meanings. This may impact patients who are illiterate as they won't know the difference. If these patients were literate, they may not have even needed an interpreter in the first place. Therefore, in this respect we have two issues: issue of translating what someone does not acute knowledge for, and violation of the code of conduct. Ethically, randomly selected people are not supposed to be used as an interpreter; someone who is properly trained must be found. However, the use of technology can be more accurate and reliable.

6.4.2 Services

The health services rendered by a hospital have to be the same to each member of the community irrespective of their spoken languages, cultural or religious background. Therefore, the innovations that the hospitals derive must be in sync with the hospital health services. Provision of healthcare services requires collaboration among health practitioners, in their use of patient information, technologies and innovations. However, collaboration was not always synonymous to service at SLH. Some practitioners rely solely on their individual knowledge of an incident or wealth of experience. Through their stock of knowledge and wealth of experience, they make decisions to create an innovative approach. This impacts the services being rendered by the hospital as a whole as the service that some patients receive depends on an individual practitioner. The danger is that some of those innovative approaches are not validated. The use of a mobile system can help address this challenge, in that the knowledge and experiences can be documented in a repository which can be accessed at any time and place, as the practitioners are static.

The innovations for health services are embedded with terms (semantics) that are only understandable by the creator. This is another difficulty that both the creator of the innovation and the interested parties (other health practitioners) are sometimes confronted with. This challenge can be attributed to the main reason why the creator of the innovation had rather chosen to make it exclusive. However, if they could communicate and enlighten other colleagues of the particular innovation and share their knowledge and interest around this innovation, they might form networks through which more practitioners can be persuaded towards adoption of the innovation. Duplication of services costs valuable hospital resources and time as people have to redo what has been done but in a different format. This might also have an impact on the use of technologies as each comes with its own terminologies. However, the hospital must be able to use the same terminology to avoid being lost in translation as some people might not be able to understand the semantics in those systems of which they are unaware.

i. Synchronisation

Taking ethics into considerations, synchronisation is critical within the healthcare environment, primarily because it experimental-based. Some health practitioners,

particularly doctors, bring into their practice what they think is the best innovation according to their knowledge without considering what already available. For example, one of the doctors was the only one at SLH who was using an opensource system for pregnant women who are on chronic medications to communicate with each other about their experience. They sometimes do this without following any stringent process, which often affects an existing process. Because they didn't follow the process, some of the employees end up being confused without knowing what was done. This was beginning to affect their knowledge of the environment. If they had followed a process, they would have been able to persuade employees through relevant training on the use and application of the innovation. Then one particular system would have then be enhanced, if need be; however with this process they end up with two systems which are not integrated, running in parallel. Therefore, even if they choose to enhance this, the challenge comes in having to decide which system to enhance and this impacts the services they render.

ii. Spoken language

As revealed from the data analysis, spoken language was key to provision and receipts of healthcare by SLH and patients, respectively. At the time of this study, SLH did not have a system to identify the areas as per different spoken languages. Therefore, such identifications were done by guesswork. As a result, practitioners were allocated to areas for health services based on their availability, not based on whether they can communicate in the predominant language of the people in the area. The implication of this decision impacted on prescriptions, medications and medical guidance provided to some patients. The healthcare practitioners were not knowledgeable enough to make the responsible decision that they made when they sent practitioners out to the field. They sent people based on guesswork and network of availability, but this is insufficient.

6.4.3 Systems

At the SLH, there were various ICT systems. The use of systems was intended to and in fact did improve healthcare services to patients. However, the implementation of different systems needs a deep knowledge of what systems are needed before they can choose which system to use. Because of the lack of knowledge and poor communication among the practitioners, each group of practitioners tried to find a system that worked best. Thus, some of the systems were implemented in isolation, without communicating or making their colleagues aware of the system's existence.

The implementation of numerous systems without proper valuation led to duplication of systems as well as services, as some practitioners made use of systems in isolation, while other practitioners employed their own systems. The systems then run in parallel without integration. Therefore, patient information gets duplicated depending on the structure of the system. In some cases, patient information was not captured appropriately in alignment to reflect the same patient. In emergency cases, this caused frantic delay in trying to identify the patient on the parallel systems and not being able to do so as that person's information had been captured differently. Even when the patients change things like surnames and addresses of employers, they end up having double or triple work as all the systems require updating, whereas if these systems were synchronised, an update to one system would be sufficient as it would update all the patient's information across the board.

Through this interaction process, it has been realised that systems or applications to translate are necessary for rendering a reliable service to all patients.

i. Integration

Sweet Love Hospital (SLH) systems were not integrated at the time of this study. From the inquiries to the general practitioners to the pharmacy, they run parallel systems. Unfortunately, these systems are not 'talking to each other'. As the result some patients end up with more than one prescription. This means that the patients might have duplicate medication for one prescription because as the systems that are not linked, they won't be able to trace it. As was revealed by the data analysis, at squatter camps, clinic patients collect medication and subsequently travel to another clinic to collect again the same medications because their systems cannot detect that the patient has already received this medication.

Some patients take advantage of the lack of integration between the systems, by falsely duplicating their medical prescriptions so that they can collect more medications. The patients approach different clinics and collect medications, for two main reasons: (1) some of the patients sell the extra medicines to friends and interested persons; and (2) others consume more medicines than the prescribed doses. As for the latter, some of the patients held the erroneous belief that the more medicines they consume, the quicker they will heal. As the result of dual collection, the hospital (SLH) and its clinics are sometimes short of medications, not able to supply everyone who needed to get medications. Shortage of medications lead to fatalities as people are dying because of shortages in the supply of medications.

These challenges are yet more devastations caused by inaccurate translation of languages or the semantics in languages.

