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Defining a comprehensive telemedicine framework for emerging market healthcare industries.

By

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ABSTRACT

Global trends lean towards a digital shift whereby multiple industries are being disrupted by innovation and digitisation. Technology has been described to create an ease of doing business and assists firms in reaching economies of scale, whilst maintaining superior customer value provision. The health sector is no different. Telemedicine and digital tools have revolutionised the traditional forms of health services to ensure that health, a basic human right, is attainable to all. With health being an essential service, improving efficiencies, reducing costs and increasing accessibility are prime objectives for telemedicine service providers. The research indicates that achieving these objectives will define successful implementation which characterises the business need for the research.

Achieving this, however, is a complex task posing many challenges and requiring the collaboration of multiple stakeholders, which further adds to its complexity. An understanding of how firms can navigate this complexity to accomplish this goal, prescribes the theoretical need for the study. The complexity of wicked problems in large scale systems theory assists in deciphering how best to approach the mammoth task of implementing a successful telemedicine industry.

Owing to the limited research and understanding of the telemedicine industry, a qualitative, exploratory and deductive research method was adopted. The literature was review findings were used to inform the research questions and interview guide. A total of 13 semi-structured interviews were conducted with industry specialists providing various services within the telemedicine industry. Thematic analysis of each interview was done to analyse the data, giving insights into the local response to the industry. Given the research population, South Africa was used as a case study, with the hopes of applying findings to other emerging markets.

Interview findings supported the key literature themes but also contributed by suggesting unique considerations under each section, to address some of the challenges encountered in the local market. The findings were summarised and compiled into a comprehensive framework that proposes key elements for emerging markets to apply when planning a successful implementation and roll-out of a telemedicine industry. The findings of this literature add to the body of knowledge in the telemedicine literature.

Declaration

The following declaration should appear on a separate page:

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

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Acronyms:

HCP: Healthcare Provider

HCS: Healthcare systems

IOT: Internet of things

LSC: Large system change

NHI: National Health Insurance

Table of Contents

List of Figures

List of Tables

Chapter 1: Introduction to Research Problem

1.1. Introduction: Background to Research Problem

Together the USA and Canada constitute 14% of the world's population, yet together they are burdened by 10% of the world's disease spectrum, they carry 37% of the worlds workforce population and spend 50% of the world's financial resources (Anyangwe & Mtonga, 2014). On the contrary, Sub-Saharan Africa contributes 11% of the world's population, bares 24% of its disease spectrum yet has a far smaller global workforce population and healthcare spend, at 3% and less than 1% respectively (Anyangwe & Mtonga, 2014). There is an apparent health service supply-demand discrepancy that prevails within the Sub-Saharan region, with a million healthcare providers in Sub-Saharan Africa required to address the problem (World Health Organisation, 2008). With health qualifying as a basic human need and right, and with it informing one of the Sustainable Development Goals (SDG) (WHO, 2018) this health disparity can no longer be ignored.

In attempts to explore the root cause of the disparity in sub-Saharan Africa, with particular focus on South Africa, multiple factors are considered. Reason would have it that the past and the present be examined, to better understand probable future trends. Therefore, a holistic review is taken, starting with an analysis of the past, in order to understand the described current state of health affairs. For the purpose of this analysis, the past afflictions of political institutional legacies on modern day socio-political and economic performances will be analysed. Coupled with this, the current state of medical affairs and its influence on the medical industry performance indices will be unpacked. This will then be followed by an insight of a probable future for health care.

South Africa is an emerging market (McKinsey Global Institute, 2018), whose current socioeconomic inequality status still remains influenced by its colonial past. Almost three decades post democracy, South Africa still continues to rectify the woes of its historical conjure (Leibbrandt, Woolard, Finn, & Argent, 2010). This is evidenced by corrective policies instituted to address the inherited systemic discrepancies and inequalities that affect multiple sector services such as health, education, geopolitical expression and access to basic human amenities (Ozler & Hoogeveen, 2005). These factors have a far greater impact on global market performance indices and ultimately

its global competitiveness (Pérez-Moreno, Rodríguez, & Luque, 2016). Similar to South Africa, other emerging economies are faced with comparative conditions that impede their current socioeconomic success, furthermore, dictate the pace at which they reap economic prosperity and societal global competitiveness (Schwab & Forum, 2017).

The Apartheid South African government had a prudent health spend which resulted in inequities in healthcare access and inefficiencies in the industry that are still being undone to date. The health budgetary fund was informed by the political tenure and practices the time, mainly seeing favour to the development of the private health sector (Coovadia, Jewkes, Barron, Sanders, & McIntyre, 2009). " Socio-economic status, race, insurance status, and urban-rural location were associated with access to care, with black Africans, poor, uninsured and rural respondents, experiencing greatest barriers" (Harris et al., 2011, p. 1). To add, Burger, Bredenkamp, Grobler and van der Berg (2012) reported that the South Africa's Apartheid health care system was inadequate in catering for the nation's health care needs. Burger et al. (2012) reported that in 1992/1993 the government spent 8,4 % of its fiscal budget on both private and public health sectors, among the highest in the world, yet irrespective of which still did not feature in the top 60 global health indicators. Today the current government has increased the total expenditure on health programs and initiatives to 13,5 % with 20 to 40 % of the budget being allocated to primary healthcare services in the public sector (UNICEF, 2017), resulting in industry milestones achievements. This is also evidenced by the significant expansion of the primary health care system with more than 1300 clinics built or renovated since 1994 (Manuel, 2006) and innovative solutions such as the National Health Insurance (DOH, 2017).

Irrespective of which, subject to its legacy, the current health climate still portrays inequities, with the private health sector being more developed than the public sector and also having a larger healthcare spend. The World Health Organisation (2016) reported that the percentage of private healthcare spend in 2014, as a total health expenses was 51.76 versus 14.23 of the government. To add, McGrail & Humphreys (2015) demonstrate that irrespective of government's efforts to address healthcare access inequities, distance decay still remains a global issue in today's setting. McLaren, Ardington, & Liebbrandt (2013) reported that a significant portion of the South African population, 90%, reside within 7km of the nearest public clinic,

with about two thirds living less than 2km's away. McGrail & Humphreys (2015) further added that distance reduced health seeking behaviours and led to poor health outcomes. The poorest tend to live furthest away and were the most affected, furthermore, mothers and children were most impacted by distance decay (McLaren et al., 2013). However, "Women must be able and enabled to make the decision to seek care, otherwise the availability, accessibility, acceptability and quality of services becomes irrelevant" (Ebener et al., 2015, p. 2). Spatial access disparities perpetuate inequities and are one of the factors that add to the Sub-Saharan health supply-demand discrepancies described above. Equity to health care access is a key element of performance and quality indicators in the health system performance of OECD countries (Kelley & Hurst, 2006), therefore, rectifying this problem becomes a priority.

Another modern-day factor to consider is the urban to rural region workforce distribution discrepancy in developing economies. Most of the workforce being allocated to cities and towns and only 23% of doctors and 38% of nurses being working in rural areas (Anyangwe & Mtonga, 2014). This implies that those that reside in remote regions are not only affected by geographical proximities impeding access to health care facilities but are also subject to reduced quality of health care, if sought within these regions. Furthermore, modern healthcare concerns range from a lack of trained and skilled health care workers, internal mal-distribution of the health workforce, international migration of skilled healthcare workers (brain drain), to name but a few (Padarath et al., 2003). These factors result in a loss of workforce moral, early retirements or career changes, thus further contributing to workforce deficiency and increasing impediments to healthcare access. Innovative thinking and tools are required to address the challenges facing both the patient and other stakeholders. Telemedicine seems to be the answer.

In describing the probability and plausibility in scenario planning, Ram'irez & Selin (2014) discusses the relevance and importance of retrospective and prospective sense making when conducting future foresight studies. An overall assessment and an understanding of the past gives us insight on how it can mould and shape a nations current state of affairs, and why some nations perform better than others. In the same light, it enables us to conceive how we can leverage off socio-political and socio-economic decisions to influence our futures by envisioning and planning the most suitable and probably future. Silva (2015) states that "Foresight also discloses

opportunities and threats that are not always easily perceived, allowing for an anticipatory awareness to risks and challenges and enabling better informed decisions" (p. 8). The prospect of emerging nations to shape their future, means that they can break free from the shackles of their past and present states, by designing better futures that allow them to compete with global health market trends. Telemedicine promises that better future.

1.2. Purpose of Research

1.2.1. Business need for study

In attempts to manage similar challenges in America, a study using telemedicine was conducted by Russo, McCool and Davies (2016) on the Veterans Affairs (VA) healthcare system. It reported how the use of Telemedicine resulted in reduced travel distance, saving travel time and reduced costs. The study reported that comparing telemedicine visits to traditional patient-provider consultations, the former resulted in an average travel saving of 145 miles and 142 min per patient per visit, and cost savings totalling $164,394 (Russo et al., 2016). If replicable in the South African setting, it could address some of its health challenges by potentially improving healthcare access thereby bettering health seeking practices, it could alleviate the burdens of distance decay, and also help reduce citizen and government healthcare spend. The suggestion is, in attempts to address these social and sectoral health injustices, South Africa and other emerging markets can learn from their more established counterparts by leveraging off innovative technologies, shaping the future of healthcare in emerging markets.

Atun (2012) defined innovation in Healthcare services (HCS) as "new medicines, diagnostics, health technologies, new ideas, practices, objects or institutional arrangements perceived as novel by an individual or a unit of adoption" (p. 5). Craig and Patterson (2005) describes telemedicine as an alignment of medicine with information technology, informatics and telecommunications, further elaborating that it has the potential to transform HCS's. It is an innovative new healthcare technology that aids Healthcare provider (HCP) services, improving efficiencies and resulting in better care-receiver outcomes, furthermore, resulting in positive socio-economic implications. The four pertinent attributes of telemedicine include: clinical support, remote access to healthcare or a HCP, incorporation or use of a technological tool

and lastly the intent of improving health outcomes (World Health Organisation, 2009). These address some of the herein-described South African Healthcare access and quality challenges, so for these reasons the telemedicine industry will be studied in this literature review. The purpose of this study is to determine whether there is potential for a telemedicine initiative to be implemented in an emerging market setting, to the same level of success achieved by some developed nations, using South Africa as a case study.

1.2.2. Theoretical need for study

The South African healthcare system has an ultimate goal of correcting the errors of the past and has two main actors (public and private healthcare sectors) who will need to be involved in the change effort required to achieve such a goal. Multiple stakeholders may add complexity to the problem (Wright, Cairns, O'Brien, & Goodwin, 2019). To add, the problem (healthcare access, healthcare costs and healthcare efficiency) is multi-faceted making its resolution more complex and challenging (Dutta, 2018), furthermore, qualifying it as a wicked problem (Elia & Margherita, 2018). Lastly, the South African healthcare system falls within the definition of a large scale system (LSC) as it is national system with large numbers of people and resources (Waddock, Meszoely, Waddell & Dentoni, 2015). As a result, an apt (adaptive, participatory and transdisciplinary) approach to addressing this wicked problem is required (Head & Xiang, 2016). Waddock et al. (2015) recommended that future scholars "help think through the cross-sectoral, inter-organizational, and change dynamics involved in the types of LSC efforts need to bring about a more sustainable, secure, and equitable world for all" (p. 1008). This study aims to align with Waddock et al. 2015) as it aims to review how the South African healthcare system as a large system, through the use of telemedicine initiatives, can overcome the impediments to health access, inefficiencies and expenses; and as a result, take a step closer to making healthcare more secure, sustainable and equitable for all South Africans.

1.3. Conclusion

Irrespective of health being a basic human right and informing one of the Sustainable Development Goals, there is an apparent health service supply-demand discrepancy that prevails within the Sub-Saharan region. This is evidenced by issues in access

to health services, health cost and healthcare efficiencies. Global health trends are leveraging on technology and innovative trends such as telemedicine to address these issues. Regions affected by the above health challenges can learn from their more established counter-parts. The research proposal aims to study the elements required to ensure a successful telemedicine health industry in emerging markets, using the South African healthcare sector as an example. A qualitative deductive study will be conducted using the complexity of wicked problems theory lens to better understand the telemedicine industry.

Chapter 2: Literature Review

2.1. Theoretical Framing: Complexity of wicked problems in large scale systems

2.1.1. Introduction

Global markets are a highly competitive and evolving spaces with innovation as the key theme that drives the change (Christensen, Raynor, & McDonald, 2015). In order to remain ahead of the game and competitive individuals, organisations and countries seek to constantly innovate and redefine themselves (Kalleberg, 2009). They compete to be at the forefront of pioneering trendsetting products and services in their respective fields. McKinsey Global Institute (2018) reported that all industries are being impacted by digital technologies. Industries need to change or become obsolete. In such large and complex systems such as the health industry however, such change can pose a challenge. The complexity of wicked problems in large scale systems theory, will be used to decipher how the healthcare industry can take advantage of telemedicine as a change agent.