The fact that the parallel systems are not in sync has led to poor performance of some of the staff members as they find themselves having to perform certain tasks repeatedly. The data capturer is hard-pressed with capturing patient information that comes from the doctor and also what was given to patients at the pharmacy. If the systems were integrated, several of these continuously repeated steps would be eliminated. As it stands, the process takes long, and patients queue for long hours. As revealed in the data analysed, some patients passed out as a result of fatigue, owing to the fact that as chronic patients they were not supposed to stand for long hours. Mobile systems would be the solutions, as they can be used to integrate the parallel systems so that the information can be synchronised for improved efficiency and effectiveness of healthcare services.

6.5 Interpretation of the results

The data analysis and the combined results from the three cases were interpreted. Interpretation is about making sense of what has been found (Serrell, 2015). Interpretation is at the heart of qualitative research because qualitative research is concerned with meaning and the process of meaning-making (Willig, 2017). Based on the interpretation, five factors were found to be fundamental to the translation of semantics in South African languages for healthcare services: communication, mobile systems, system engines, system integration and health facilities.

South Africa as a country is very diverse, consisting of different ethnicity, various culture, and people who speak multiple African languages. This type of setting intensifies interactions among residence of the community. The challenge comes when the healthcare service providers are not residence of the community. The challenges are centred on differences in culture and lack of understanding of each other's spoken languages. The challenges are worst in providing healthcare because of the need to keep patients' information private and confidential. This challenge is caused because both the healthcare practitioners and the patients often do not speak or understand each other's language. Even when tries to learn and understand the languages, the semantics do not make it easier.

Based on the factors, a framework (Figure 6.5) that can be used to guide the selection and implementation of mobile systems in the translation of language semantics for

healthcare service delivery was developed, which was the intended aim of the study as presented in Chapters 1 and 3. The factors are discussed below. The factors should be read with the following framework in mind to gain understanding of the framework.

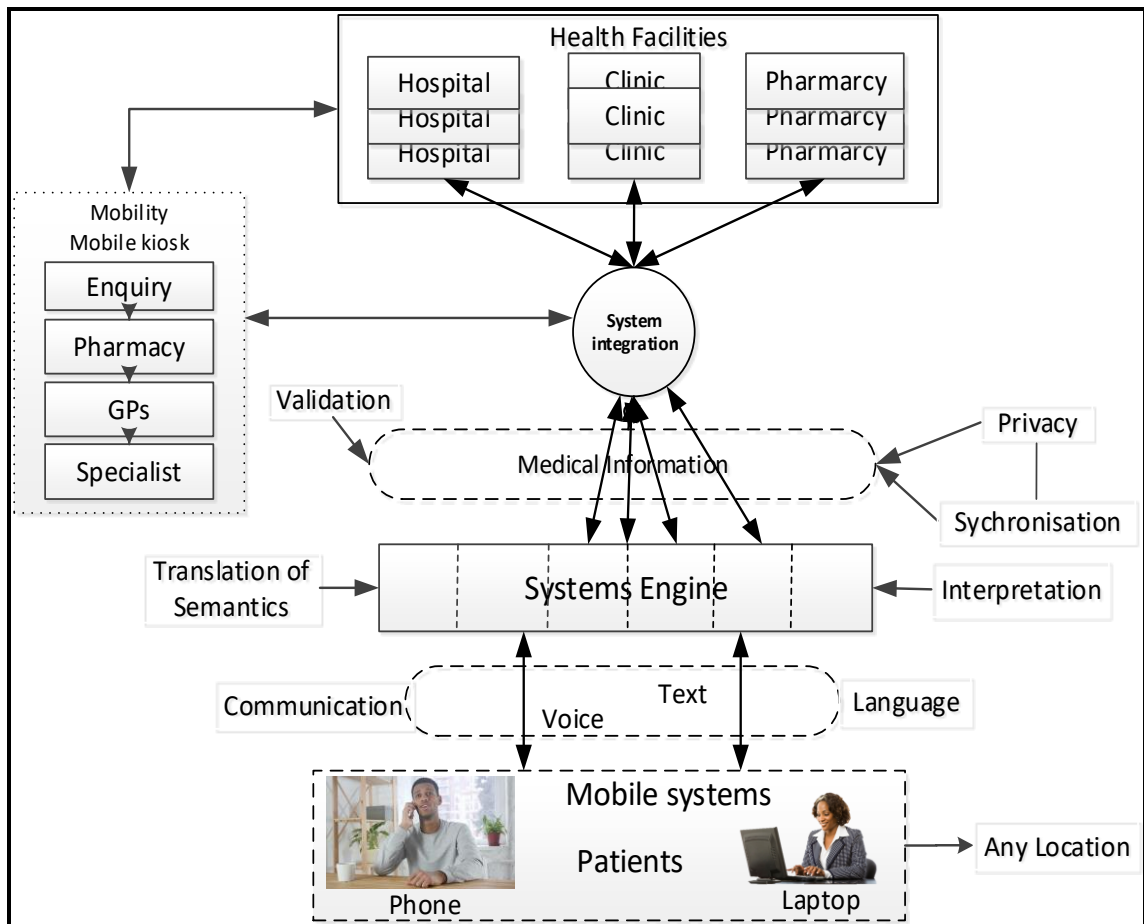


Figure 6. 5: The translation of language semantics using mobile systems

6.5.1 Patient communication

Patients live all across the South Africa, and they should be able to access healthcare from any location. However, in some areas of the country the healthcare facilities are far from many patients, particularly areas that were previously designated to non-white people. The solution to this challenge enacts the need for real-time communication, especially for emergency purposes. Such communication with the health facilities can be enabled through mobile systems via devices such as phones and laptops. These patients speak different languages. This is where the actual problem is, as revealed in the analysis of this study, that there are semantics in the different South African spoken languages which affect healthcare service delivery to the community.

There is always a miscommunication which manifests from semantics in the different spoken languages. According to Hannawa, Wu and Juhasz (2017), effective communication means that all participants in the communication comprehend and understand the content of the communication. Therefore, to achieve this, when the patients make use of mobile systems to communicate, the mobile systems should be able to translate the semantics in the chosen language to that which is the preference to the health practitioner. Also, mobile systems should store the translation for automated retrieval and reuse purposes.

Irrespective of the form of communication, whether in text or voice, the system should be able to translate the language and its semantics to the preferred language of the other parties (patients and health practitioners). Thus, neither the patients nor the healthcare practitioners would need to worry much about the communication between, which has been a serious challenge in the South African environment for many years now.

6.5.2 Mobile systems

The use of mobile systems is more accurate in the translation of semantics in spoken languages. In addition, a mobile system is primarily useful in three ways: (1) to assist in a situation where it's not necessary for patients to physically go to hospitals, clinics or pharmacies. Even when they want to do that, they can simplify the process by using mobile systems to make appointments, to get the prescription and to forward the prescription to the pharmacy. Therefore, this will assist to reduce long queues in the hospital, assist pharmacists to pre-pack the medications for patients including delivery; (2) to trace and track medications and diagnosis to patients, and by the healthcare practitioners; and (3) to track, monitor and manage availability of stock, and arrangement of patients' medications on time.

Also, the mobile systems can enable patients to access their medical history through online facilities. This means that the system should be embedded with security and validation capability as adherence to personal information privacy policy. Another benefit in the use of a mobile system is that it allows synchronisation of patient data at real-time, and seamlessly. The synchronisation of information would occur irrespective of the language of communication.

6.5.3 System engine

The health practitioners, including pharmacists, nurses and doctors, more often than not make use of different systems, often duplicated systems. This sort of approach hardly enables synergy, rendering validation of patient information difficult or virtually impossible. The system engine allows single point of entry. This is irrespective of the systems and devices used by patients or health practitioners.

Also, the system engine enables and supports the storage of various languages which include South African languages such as Tshivenda, Sepedi, Xitsonga, IsiZulu, Xhosa, and international languages such as English and French. There should be an option for both patients and health practitioners in the selection of languages, for communication and translating. The system engine enables the translation of one language and its semantic meanings accurately into another language.

However, privacy and security do become concerns when using mobile systems. According to Bromwich and Bromwich (2016), the risks which are associated with the use of smart phones to produce and store medical data include privacy breaches, insecure data storage and physician or institution liability for failure to obtain patient consent. Therefore, whichever language the practitioners or patients choose, the system should be able to enable validation for security reasons.

Every patients' privacy must be adhered to based on the healthcare ethics code of conduct. An effective ethical code for healthcare provides guidance on managing ethical problems that arise at all healthcare levels (Epstein & Turner, 2015.). For privacy, information must be synchronized to avoid duplication and gaps, gaps in the sense that a patient can go to two different pharmacies and use the same prescription.

6.5.4 System integration

A system's integration mechanism allows the coexistence of different systems. As in healthcare, and revealed in this study, the practitioners, which include pharmacists, nurses and doctors, whether general practitioners or specialists, currently make use of different systems. More often than not, the systems are deployed in isolation, not integrated. Instead, whether the patients visit the hospital, clinics or pharmacy, the healthcare practitioner should be able access the same patient's portfolio. As discussed in the literature review in Chapter 2, some of the problems that are faced in healthcare include incorrect recording of diagnoses, unavailability of patient

information, delays in accessing the information, space limitations for record-keeping and insufficient personnel for patient monitoring (Ball *et al.*, 2015). Therefore, system integration will address these problems as well as minimise redundancy and eliminate mismatched information. This can be accomplished through different mobile systems, irrespective of which mobile system is used as it won't have an impact as this system will be integrated and will eliminate a great deal of capturing.

When systems are integrated it becomes easier to access and extract patient data from databases, improving management and services of healthcare delivery to the community. System integration also eliminates data mismatch. Therefore, practitioners are able trace a patient's medical history. System integration gives users the ability to synchronize the information because there will be alignment in the information. Maruthappu, Hasan and Zeltner (2015) explain that integrated care holds the prospect of reducing overtreatment waste, and redundancy, while providing higher quality coordinated care to patients. When systems are integrated, it's easier to put in place rules and procedures intended to guide the privacy of their activities, primarily because patient information will be synchronised, easing the validity for security purposes.

6.5.5 Healthcare facilities

As empirically revealed from two of the three cases, Mukhethwa Hospital and Sweet Love Hospital (SLH), there are various health facilities spread the country. This includes hospitals, clinics and pharmacies. Many of these health facilities employs individual systems to provide their services. This is attributed to the fact that many of the hospitals and clinics including pharmacies separately, and sometimes collaboratively provide healthcare services to communities (patients). The facilities don't always operate in isolation, or in a vacuum, to provide services, in that more often than not, pharmacies rely on prescriptions to provide services. In order for this healthcare facilities to operate efficiently, as they are located all over the place, they need mobile systems render their services more fluently and fluidly. It's advisable to have the healthcare systems integrate. Integration of systems enables and supports consolidation of interpretation and translation of languages and semantics in the languages. Also, integrated healthcare systems hold the prospect of reducing overtreatment, waste and redundancy, eliminating inefficiencies and controlling costs, while providing higher quality coordinated care (Maruthappu, Hasan & Zeltner, 2015).

Due to the boundary-less nature of healthcare, health facilities are spread across the country. Thus, health facilities can include mobile kiosks, as shown in the framework (Figure 6.5). The mobile kiosks include systems that can be used to provide services such as enquiry, documentation of consultation, access to treatment and dispensing of medications. However, each system that runs as a kiosk needs to be integrated with other related systems; they need to be in sync with each other and aligned so that they can feed information to either hospital if they want to see a patient's medical history or pharmacy when they need to dispense medication.

The integration of the systems also help to coordinate the interpretation and translation of language semantics through centralization and in general understandable terms to both practitioners and patients. Communication and interaction using mobile systems is possible, as the system should be able to send either voice or text messages to the recipient. The use of mobile systems is fast and convenient as the patients will be able to interact irrespective of where they are. Through the use of either mobile phones or laptops, patients will have access to their practitioners.