In describing Large Scale Systems, Waddock et al. (2015) defines 'large' as the involvement of "large geographies (e.g. national, regional, and global), multiple institutions, and large numbers of people and resources" (p. 995). Silva, Rodrigues, de la Torre Díez, López-Coronado, & Saleem (2015) describes telemedicine as a collaborative technology that connects people distributed across large spatial geographies. The medium of communication and the platforms facilitating the connection, is dependent on various resources and infrastructure (Güler & Übeyli, 2002), requiring multiple stakeholders and employees be involved to ensure its efficiency in service provision and functionality. Therefore, the telemedicine industry qualifies as large.

Waddock et al. (2015) elaborate in saying that 'systems' are similar to communities. Zivkovic (2016) contributes in reporting that communities comprise of multiple stakeholders that interact with each other at different levels, therefore creating complexities. Telemedicine enables the effective collaboration and communication of groups of people at anytime and anywhere, by connecting people and creating

communities (Craig & Patterson, 2005). This is evidenced in two occasions, the first being for decision making processes, planning and the strategic implementation of the telemedicine services. This dictates the formation of collaborative networks to facilitate new product development and performance (Najafi-Tavani, Najafi-Tavani, Naudé, Oghazi, & Zeynaloo, 2018), whilst enabling new knowledge gathering and sharing, stimulating creativity and ultimately promoting innovation (Wang & Hu, 2017). Secondly through the practice of telemedicine where health communities are formed for collaborative innovation activities which promote remote service provision by connecting HCP and patients (Craig & Patterson, 2005). Sims (2018) describes online communities and communities of practice in telemedicine as informal networks formulated for knowledge sharing and driven by common goals, rituals and practices. Although heterogeneity is suggested in collaborative efforts (Dahan, Doh, Oetzel, & Yaziji, 2010), multiple stakeholder involvement may add divergence in objectivity and create 'multiple realities', summating to the complexity (Wright et al., 2019), certifying the context as a wicked problem.

'Wicked problems' are defined as any large scale challenges such as affordable healthcare access, socio-economic transformation or in this instance, a telemedicine framework development and implementation (Zivkovic, 2016). Wicked problems are multi-factorial in causation with no one direct root cause. They are complex, uncertain, ambiguous and contrastive with no single approach to their management (Webber, 1986). As illustrated with the health inequity dilemma, the problem is a culmination of past injustices perpetuated by current health trend challenges. It requires innovative management laden with variance, multiple stakeholder collaboration and co-ordination, and a participatory system thinking approach to allow for emergent change (Head & Alford, 2015).

Similar to Large scale systems, complex adaptive systems (CAS) are comprised of interacting multiple players with contrasting views, however CAS are self-organising as they co-ordinate to sync ideas, share knowledge and align objectives in attempts to respond to internal and external pressures (Lichtenstein et al., 2006). The seamless integration of health systems with the objective of providing patient-centred health services, qualify the health sector as CAS (Sturmberg, O'Halloran, & Martin, 2012).

"Wicked problems and CAS (Complex adaptive systems) are both characterised by non-linear, co-evolving, and emergent dynamics that are inherently unpredictable" (Waddock et al., 2015, p. 998). Resolution of both requires an understanding of their defining properties, so to best inform decision making processes, strategic planning and implementation that is best suited for each. Whilst the Wicked Problems Theory in Large Scale Change assists us in understanding the magnitude and complexity of the problem and proposing directive change (Elia & Margherita, 2018), the Complexity Leadership Theory offers insight on the processes required to resolve the complexity and define emergent change (Carlisle & McMillan, 2006). It does this by managing tensions through bridging connections, creating cohesive clusters and creative adaptive spaces between stakeholders to pave way for emergent change (Arena & Uhl-Bien, 2016), as practiced within the telemedicine sector. The Complexity of Wicked Problems in Large scale Theory suggests that in order to obliterate wicked problems such as social and economic injustices and healthcare access inequities, change needs to occur. This study suggests that telemedicine is the proposed change required to accomplish sustainable transformation in the social, political and economic sectors of emerging markets to ultimately achieve the changes required in their current health trends.

Change agents are required to prompt and action change in the LSC. Change agents display features of co-evolution and emergent action (Waddock et al., 2015). Emergence requires an appreciation and alignment with environmental and global trends, whilst co-evolution allows for the realisation of a thriving and sustainable future. Both are attributes typical of the telemedicine industry. Similarly, when discussing Innovation in organizations from a complex adaptive systems perspective, Carlisle & McMillan (2006) suggest incremental innovation when operating at the edge of stability and radical innovation during unstable times. Incremental change is permissible when one has control and during stable periods, whilst radical innovation transpires during tumultuous and precarious conditions, allowing for rapid yet effective strategic decision-making processes. Telemedicine is subject to both incremental and radical innovative processes with emergent and transformative properties. Therefore, it be applied as a change agent permissive of gradual and controlled evolutionary changes, or as a stabiliser in disruptive and turbulent periods.

2.1.2. Conclusion

In summary, the health sector comprises of multiple stakeholders and numerous institutions that deliver care and are reliant on a fortitude of resources to ensure patient-centred quality services are provided (Sturmberg et al., 2012). The complexity and scale of these interactive bodies qualifies the health system as a LSC (Head & Alford, 2015). The interaction of these dynamic elements may result in added pressures and challenges, further layering the system with wicked problems (Zivkovic, 2016). Collaboration and self-organisation to action change is necessitated. It is therefore concluded that the health industry is a not only a large-scale system but also a complex adaptive system wrought with wicked problems. The heterogenicity of the system translates into complexity with its ability to evolve in order to survive, becoming crucial. Waddock et al. (2015) suggests that the Complexity of Wicked Problems Theory can be used to action change in the large-scale system through the employment of change agents, with objective of managing the change process to ensure a positive and sustainable outcome. The complexity Leadership Theory proposes the systems and processes employable to action this change. Based on the literature findings around telemedicine, the author proposes that the change agent be the telemedicine industry as it leverages off such systems and processes to effectuate change both during stable or unstable periods, with the objective to achieve equitable, affordable and efficient healthcare for all global citizens.

2.2. The Origins of Healthcare

2.2.1. Traditional Healthcare systems

The traditional health care system's (HCS) are designed to identify patient ailments through face-to-face consultation sessions between patients and a healthcare providers (HCP), with a desired end result of treating the diagnosed condition. Serbanati et al. (2011) reported that HCS are still largely paper based, and do not leverage off existing technologies to modify traditional means of healthcare provision, and as a result fail to qualify and quantify the care provided. Considering global technological trends and the automation of labour (Kromann & Skaksen, 2007), this traditional system is archaic as more efficient means of health provision exist, such as health information technologies (HIT) (Yeow & Goh, 2015).