6.6 Conclusion

This chapter presented the results of the three cases, respectively. The factors which were drawn from the results were interpreted. A framework to guide the translation of language semantics using mobile systems in South African healthcare was proposed. Finally, this chapter further demonstrated how each component of the framework operated within the framework.

The next chapter presents the conclusions drawn from the study, the benefits and then recommendations made from the study.

CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

7.1 Introduction

This chapter presents the conclusion as well as the evaluation of the research. Also covered in the chapter are recommendations based on the results of the research.

The aim of the research has been to contribute towards providing a guide that can address translation of language semantics in the provision and receipt of healthcare services in South Africa. In achieving this aim, the study adopted the interpretive stance, a three-case study design approach, and a semi-structured interview technique. Three cases were not adopted for comparison purposes, but to gain a more thorough understanding of the challenges surrounding language semantics, with careful consideration of how these challenges can be addressed.

The remainder of this chapter is divided into five main sections. The first section provides a summary of the entire research through a review of each of the chapters. The contributions of the research are discussed in the second section. The third section presents the assessment of the research. Lastly, the fourth and fifth sections address the study limitations and areas of further studies, respectively.

7.2 Summary of the study

The study is divided into seven chapters. Each of these chapters covers a distinct area of the thesis. The chapters are summarised as follows:

CHAPTER 1: Introduction of the study

Chapter 1 introduced the entire research as is documented in the thesis. In this chapter, the research problem was presented, which led to the formulation of the aim and objectives. Based on the research problem, it was established that although many studies have been conducted in the areas of healthcare and health informatics, no study have intended to address how the difficulties of translation of language semantics can be solved. One such objective was to examine the translation of language semantics in services that the healthcare organisations provide to communities in South Africa.

A review of literature was also provided in the chapter, covering information and technology communication, mobile systems, healthcare and language semantics. The review helps to establish the prevalence of language semantics, and the impact it has on healthcare services. The rest of the chapter covered the research question; the methodology that was applied in the research; an overview of the cases used in the research; data collection; data analysis; and finally, the conclusion. This chapter supplied the relevance of the study and outlined the different chapters.

CHAPTER 2: Literature review

Chapter 2 provided background to healthcare services and language semantics, dividing the chapter into two parts. The first part focused on the key components (or keywords) that are particularly relevant to the study, including ICT, mobile systems, healthcare and language semantics. Some of the literature suggested that there is power in the use of language for communication. Similarly, some of the literature argued that mobile systems are vitally important in the delivery of healthcare services.

The literature contained mainly peer reviewed articles. Acknowledgements were made of all the literature that was reviewed and referenced. Through the review, gaps in the area of study were highlighted, prompting the researcher to pursue the objectives of the research. The second section of the chapter focused on the theories that underpin the study. An extensive and comprehensive review about the theories was conducted, including an explanation of how the theories relate or underpin the study. Examples of where and how the theories have been applied previously in other studies were also acknowledged. Reasons for choosing the theories were addressed.

CHAPTER 3: Research methodology

This chapter discussed the research methodology, including research philosophy, approach, design, techniques and methods that were applied in the study. As discussed in the chapter, the approaches, methods and techniques selected were in line with the aim of the research, which was to develop a framework that can be used to guide the selection and implementation of mobile systems in the translation of language semantics for more effective healthcare service delivery in South Africa. The discussion in the chapter clarifies why and how the different techniques, methods and approaches were employed in the study.

Three case studies were conducted, two in hospitals and one in a community, specifically, from healthcare services, language semantics and ICT enablement

perspectives. Data was collected by using the semi-structured techniques which allow conversation between the interviewer and the interviewees for gathering rich data.

CHAPTER 4: Case study overview

This chapter presented the overview of the three cases used in the study. This included how the cases were selected for the study. Moreover, the chapter introduced the three cases by giving the background, structure and manner in which these case studies fit into the research.

CHAPTER 5: Data analysis

This chapter presented the analysis of the data from the three case studies. The moments of translation and innovation decision process from Actor Network Theory and Diffusion of Innovation theories, respectively, were applied as lenses in the analysis of the collected data.

Actor Network Theory was useful in the analysis of the formulation of the networks, relationships between the actors, and their actions, and in the use of languages for providing and receiving healthcare services. The Diffusion of Innovation theory was used to focus on how decisions pertaining to language preferences and available technologies were made, as they were influenced by knowledge.

CHAPTER 6: Results and interpretation

Chapter 6 presented the results from analysis from each of the case studies. For each set of the results, a framework was developed. The frameworks indicate the factors that influence language preferences, the impact of language semantics, and the roles of mobile systems for translation of language semantics in the delivery of healthcare services. Also presented in this chapter is the interpretation of the results, based on which the framework was developed, to guide the selection of mobile systems for the translation of language semantics in healthcare service delivery.

CHAPTER 7: Conclusion and recommendations

This chapter summarised the results, drawing conclusions from those summaries and making future recommendations. It also includes an evaluation of this study. The theoretical, methodological and practical contributions of the study were presented. Recommendations and suggestions for further research were included, as well as benefits of the study and then, finally, the conclusion of the study.

7.3 Evaluation of the study

The conclusions are drawn from the results of this study. These conclusions are the answers to the research question that has been presented at the centre of this study.

How the study achieved questions?

Below are research questions as they were formulated in Chapter 1. They include a main question and four sub-questions:

Main question

“How can the challenge(s) of semantics and language translation in South African healthcare delivery be addressed using mobile systems? The framework is intended to improve the services which healthcare organisations provide to communities, particularly in areas where many different languages are spoken, and many speakers, including healthcare service providers themselves, do not understand or are not fluent in each other spoken languages.

Sub-questions

The sub-questions include the use of mobile systems in healthcare services and the semantics of language translation. The questions were organised into two categories:

i. Use of mobile systems in healthcare services

- a. How would mobile systems be employed in multi-language translation in the delivering of healthcare services to communities in South Africa?
- b. What are the factors which influence the selection and use of mobile systems for language semantics for healthcare service delivery in South Africa?

ii. The semantics of language translation

- a. What are the factors of influence in spoken languages, and how can semantics be translated from local dialect to English by using mobile systems to improve healthcare services in South Africa?
- b. How does the translation of language semantics impact the services that healthcare organisations provide to the communities in South Africa?

Category I: Use of mobile systems in healthcare services

- a. How would mobile systems be employed in the multi-language translation in the delivery of healthcare services to communities in South Africa?

In an environment with the use of multi-languages from within the community, it was always going to be difficult to find manual solution for language barriers. Also, automated systems, such as mobile systems, were not necessarily going to be easier. This is mainly because of the diversity of the languages and the heterogeneity of some of the actors (patients and health professionals). Based on the analysis of participant responses, determining factors were identified.

Search engine: in order for a community to access health information, the information must be available or communicated via mobile systems. It was stated that the communication is done in English. Therefore, language translation of semantics need to be built into these systems (search engine) to deliver a better, more efficient healthcare information services to all people, irrespective of languages they speak

Health facilities: using apps on mobile systems to translate for healthcare practitioners, because using interpreters cannot solve the problem as they are still human beings who sometimes err in the way they speak or make choices influenced by their background. Therefore, at health facilities, mobile system apps for language translation of semantics need to be deployed. This will also assist those who are unable to speak any other language accept their mother tongue.

b. What are factors influencing the selection and use of mobile systems for language semantics for healthcare service delivery?

This question intended to determine the factors that influence the selection of mobile systems for the translation of language semantics in the delivery of healthcare services in South Africa. This question was important in terms of improving the healthcare services that are provided in South African communities, where multiple languages are spoken. The responses from the participants were analysed using the Actor Network Theory and Diffusion of Innovation, and the results interpreted.

Although human interpreters were used, there was no system that can be used to translate semantics in languages, particularly between health professionals and patients with medical terms. To make matters more difficult, at the time of the study there was no framework in place that could guide selection of a mobile system that can be used for the translation of language semantics in the provision and receipt of healthcare services.

What is even more interesting is that almost every patient and their relations, including the health professionals, made use of mobile systems, but for purposes other than healthcare provision and receipt. Hence, understanding factors that influence the use of mobile systems for health delivery was critical.

Category II: The semantics of language translation

a. What are the factors influencing spoken languages, and how can semantics be translated from local dialect to English by using mobile systems, in order to improve healthcare services in South Africa?

Through the use of Actor Network Theory, networks (groups of people) were identified. This included an understanding of why and how the groups were formed, through conscious and unconscious behaviour. Some groups were formed based on culture, tribe (of the same spoken language), health conditions and professions.

The majority of the participants, both patients and health professionals, were not fluent in languages other than their home (or first) language. Also, many of the patients were illiterate, jeopardising their use of English for critical medical communication. This averts the use of a common language for communication, which could have helped to address the semantics in some of the languages.

These types of situations open room for misinterpretation that can lead to wrong prescriptions at times. Therefore, there is a need for direct automatic translation for correctness, for completeness and for accuracy. This can be enabled and supported by mobile systems to ensure consistency and avoid repetitions. Also, language barriers influence divisions caused by cultural and traditional affiliations, which can also be addressed through the use of mobile systems.

b. How does the translation of language semantics impact the services that healthcare organisations provide to the communities in South Africa?

Even though some of the healthcare organisations have interpreters at their premises, the translation of language semantics remained a challenge as to how they delivered the services to the community in the following ways:

Wrong diagnosis: because of the inaccurate translation of language semantics, some of the patients were given wrong prescriptions. This meant the collection of wrong

medications, a problem that can be detrimental to a patient's health in the long run or fail to curtail an illness that could have been prevented if it had been identified earlier. This also causes shortages of medication as medications are dispensed to people who sometimes are not really in need of those medications.

Long queues at facilities: facilities ended up housing long queues because they had to find a person who could translate for them; this impacted the turnaround time that for assisting the patient and some patients then end up returning home without receiving help. For others, conditions deteriorated because of the wait in the long queues. This affects the entire administration of the healthcare.

Lost to follow-up: some healthcare facilities lost some of critical patients who are on chronic medications because of the language spoken; they ended up not rendering the services as they should because they couldn't retain the patient.

How the study achieved the research objectives?

Below are research aim and objectives as formulated from Chapter 1:

Aim

- To develop a framework which could be used to guide the selection and implementation of mobile systems in the translation of language semantics for healthcare service delivery in South Africa. A framework was developed and is presented (see Figure 6.5) in Chapter 6.

Objectives

- i. From a language semantics perspective, to examine and understand the factors that hampers the services of healthcare in South Africa.**
 - Four factors were established which influence the selection and use of mobile systems for language semantics for South African healthcare organisations.

- ii. To examine and establish the factors potentially influencing the selection and use of mobile systems for language semantics for South African healthcare organisations**
 - Through the proposed framework, the researcher managed to understand how mobile systems can be employed in multi-language translation, in the delivering of more effective healthcare services to communities.

iii. **To examine and understand how mobile systems can be employed in the multi-language translation, in order to improve the delivery of healthcare services to communities in South Africa**

- Through the interpretation of the results of this study, the research elaborated on how the mobile systems can be employed in multi-language translation, in order to improve the delivery of healthcare services to communities in South Africa, addressed in the section of research questions above “Category I: Use of mobile systems in healthcare services”, question a.

7.4 Contribution of the research

The aim of the study was to develop a framework that can be used to guide the selection of a mobile system for the translation of language semantics for healthcare services. The contributions of the study are three-fold, namely, theoretical, methodological and practical.