HIT models meet the criteria for what Deloitte (2019) classifies as characteristics for a *smart health community*, being: use of technology for accurate diagnostics and treatment, improved efficiencies, cost-efficiencies due to remote patient management and health educational support. In comparison to Traditional HCS, use of technology has proven to reach the remote patient, continues a multidisciplinary management continuum in the out-care patient setting, offers continuous supportive care to those with chronic medical conditions and has more superior diagnostic accuracy (Currell, Urquhart, Wainwright, & Lewis, 2003). It does so by disrupting how health services are provided. Gone are the days where health services could only be provided by a HCP with which you physically interact, teleconferencing platforms like telemedicine can be used to facilitate such consultations. Although Sims (2018) suggests that telemedicine can be used as a substitute to face-to-face consultations, Eashwari (2014) states "It is important to emphasize that eHealth is not a substitute for face-to-face medical practice, but rather it is a tool to compliment the current health care delivery in South Africa" (p.37).

2.3. Healthcare Today

2.3.1. The Health Revolution: Innovation

2.3.1.1. Health information Technologies (HIT): e-Health, m-Health systems

HIT comprises of numerous innovative technologies designed and utilised internationally. Two main forms described Silva et al. (2015) are Electronic Health systems (e-health) and Mobile health Systems (m-Health). These innovative designs are designed to facilitate patient treatment through a variety of ways including preventative health through screening, definitive treatment objectives, and assistance in healthy lifestyle practices (Craig & Patterson, 2005).

2.3.1.2. e-Health Systems

e-Health uses the internet as a means of connecting numerous disciplines in the health care fraternity for a more holistic patient management practice (Eashwari, 2014), whilst m-Health is an evolution of e-Health to wireless and mobile configurations that ensure a more intimate connection between the healthcare provider and the patient (Istepanian, Jovanov, & T, 2004). Evidently this is highly sort as Silva et al. (2015) reported that, year-end 2010, there were millions of m-Health

applications being downloaded, with the majority of global citizens, 70%, showing interest to access at least one m-Health application.

2.3.1.3. Mobile Applications: m-Health Systems

Mandl, Mandel and Kohane (2015) added that applications (apps) are integrated into numerous technologies and play the role of data collection and health analytics. Klonoff & Kerr (2018) describe these applications as the *Internet of Medical Things (IOMT)*, adding that they have evolved to offer precision medicine by using artificial intelligence. These apps are used to track fitness and activity, monitor and improve adherence to medications, assist in the management of chronic diseases such as diabetes, perform screening of high risk and high-cost patients, lastly, they add value to collaborative healthcare services (Brzan, Rotman, Pajnkihar, & Klanjsek, 2016). The app functions are performed in real time assuring expedient management for care-receivers. Apps are increasingly becoming popular in the e-health and m-health spaces as they facilitate remote geographical locations consultations, therefore adding value to the telemedicine sector. These innovative health technologies have been effective in improving patient medical outcome, reducing undue healthcare provider consultations, reducing hospital stays and improving management of preventable conditions and reducing healthcare spend (Silva et al., 2015).

2.3.1.4. Telemedicine

World Health Organisation (2009) define telemedicine as:

> The delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities. (p. 9).

Telemedicine is an m-health tool designed to facilitate patient-doctor consultations in the out-patient setting (Sims, 2018). This is done through the use of health telematics such as teleconferencing, texting, pictures or voice-calls (Craig & Patterson, 2005). In reporting the applicability of telemedicine in emerging markets

or developing countries, World Health Organisation (2009) described its ability to assure equities in health access particularly to the under-served communities. This could alleviate the distance decay challenge imposed by the geographical dispositions experienced by the poorer communities in South Africa and potentially other emerging markets. World Health Organisation (2009) added that telemedicine provides clinical support to HCP deployed in remote regions, therefore potentially addressing the subject of lack of skilled clinicians in remote regions, inadvertently resulting in improved quality health services to all, irrespective of location. Russo et al., 2016 reports that this will ultimately result in reduced patient transfers, reducing travel distance, time and costs.

2.3.1.5. Implications of practice

A Cochrane review of seven trials involving 800 people was conducted. The study assessed the effects of telemedicine in comparison to the traditional face to face patient care practices. The findings revealed that although there is room for telemedicine practices (technology may provide access to healthcare in areas not previously possible), there was limited evidence of clinical benefits, cost effectiveness, efficiency and sustainability of telemedicine initiatives (Currell et al., 2003). Sarkar et al. (2016) report suboptimal usability of m-health commercial devices and apps. They demonstrated that apps do not always have customer friendly user interfaces, making it difficult for patient engagement. Lastly, they illustrated that the m-health industry is fragmented with a lack of tool integration for seamless client services. Deloitte (2019) also demonstrates that safety of IOT-enabled medical devices has been of concern over the last 10 years. Cyber hacks have caught telemedicine firms unawares, pressing for urgent developments in patient data privacy and security practices. This is evidence that although telemedicine is growing increasingly popular, there is room for further improvements and developments, furthermore, that such practices should not exist in isolation but as an integral part of existing healthcare services.

A literature review conducted by Wootton, Jebamani, & Dow (2005) on 12 articles assessing E-health and telemedicine projects was conducted. The study analysed the strengths, weaknesses, opportunities and threats (SWOT) of telemedicine projects. The findings under the strength umbrella illustrate that telemedicine offers improved quality of treatment in underserved populations, furthermore enabling more

rapid and accurate diagnosis improving the quality of treatment (Wootton et al., 2005). An example of this is offered by Hampshire et al. (2015), by demonstrating the successful use of informal m-health means in Sub-Saharan Africa. Yeow & Goh (2015) support Wootton et al. (2005) findings by showing a positive telemedicine impact on allocative efficiency pertaining to select resources and processes. They showed that this improved administrative efficiencies in health institutions, reducing waiting times, hospital admissions and matching HCP and patient with accuracy. They describe this as 'working smart not hard'.

In conclusion, there are strengths and weaknesses to consider in the use of telemedicine and its axillary tools (IOMT), furthermore opportunity costs need to be weighed against the benefits of implementations. One should be reminded that it is a growing industry with room for further developments but also keep in mind that telemedicine may offer the solution that emerging markets require to address some of their health equity challenges.

2.4. Global Health Trends

Global market trends indicate that industries are becoming more disrupted in their business of things (Autor, 2015; Christensen et al., 2015), these changes are also evident within the healthcare industry. The new millennium has resulted in disruptive innovative changes that have sought to redefine the traditional HCS and ensure a more patient-centric approach by leveraging off technology (Serbanati, Ricci, Mercurio & Vasilateanu, 2011). Lupton (2017) describes technologies on the digital heath landscape ranging from mobile and web-based platforms, electronic medical records and social media platforms to name a few. These are designed with the objective of facilitating patient and healthcare provider interactions, improving patient medical outcomes and medical provider efficiency and experience (Craig & Patterson, 2005). The overall outcome is intended to relieve the current burden on the health industry by reducing the burden of ill health on government structures and reducing the requirements of health fiscal expenditures, furthermore, reduce patient morbidity and mortality.