7.4.1 Theoretical perspective

The main theoretical contribution of this research is through the framework (see Figure 6.5 in Chapter 6) that was developed in this study. As shown in the framework, five categories of factors – communication, mobile systems, system engine, system integration and health facilities – are proposed to enable and support the use of mobile systems for translation of language semantics for healthcare services in South Africa.

Many studies have been conducted separately in the area of translation of languages, semantics of language and the use of mobile systems in healthcare. This study, however, combined all three areas, which is, theoretically, an enormous contribution to the three related domains of language, health and ICT. Thus, the study contributes to the academic body of knowledge in all three areas, through its addition to the extant literature. So far, two articles entitled ‘*Introducing Mobile device for Health Services: The Semantics of Language Translation*’ and ‘*the connectedness in selecting socio-technical theory to underpin information systems studies*’ have been published from this study.

7.4.2 Methodological perspective

The combined use of the two sociotechnical theories – Actor Network Theory (ANT) and Diffusion of Innovation (DOI) – as lenses to guide the analysis of the data has

been the primary methodological contribution of the study. The theories were separately applied.

In addition to the complementarily application of the theories, the way in which they were used brought a fresh perspective to the study, thereby making a significant contribution to the field of information systems research. This is mainly because the two theories had not previously been combined in any study. Through the combined use of these theories, a deeper understanding of how language semantics could be translated using mobile systems to better the services rendered by South African healthcare was gained.

7.4.3 Practical perspective

Practically, the contribution of the study comes from the framework (Figure 6.5) that was developed. In practice, the framework can be used by both healthcare practitioners and ICT specialists to guide the selection, use and support of mobile systems for the translation of language semantics in South Africa.

Both patients as well as the health professionals would undoubtedly benefit from the use of mobile systems in the provision and receipt of healthcare services. This will promote security and privacy of patients during their attempts to seek care from health professionals, without the services of interpreters. Also, it will improve accuracy in that both health professionals and patients can now make use of their preferred languages.

7.5 Evaluation of the study

The research was assessed in line with the aim and objectives. The criteria of Whetten (1989) were used in the assessment. Even though the set of criteria are very old, they are still highly relevant today as over two decades ago. The following assessment questions were based on Whetten (1989):

i. What new perspective has the research contributed?

In the field of research and academia, the study has introduced the combined application of two theories, ANT and DOI, in terms of how the theories can complement each other to achieve the objectives as stipulated. ANT was used to identify the actors involved in the study and the relations that those actors formed which are different networks. DOI was used to gather the knowledge,

these actors had around the subject matter, decisions that were made and the influence that was brought to bear on the way decisions were made.

This study has ushered in a new perspective to healthcare concerning how the issue of semantics of language translation can be addressed by proposing a framework that can be used as a guide to develop a software for the translation of language semantics using mobile systems in South African Healthcare. This proposal can help eliminate the use of interpreters at various facilities. Healthcare providers will also be able to interact with the patients irrespective of the spoken language, designation area or cultural background.

- ii. *What is the prospect that the study will change in current healthcare services which are provided and received, from the perspective of language semantics?*

The proposed framework will assist in reducing the time patients spend in queues because of delays caused when there are language barriers. Mobile systems will address these challenges. The issues of wrong diagnoses that are caused by miscommunication due to translation of language semantics will also be addressed; therefore, patients will receive correct scripts. This will eliminate duplication of efforts as the systems will be integrated so once the patient record is on the system, each mobile system, irrespective of which one is being used, will source the information from one place; the administrative process will be much quicker and faster and overall more efficient. The patients will be able to perform some personal health checks or pre-book themselves at their convenience, cutting down travel time and cost. Any practitioners will be able to assist the patients irrespective of the language they speak.

- iii. *How well is the study carried out?*

The study was rigorously, thoroughly and completely carried out. The research problem is presented in Chapter 1. The research objectives and questions are discussed in Chapters 1 and 3. A holistic review of literature is presented in Chapter 2. In Chapter 3, the methodology that was applied in the research is discussed. The details of the cases that were used in the research are provided in Chapter 4. Chapters 5 and 6 present the analysis of the empirical data and results from the analyses, respectively. Actor Network Theory and Diffusion of Innovation theory were used in the analysis of the data. Based on the interpretation, a framework was developed. The last

chapter is the conclusion which then provides review, assessment and recommendations from the research.

iv. *Why is the subject of significance to both practitioners and academia?*

On one hand, human beings will increasingly seek for healthcare services. On another hand, the spoken languages are not about to decrease. Thus, it was critical to conduct this study to contribute to the improvement of healthcare services from the perspective of ICT support and enablement. Based on the study, a deeper understanding will be gained regarding the factors that influence the translation of language semantics for healthcare services in South Africa. The findings from the study will therefore be of significance to both practitioners and academia in the areas of health and information systems.

The practitioners will have a better understanding of how patients respond to their services when it comes to the use of language. Also, practitioners will better understand the implications of the use of preferred languages. The inclusion of social, technical theories used complementarily in the study will be of significance to academics. Also, academics can make use of the results of the study as reference material in teaching and research.

v. *Who would be interested in the study?*

In addition to health practitioners and academics as mentioned above, this subject is of interest to ICT personnel, the general public who seek information on health-related matters and the South African government. Also, the study can be of interest to governments of other countries, especially developing countries. The ICT personnel can be more prepared for seeking a technology solution for health-related matters from the perspective of language translation. The public and government can be better informed of the non-technological issues that influence healthcare services to the communities. This study might trigger the South African government to develop a policy framework that is specific to the use of language in its multi-lingua environment, in the area of health. Also, the study can prompt similar studies in other African countries where there are multi-lingual challenges.

7.6 Recommendations

Analysis and interpretations assisted the researcher in achieving the objectives of the study. However, some gaps were identified. Based on the identified gaps, recommendations are made in three distinct areas:

7.6.1 Culture and traditional affiliation

Aligning healthcare culture with the patient's traditional affiliation in order to improve services delivered by healthcare is one of the gaps identified in the study. Culture is a pattern of ideas, customs and behaviours shared by a particular people or society. It is constantly evolving. The influence of culture on health is vast, affecting how people view health. Their beliefs around illness can cause fatalities. This can also affect the way they express themselves when they are in pain or expressing how they feel to someone. The patient's preference as well plays a major role, on how they would like to be treated. Demonstrating awareness of a patient's culture can promote trust, better healthcare, lead to higher rates of acceptance of diagnoses and improve treatment adherence.

During data analysis, it has been discovered that some causes of misunderstandings between healthcare practitioners was not necessarily the language spoken, but culturally related; because of some cultural or traditional beliefs, some patients were unable to communicate with their health practitioners. The factors surrounding culture and tradition are often not properly communicated to the nurses and doctors, because such patients need to be treated for their health conditions without the healthcare practitioner touching them. But the semantics when translating the way this is conveyed makes it come across as almost an abomination. But in fact, this is not an abomination. It is saying that a certain part of a woman cannot be touched by another male. However, this part of the process – careful, accurate translation – is missing and must be addressed in the future.

Healthcare needs to make a commitment to culture, to change, to challenge, to compete and to cooperate. If, as is often the case, time pressure leads to poor communication, there must be a commitment to allow time for a clear exchange of information to happen. Commitment to communication must be demonstrated throughout the healthcare process.

Commitment to culture means that both practitioners and patients will communicate, share their views, respect each other and try to meet each other half way to avoid miscommunications that lead to people's refusal to communicate. This can lead to

misunderstanding and people getting a wrong diagnosis, wrong prescriptions and ultimately and dangerously, getting wrong medications.

Healthcare should create a culture of openness that allows each individual patient to share views and fears and be able to address the culture and traditional beliefs that can impact the way they need to receive health service.

7.6.2 Using interpreters in healthcare

In general, the interpreters and translators are one and the same thing, they only differ through the medium of exchange: the interpreter translates orally, while a translator interprets written text. Both interpreting and translation presuppose a certain love of language and deep knowledge of more than one language. There are important differences between a translator and an interpreter. A translator is a person who can speak English and the patient's native language. However, the translator often does not have equal fluency in both languages and may lose important cultural nuances and meanings. In contrast, interpreters are trained professionals who are able to interpret the meaning of words and phrases using a healthcare provider's spoken language into the patient's preferred spoken language while still maintaining the same semantics of language being translated.

Language is the foundation for effective practitioner-patient relationships and is important for interpersonal and cross-cultural communication. Being able to communicate with a patient is vital for obtaining an accurate and comprehensive patient and family assessment, formulating and implementing a treatment plan, determining the effectiveness of nursing care, and evaluating outcomes of care. As a result of the multi-languages used in South Africa, practitioners are hard-pressed with the challenge of communicating with a patient who cannot speak or who speak English with only limited proficiency, or those who are illiterate.

As was also revealed from data analysis, some of community members end up expressing elements of uncertainty when a doctor uses a nurse to translate, because they were not certain the information is being translated correctly as the patient would be someone who don't understand the spoken language and their semantics.

There is a high percentage of people who speak English with limited proficiency or are illiterate in South Africa. Even the number of interpreters who can be used is limited, not enough to assist the high numbers of those who can't speak English. Therefore, there will be a need for a system that can rectify this issue.

7.6.3 System integration

Some problems faced in healthcare include the incorrect recording of diagnoses, the unavailability of patient information, delays in accessing the information, space limitations for record-keeping and insufficient personnel for patient monitoring. Therefore, system integration will address these problems and also minimise redundancy and eliminate mismatching of information. This can be done through different mobile systems. Irrespective of which mobile system is used, this won't have an impact as this system will be integrated and will eliminate much capturing because the practitioner will always see one system.

The challenge is that most of the benefits claimed for integrated health services can be cost-effective. The 'cost' part of cost-effectiveness is based on the idea that it is economically efficient to share resources (particularly human resources). The idea here is that an integrated service has more chance of ensuring more equitable access across the spectrum of priority conditions than do a series of single-issue programmes. Currently, some patients take advantage of the lack of integration between the systems by falsely duplicating their medical prescriptions, so they can collect more medications. This however, leads to increased hospital spending as they must spend double for the same medications. This gap is resulting in unfortunate deaths due to critical medication shortage, especially for sufferers of fatal, chronic conditions.

When systems are not integrated, the information doesn't flow accurately. Therefore, the information shared is not totally accurate, leading to inaccurate translations. However, when systems are integrated, it becomes easier to retrieve data from it. The report for management is generated more quickly. System integration also eliminates data mismatch. Therefore, a practitioner is able to trace a patient's medical history. System integration gives users the ability to synchronize the information because there will be alignment in the information.

7.6.4 Benefits of the study

The benefits of the study are twofold: it contributes to the body of knowledge and to the domains of healthcare and ICT, particularly in terms of the cases used in the study.

The benefits are presented as follows:

- i. Body of Knowledge*

This study contributes to the body of knowledge from both theoretical and practical perspectives.

This paper significantly refines the body of knowledge concerning the translation of language semantics using mobile systems in the healthcare context. This study will contribute to the body of existing literature on ICT, healthcare, mobile systems, language translation and semantics of language.

The study contributes to healthcare service providers, particularly hospitals, clinics and pharmacies and information and communication technology organisations. The study also contributes to health informatics in South Africa for further recommended research topics.

ii. Healthcare

The framework from the study can be useful for understanding and developing a language translation of semantics software that would be used in mobile systems for practitioners and patient interaction. The framework explains how language translation of semantics using mobile systems can be implemented in the different healthcare facilities and at mobile kiosks. The framework gives the functionality of each component and how all the components react with regards to the inputs and outputs as the results of the whole deployment.

The role of individuals and groups in the deployment of competitive intelligence will improve information system innovation within organisations. The study can assist leaders and managers in organisations to better understand the factors involved in deploying competitive intelligence in an organisation.