Innovative technologies have been employed to address the identified healthcare problems. Examples of which are CRISPR a genetic editing tool designed for therapeutic genetic imprints (TED, 2016) Paediatric HAL, a robot paediatric patient

used for medical teachings (Scientific, 2018), and the apple series 4 watch embedded with an ECG to detect cardiac rhythm abnormalities and report them timeously for early cardiac interventions (Kubheka, 2018) to name a few. Health technological advances are making way in the health care industry and are designed with the objective of improving health care access, improve the quality of healthcare, and decrease healthcare costs.

2.5. Innovation in Emerging Markets: South Africa

The World Health Organisation (2018) describes Africa as having the highest child mortality rates globally, with one of the primary reasons being deliveries in the absence of a skilled birth attendant. South Africa rated 5th on the continent in the number of child births attended by a skilled health care professional. Pillay and Motsoaledi (2018) attributed these low rates to service utilisation programs like MomConnect. MomConnect is a proudly South African digital tool that aims educate and support pregnant woman through the antenatal period (Department of health, 2019). Distribution and dispensing of relevant, current and educational health content are some of the services provided by the mobile tool. MomConnect has grown exponentially to be become one of the largest mobile health (m-Health) programs internationally (Pillay & Motsoaledi, 2018). MomConnect is but one of several other digital health programs that South Africa has pioneered. Overall, South Africa's concernment with health digitization allows it to be a strong enabling environment for the transformation of the health care sector in the country.

South Africa's competitive nature in the global innovation healthcare market has earned it popularity and has given it an advantage in the global innovation race. It is home to the first successful heart transplant performed by Dr. Christian Bernard in 1967, and of most recent times making history with the first liver transplant, transplanted from an HIV positive mother to her negative infant baby, without seroconversion (Dyk, 2018). Another example of South Africa's potential as a strong platform for healthcare innovation is Chris Hani Baragwanath Hospital which is the largest African Hospital and also the third largest hospital in the world (Mfenyana, n.d.). It has become a popular site for medical tourism attracting hundreds of international exchange students and qualified medical professionals annually. South Africa is increasingly marketed as top medical tourist destinations (BIZ Community, 2017), with 4.3 % of 9.5 million foreign tourists visits, attributed to medical tourism in

2008 (Janine, 2009). According to United Nations Department of Economic and Social Affairs (2013), healthcare is one of the fundamental pillars of economic development and sustainable livelihood of countries around the world, an opportunity emerging markets can welcome. This further proves evidence that the benefits of innovation in health exceed those to patient and health care provider, but also extend to growing the fiscal pocket through medical tourism and medical inventions and discoveries.

In summary, the global health industry is growing and global healthcare spending is increasing at an annual rate of 5.4 % annually (Deloitte, 2019). Health technology is one of the leading health initiatives in health advancements as evidenced by the 114 member states of the WHO Global Observatory eHealth survey respondents, who reported to have some degree of telemedical practice employed (World Health Organisation, 2009). Telemedicine offers solutions to the health industries challenge to access, equity, quality and cost-effectiveness of health (Yeow & Goh, 2015). However, It is not without its challenges (Currell et al., 2003). The implementation of such a large-scale initiative is an intensive task often requiring collaborative efforts from multiple stakeholders and numerous elements and resources to ensure its successful roll out (Head & Xiang, 2016; Sturmberg et al., 2012). As a result, the literature review seeks to organise the complexity by identifying the basic elements or factors required to ensure successful telemedicine practices, and organising them into a comprehensive framework that can be prescribed to emerging markets

2.6. Telemedicine element considerations

2.6.1. Introduction

The implementation of telemedicine is complex and is often approached incorrectly. Aldossary, Martin-khan, Bradford, Armfield, & Smith (2017) recommend a seven-step approach to ensure the planning and success of telehealth programs. These are: The evaluation of the healthcare needs, proceeded by the development of a health service plan. This was illustrated in chapter one and the introductory section of chapter two. This is then followed by the design of a business plan (discussed under business model and strategy), the planning of technology and resources with the training of the relevant personnel (discussed under infrastructure), and lastly, the testing of technology and evaluations of healthcare outcomes. This section aims to

discuss key considerations required for the planning and development of a telemedicine framework, that will establish success of telemedicine programs in emerging markets.

2.6.2. Business Model and Strategy

Digitalisation is defined as "the exploitation of digital opportunities" (Rachinger, Rauter, Müller, Vorraber, & Schirgi, 2018, p. 2). Digitalisation requires the use of numerous digital tools and technologies such as cloud services, mobile technologies, IOT, social media to name but a few (Srai & Lorentz, 2019). The appropriate use of these tools as an input to ensure a value adding service for a client as an out-put, requires some strategic insight and business modelling (Casadesus-Masanell & Ricart, 2010; Hwang & Christensen, 2008; Rachinger et al., 2018). Teece (2010) reports that the more radical the innovation, the less likely traditional business models will fit, warranting for a newly defined strategy and business model. In this section, business modelling and strategy in telemedicine will be explored. Casadesus-Masanell & Ricart (2010) suggest that an approach to business model planning is to define a clear strategy, design a business model, then lastly review the business tactics. The section will follow this sequence, with primary focus on the first two elements.

2.6.2.1. Strategy

As previously discussed, the health industry is a large-scale system rigged with wicked problems. This also qualifies it as complex adaptive systems (CAS) (Sturmberg et al., 2012), with complexities that further add to its wicked problems. In order for an appropriate strategy to be designed, it is best to first understand what constitutes CAS and the wicked problems that face it.

> " A CAS is comprised of agents, individuals as well as groups of individuals, who “resonate” through sharing common interests, knowledge and/or goals due to their history of interaction and sharing of worldviews. Agents respond to both external pressures (from environment or from other CAS or agents, e.g., leaders) and internal pressures that are generated as the agents struggle with interdependency and resulting conflicting constraints (e.g., when the needs of one agent conflict with those of another)" (Lichtenstein et al., 2006, p. 3).

Similarly, the telemedicine industry is comprised of multiple stakeholders that play various roles in the telemedicine value chain. These individuals or groups of participants originate from different sectors within the field and may have conflicting views or opinions with respect to how the industry should function. Irrespective, a common objective of best telemedicine practices binds these groups together. Their collaborative efforts are to ensure the successful implementation of telemedicine practices.