7.7 Limitation of the research

Like other studies, this study had limitations. There were four limitations to the study identified:

- i. Not all languages were explored. In the designation area in which the study was conducted, Tshwane (Soshanguve), the dominant languages spoken are the Nguni languages, so not all the official spoken languages in South Africa were covered.
- ii. The study only investigated the government-related hospital (the public hospital and non-government hospital); therefore, the view of the private hospital with regards to the challenges on semantics of language translation

were not incorporated. Perhaps this would have brought another dimension into the study outcomes.

- iii. The use of mobile systems for translation of language semantics for healthcare services in the South African environment was not tested. It would be interesting to experience the mobile systems that are selected and used in this regard; and
- iv. Post implementation of the framework has not yet been investigated. Thus, it would be of interest to know how the framework was received by associated stakeholders, which include patients, ICT specialists, health professionals and the government of South Africa.

7.8 Further research

This study has proposed a framework that can be used as a guide to develop software for the translation of language semantics using mobile systems in South African healthcare. Therefore, one can use the framework from this study to develop a software. One can even take this study further after the development of the software and monitor the rate of adoption of this innovation (software) using DOI or user acceptance of the innovation using a technology acceptance model (TAM).

7.9 Conclusion

The chapter has presented the conclusions drawn from the results of this study. We have many challenges in a country like South Africa, where many people have died as the results of the basic misunderstanding between a health practitioner and a patient. This study has demonstrated how a system can be developed to assist healthcare with the challenges of language translation of semantics using the framework proposed in this study as a guide. The chapter also demonstrated how this study can benefit both ICT and healthcare.

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APPENDICES

APPENDIX A: INTERVIEW QUESTIONS

RESEARCH QUESTION

i. Use of mobile systems in healthcare services

- a. How would mobile systems be employed in multi-language translation in the delivering of healthcare services to communities in South Africa?
- b. What are the factors which influence the selection and use of mobile systems for language semantics for healthcare service delivery in South Africa?

ii. The semantics of language translation

- a. What are the factors of influence in spoken languages, and how can its semantics be translated from local dialect to English by using mobile systems to improve healthcare services in South Africa?
- b. How does the translation of language semantics impact the services that healthcare organisations provide to the communities in South Africa?

Interview with the healthcare providers

1. Do you think that healthcare services can be accessed using Mobile systems/devices?
 - a. If yes, can you please explain how?
 - i. Which type of device will be more compatible to access data in this environment?
 - ii. Why do you think these specific systems will be compatible?
 - b. If no, why not?
 - c. What are some of the challenges?
 - d. Why do you think that those challenges are there?
 - e. How do you think that those challenges can be addressed?
2. Can healthcare services be accessed from any locations, outside the facility premises?
 - 2.1. If not, why not?
 - 2.1.1. What are some of the challenges?
 - 2.2. If yes, how (through what means or channel) do you access the services?
3. Do you think that the use of mobile systems (phone) can improve the services that you provide to patients?
 - 6.1 Why do you think so? Or why don't you think so?

4. What language do you normally use when you communicate with the patients?
 - 4.1. Would you say that is your preferred language?
 - 4.1.1. If no, why do you use that language to communicate with your patients?
 - 4.1.2. If yes, do you think that your patients can understand your preferred language of communication?
 - 4.1.3. What different would it make if the language of communication is changed to your preferred choice?
5. How can we translate some of the terms in your spoken language to patients' understanding, in order to improve the services that you deliver to them?

Interview with the community

Gender: Male Female

Age: 18 – 25 26 – 35 – 36 – 45 above 45

What do you do for a living: Employed, student, Unemployed pensioner, Educated, not educated

6. How often do you visit a hospital in a year?
7. What are some of the services or information that you do normally access?
 - 9.1 How do you normally access healthcare information?
 - 11.1 What are some of challenges that you encounter when accessing those services and information?
8. What language do you normally use when you communicate with the nurses and doctors?
 - 12.1 Why do you normally use that language?
9. What difference would it make if the language of communication is changed to your preferred choice?
10. How do you think that the nurses and doctors receive or respond to your explanation, using your preferred language?
11. Do you think that they would prefer a different language in your communication interactions with them?
12. Do you think that the use of mobile devices (phones) can improve the healthcare services you receive?
 - 15.1 Why do you think so? Or why don't you think so?

APPENDIX B: INTRODUCTORY LETTER



Introductory letter for the collection of research data

Phathutshedzo Nemutanzhela is registered for the D Tech (IT) degree at CPUT (216247551). The thesis is titled the semantics of language translation using mobile devices and aims to develop a framework, which could be used to guide the selection and implementation of mobile devices in the translation of language semantics, healthcare service delivery. The supervisor for this research is: Prof Tiko Iyamu.

In order to meet the requirements of the university's Higher Degrees Committee (HDC) the student must get consent to collect data from organisations which they have identified as potential sources of data. In this case the student will use Semi-structured interviews to gather data.

If you agree to this, you are requested to complete the attached form (an electronic version will be made available to you if you so desire) and print it on your organisation's letterhead.

For further clarification on this matter please contact either the supervisor(s) identified above, or the Faculty Research Ethics Committee secretary (Ms V Naidoo) at 021 469 1012 or naidooove@cput.ac.za.

Yours sincerely

Prof Tiko Iyamu

15 September 2016

APPENDIX C: LETTER OF CONSENT

APPENDIX D: ETHICAL CONSIDERATION APPROVAL LETTER



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
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Ethics approval was granted to MS PHATHUTSHEDZO MAKOVHOLELO, student number 216247551 on 21 October 2016 for research activities related to the DTech: Information Technology degree at the Faculty of Informatics and Design, Cape Peninsula University of Technology.

Title of dissertation/thesis:	The semantics of language translation using mobile devices
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Comments

Research activities are restricted to those detailed in the research proposal.

 Signed: Faculty Research Ethics Committee	21/10/2016 Date
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May 2018