In order to achieve this common goal, collaborative networks would have to be formed (Najafi-Tavani et al., 2018), where stakeholders interact with each other to share information, learn from each and adapt in cohesion to the changing external influencers (Wang & Hu, 2017). This is called adaptive change. "Their ability to learn and adapt is underpinned by key self-organizing behaviours including exploration and experimentation" (Carlisle & McMillan, 2006, p. 4). In order to achieve the desired outcomes and an advantageous adaptation, this exploration and experimentation has to be directive and organised. This is achieved through the employment of the Systems Thinking and Complex Leadership Theory models.

Systems thinking can be used to understand the CAS dynamic complexities, which is a crucial step in resolving it's wicked issues. Atun (2012) suggests employing the systems thinking strategic approach because "systems thinking can help address the linear and reductionist approaches which prevail in health systems, by enabling testing of new ideas in social systems" (p. 5). This means that systems thinking can simplify the complexity that rigs health systems, by not only analysing all parts of the sum, but also the sum of all the parts, making identifying and solving for both micro and macro challenges more probable. Systems thinking can improve the quality of the assessments made on all parts of the system (Peters, 2014). "Hence, approaches that foster systems thinking are particularly useful when planning the introduction of innovations into health systems to improve health outcomes, efficiency and equity " (Atun, 2012, p. 5). To conclude, systems thinking can be applied as the strategic approach for telemedicine.

The Complexity Leadership Theory (CLT) offers insight into the processes required to resolve the complexity and define emergent or adaptive change (Carlisle & McMillan, 2006). Arena & Uhl-Bien (2016) classify CTL as a social strategy that drives performance and innovation. They describe how individuals organise into

groups which form group clusters, which in turn form cohesive networks interacting through brokerage or bridge formations to facilitate information exchange. The information exchanged falls into one of two systems: entrepreneurial or operational. " The operational system drives formality, standardization, and business performance, and the entrepreneurial system strives for innovation, learning and growth" ((Arena & Uhl-Bien, 2016, p. 23).

These systems collaborate in an adaptive space which is interactive space layered by cohesive clusters and brokerages. In proposing a strategic plan, the author suggests that the telemedicine industries complexity be approached by creating adaptive spaces in which stakeholder clusters can interact, share information and learn from each other, in order to conceptualise the innovative ideas required for this digital era (entrepreneurial system) and match them with the operational capabilities required to actualise the change needed.

In summary, the telemedicine industry is a CAS laden with wicked problems. Lessons from the Systems Thinking and Complex Leadership Theory can be applied to decipher its complexities and to find solutions for its problems. Systems Thinking Theory unpacks the CAS to understand the micro and macro components of the system, whilst the Complexity Leadership Theory prescribes an approach to an orderly systems re-organisation and engagement that will actualise the innovative and adaptive change required for success. This is the strategic approach recommended by the author as it gives clarity to the complexities of the industry, making business modelling possible. Afterall, strategy is an antecedent to the business model it will adopt (Casadesus-Masanell & Ricart, 2010).

2.6.2.2. Business model

Chrisetensen and McDonald (2015) define a disruptive business model as one that is distinct from competitors and market traditions yet offers an organisation a competitive advantage. Disruptive business models offer innovative ways of interacting with the customer whilst creating and capturing value and making a profit (Casadesus-Masanell & Ricart, 2010; Teece, 2010). Peters, Blohm and Leimeister (2015) describe the importance of a dynamic, robust yet comprehensive approach to business models suitable for telemedicine services. This is an imperative element as it ensures that value is continuously provided for all stakeholders, it supports

management in strategic planning processes, furthermore, assures that the industry will achieve societal advancements in a measurable, ethical and satisfactory manner.

The telemedicine industry is complex often involving multiple stakeholders for its efficient and successful implementation (Peters et al., 2015). It requires complex and intricate structures to manage and co-ordinate the interactions of the various stakeholders to ensure efficient service provision and value creation for its clients (Sturmberg et al., 2012). Hwang and Christensen (2008) suggest that the health care sectors' complexity and uniqueness qualify for a disruptive business model to cater for its complexity. As a result, Peters et al. (2015) propose a Complex Service Business Model (CompBizMod) as the preferred model in such circumstances .

CompBizMod is a tool to analyse business models of complex service providers. It assesses four features of business models constituting of: 1. Value proposition: value co-creation, transfer and capture 2. Business modelling structure 3. Information sharing 4. Dominant business model pattern reviews (Peters et al., 2015). Hwang & Christensen (2008) states that value-adding process businesses are best suited for the health sector, as they are in the business of creating and capturing value for their clients. These elements will be discussed in this section; however, information sharing will be discussed under the *collaboration* section.

2.6.2.2.1. Value Proposition

This seeks to describe and define how the business model will create value for all stakeholders, including the patient. This is an important consideration because as illustrated, telemedicine utility lies in its ability to provide remote healthcare services in order to increase healthcare access, reduce costs and improve health facility efficiencies (Currell et al., 2003; Yeow & Goh, 2015). Success in practice is defined by the quality of the services provided, as well as in consistent value creation.

2.6.2.2.2. Business Modelling Structure

Once the nature of value creation has been established, the 'how' should be addressed. This is attainable through the business modelling structure. Hwang & Christensen, (2008) propose that there are four components to a business model, inclusive of: the value proposition as discussed above; the processes to provide the services, what this research seeks to find; the resources utilised; and the profit

formula. To address the latter, with health cost spend projected to increase at an annual rate of 5.4 % (Deloitte, 2019), health capital efficiencies are necessitated. Capital cost should be kept at a minimum to ensure new project funding is made possible (World Health Organisation, 2009), which in turn will add more value to the client. As a result, pre-medicated efforts to actualize an economically viable telemedicine platform are required for its effective implementation. These intensions are realised through a business model and strategy design that prioritises project funding.

2.6.2.2.3 Dominant Business Modelling Pattern Review

As illustrated, the health industry has a predominately value-adding type of business model (Hwang & Christensen, 2008). By pairing this with technological advancements, as the case with telemedicine, a new type of business model is recommended (Peters et al., 2015; Teece, 2010). The Complex Service Business Model (Peters et al., 2015), may be used to evaluate the most suitable type of business model, however customisation is recommended to suite the local market. Tailoring of the business strategy and modelling to ensure it is more customer-centric is imperative if enterprise success is to be accomplished (Teece, 2010).

Research Question 1: What type of business modelling and strategy is required for the successful implementation of telemedicine in emerging markets?

2.6.3. Collaboration

Telemedicine is a large-system venture, therefore "Collaboration, participation, and capacity building are fundamental to the success and sustainability of telemedicine initiatives" (World Health Organisation, 2009, p. 24). Private-public partnerships, international and cross-industry collaborations are necessary for the success of such new venture creations (Haus-Reve, Fitjar, & Rodríguez-Pose, 2019; Santoro, Bresciani, & Papa, 2018). This chapter will discuss collaborative innovation and its effect on product performance, furthermore, the collaborative factors required to ensure prosperous collaborative partnerships.

2.6.3.1. Knowledge Sharing

Collaboration innovation is defined as the sharing of knowledge between two or more parties within the supply-chain network, done with the intent of achieving supply

chain R&D initiatives (Wang & Hu, 2017). This is achieved through "combining knowledge, technologies, and other resources across organisational boundaries" (Davis & Eisenhardt, 2011, p. 160) These parties, otherwise called 'collaborative innovation networks', may include suppliers, customers, academic institution, the government and competitors (Najafi-Tavani et al., 2018). The benefits of the collaborative efforts vary from gaining access to new technological knowledge which can improve operational efficiencies and remedy existing challenges (Shi, Wu, & Fu, 2019); To market knowledge acquisition offering market insights that provide new idea formation and stimulate innovative capability for the purpose of new product development (Najafi-Tavani et al., 2018); And mitigating risk, reducing costs and shortening time to market (Wang & Hu, 2017). World Health Organisation (2009) further added that collaboration allows for improvement of reliability and sustainability of programs. Ultimately, collaborations, if done right, offer firms a competitiveness advantage (Santoro et al., 2018).

2.6.3.2. Risks of Collaboration

There are some risks that have been described with collaboration innovation networks and information sharing. These include increased vulnerability by knowledge leakage which can lead to intellectual property theft and imitations (Smirnova, Rebiazina, & Khomich, 2018). In fear of this, Wang & Hu (2017) propose that knowledge has more value undisclosed among supply chain partners. Shi et al. (2019) reported that raising overhead costs due to partnership engagement activities may become a problem, particularly in University-Industry (UI) collaborations. Shi et al. (2019) also added that multicultural collaborative partnerships as well as collaborations that result in conflicting ideas, may pose a challenge and invariably affect the efficiency and performance.

2.6.3.3. Collaborative Modes

There are different collaborative modes described by the literature. Santoro et al. (2018) describes two forms of collaborative modes being Formal and Informal collaborative modes. The formal collaborative modes (FCMs) are defined as formal arrangements between collaborating parties, often involving contractual and legal binding documentations; whist informal collaborative modes (ICMs) are non-contractual and loosely defined relations between the collaborative innovation networks (Santoro et al., 2018). ICMs are more flexible and are often preferred to

FCMs. Haus-Reve et al. (2019) argued that collaborations can either originate from the 'Science, Technology and Innovation mode' (STI) or from the 'Doing, Using and interacting mode' (DUI), furthermore, added that either DUIs or STIs should be selected for collaboration as concurrent collaborations has not shown to yield additional benefits. STIs are often experienced with universities and research institutions and are found to be more explorative and radical in nature, as the objective is to add to the body of knowledge and develop new products; Whilst DUIs are found in the supply-chain networks, are exploitative and incremental in nature and are defined by experimental iterations and experience (Haus-Reve et al., 2019). The above interactive modes are important to understand as they define the scope and depth of the interactive relations involving various stakeholders across various sectors. They also assist in deciphering which types of collaborative partnerships need to be formed, where and how. Based on the literature descriptions of telemedicine, the author deduced that telemedicine is subject to both incremental and radical innovative processes with emergent and transformative properties, therefore, both STI and DUI interactive modes may apply, dependant on the context.

2.6.3.4. Types of Collaborative Partnerships

Specific collaborative innovative networks are recommended in emerging economies. Shi et al. (2019) reported that University-Institution (UI) collaborations are crucial for emerging economies as they enable and sustain economic growth, however, they added that collaborative benefits are only attained after certain barriers of engagement have been overcome. Scientific Institution input is required for innovation, development and the formation of a collaborative space to allow the co-exitance and co-dependence of supportive axillary tools, IOT and Gadgets, which assist in the management of care receiver and giver values and challenges (World Health Organisation, 2009). To illustrate this, Chandwani, De and Dwivedi (2018) describe how a UI collaborative innovative network between Sanjay Gandhi Post Graduate Institute for Medical Sciences, an academic hospital and the rural community, resulted in the successful and sustainable implementation of a tailored telemedicine initiative in rural India.

Dahan et al. (2010) suggested multi-national (MNE) and non-governmental organisation (NGO) collaboration as a means of new value creation by delivering both social and economic value to developing countries. The emerging economy

states are unique and require pre-meditated and strategic collaborative efforts in order to ensure that the large-scale change is founded and is successful (Teece, 2010).

2.6.3.5. Elements Influencing Collaboration

There are numerous factors to be considered with collaborative innovative networks. These factors either negatively or positively affect the formation of partnerships, hence stand chance to influence the outcomes of the collaborative effort. The first is rational learning (RL), an antecedent to innovation collaboration as it defines the partnership and gives strength to the collaboration (Smirnova et al., 2018). Rational learning is considered a dynamic capability as it allows for interorganisational knowledge exchange and learning, therefore enabling for market knowledge acquisition and the gaining of market insights which can help improve the firms performance (Najafi-Tavani et al., 2018; Smirnova et al., 2018). Irrespective, acquired knowledge is not always utilised so Najafi-Tavani et al. (2018) added the second element in stating that collaborative innovation network efficacy is actualised by a firms absorptive capacity, which is an internal capability that is required for the capitalisation, processing and usage of acquired knowledge. The third element is heterogeneous sources of knowledge (HSK) to diversify the knowledge and skills shared, adding variety and value to the collaborative partnership (Santoro et al., 2018). However, this will have to be closely managed as the larger the scale of engagement, the more complex the system becomes and the greater the chances of it being wrought with wicked problems (Waddock et al., 2015). Finally, the timing of collaborations is a key element to consider. "Collaborations might have different implications for efficiency at different stages of the innovation process" (Shi et al., 2019, p. 3). Smirnova et al. (2018) concurs in reporting that the innovation process is continuously evolving over time, which may require the input of different stakeholders at different parts of the cycle. These elements determine how collaborations are formed, when they are formed, who constitutes the collaboration and how knowledge is shared and utilised. This is also important for the information sharing component of the CompBizMod business modelling and strategic considerations described above.

To illustrate the importance that these elements play, Davis & Eisenhardt (2011) states that collaborative innovation enables interorganisational knowledge sharing,

whilst Wang & Hu (2017) demonstrates that there is a partial mediating role between collaborative innovation activities and innovation performance, concluding that the pairing of the two can offer firms a competitive advantage. Najafi-Tavani et al. (2018) illustrated that absorptive capacity is needed to complete the knowledge sharing process as this positively influences product and process innovations and ultimately innovation performance.

In closing, the healthcare industry requires multiple stakeholder involvement to facilitate efficient and accessible health services. Similarly, the telemedicine industry has been projected to require a multi-disciplinary approach in order to serve utility to its clients (Sims, 2018). Stakeholder management is imperative to ensure that the most appropriate type of partnerships are formed at the right time and under the most appropriate of conditions, so as to encourage collaborative innovation networks that promote innovation performance. It thus brings us to the proposition that collaboration is imperative to ensure a successful digital economy.

Research Question 2: What role does collaboration play in the founding of a successful telemedicine industry in South Africa?

2.6.4. Ethics and Regulation

The establishment of a telemedicine platform implies multiple stakeholder management of patient data and information. Health data is the most personal of all forms of data (Currie & Seddon, 2014), which leads the EU treaty to declare personal data protection a human right, therefore mandatory (Seddon & Currie, 2013). This necessitates for client e-health security and privacy protocols (Löhr, Winandy, & Sadeghi, 2010). To add, Healthcare regulation as a tool of public accountability is needed to assure equity and fairness in health access to all who need it (Nunes, Rego, & Brandão, 2009). This section will review the ethical, regulatory and compliance requirements needed for the successful implementation telemedicine in emerging markets.

2.6.4.1. The Need for Regulation

Rapid innovation can be a matter of contention. In 2018 the giant social media platform Facebook was sued for billions of dollars over the Cambridge Analytica scandal, for the sharing and misuse of confidential client information (Lee, 2018).

This lawsuit made it evident that the monitoring and regulation of company activities in the digital space is imperative. Similarly in healthcare, organisations face serious penalties and sanctions for the mis-management of patient data (Currie & Seddon, 2014). "Policy makers had to learn that privacy, confidentiality, liability and data protection all need to be addressed in order to enable a sustainable implementation of and use of eHealth applications" (Stroetmann, Artmann, & Stroetmann, 2011, p. 1351). Quality checks of medical products and services are mandated to ensure client data and information is secure and that consumer rights are protected (D. Lupton, 2017).

2.6.4.2. Regulatory Guidelines

There are various regulatory bodies whose objective is the invention of numerous governing principals and policies for use by innovative products and services. These are established to ensure the ethical rooting of the medical fraternity is upheld whilst transparent, patient-centred health services are provided (Löhr et al., 2010; Nunes et al., 2009). One such is the FDA (Food and Drug Administration), a US federal agency which sees to the establishment of guidance documents that regulate numerous products including medical devices (FDA, 2019). The FDA published two advisory guidelines which saw to the integration of risk management protocols and the monitoring of cybersecurity threats in medical devices. (Yuan, Fernando, & Klonoff, 2018). Unfortunately, these are guidelines and are not enforceable by law. The latter is however supported by the Technical Information Report (TIR) 57, designed by private organisations to monitor the global standards for medical device cybersecurity (Instrumentation, 2016).

In South Africa, Parliament of the Republic of south Africa (2013) drafted regulatory guidelines to ensure that patient data is protected. These guidelines are the Protection of Personal Information Act (POPI) act, and their objectives range from the protection of client personal information, to the issuing of a code of conduct for institutions for the management of patient information and the establishment of an information regulatory body to oversee these clauses.

Irrespective of these efforts, what is conspicuous is the lack of consistency and standardisation in these regulatory efforts as different technological tools and services employ different policies and quality checks. This is evidenced by Paulus, Davis and Steele (2008) when they stated that American health care systems are

currently challenged with a fragmented and disco-ordinated health system that has reduced efficiency, high operational costs and poses high risk to all stakeholders. Stroetmann et al. (2011) added that no country had a coherent set of laws to which organisations needed to abide, rather they proposed regulatory guidelines and legal frameworks as illustrated above. This makes the management, replication and advancement of technology difficulty. Unified, formalised and organised regulatory institutions and laws need to be established to ensure the effective and responsible collection, protection and sharing of health data (D. Lupton, 2017), in order to secure ethical, equitable and fair health services to all.

2.6.4.3. Regulatory Boards and Bodies

Some argue that ethics and regulation is a double-sided factor and that stakeholder monitoring is as imperative as the management of patient data. Regulatory body supervision is important because 'regulatory capture' is a threat in instances of conflicts of interests (Nunes et al., 2009). In combat of this, Nunes et al. (2009) suggests the establishment of independent regulatory agents (IRA), who play the role of an external regulator keeping all stakeholders honest and accountable. In the context where multiple stakeholders are involved for trans-border health data management, Seddon & Currie (2013) proposes a conceptual framework which addresses the regulatory and compliance challenges in the cloud eco-system. Similar frameworks and regulatory practices would need to be considered in the South African setting.

In closing, patient data privacy and protection is a human right mandating for regulatory governance and ethical processes in the healthcare sector (Deborah Lupton, 2017). All levels of the industry need to be monitored to ensure compliance to regulatory guidelines (Seddon & Currie, 2013). This includes all stakeholders and the technology that interacts with the patient data (Löhr et al., 2010; Nunes et al., 2009). As a result, we propose ethical and regulatory considerations must be considered with the implementation of telemedicine in South Africa

Research Question 3: What are the ethical and regulatory management considerations required for the successful implementation of telemedicine in South Africa?

2.6.5. Health Infrastructure

According to Aldossary et al. (2017), health infrastructure is essential for the successful implementation of telemedicine. "Infrastructure is understood as human and non-human conduct that is embedded into wider organisational conventions, sites and structures" (Nickelsen, 2019, p. 67). The collaboration section discussed the human infrastructural requirements. This section will discuss the non-human infrastructural requirements needed for the successful implementation in South Africa.

2.6.5.1. The need for Infrastructure

The health industry is growing rapidly with demands currently exceeding supply (Anyangwe & Mtonga, 2014; Deloitte, 2019). OECD (2017) stress that not enough has been done to improve information technology infrastructure in primary health, yet it is imperative to ensure its growth and sustainability. UNICEF (2017) urge that the "government should selectively invest in accelerated investment in infrastructure, especially for the poorest provinces where opportunity costs for accessing health services are high" (p. 16). Without sufficient infrastructure to support the advancement of innovative health initiatives such as telemedicine, healthcare practices will falter to detriment of those it serves utility, particularly the underserved communities. Evidently, neglect to address the supply-demand discrepancy has far greater socio-economic consequences for the state, to add, stands chance to worsen the health inequity challenges at hand. Therefore, the development of national eHealth infrastructure is imperative.

2.6.5.2. Non-Human Infrastructure:

Löhr et al. (2010) report the need for infrastructure and equipment that facilitates the acquisition of patient data, efficient and safe storage of the data and also protected sharing of information amongst stakeholders. Güler & Übeyli (2002) reported that this includes: acquisition infrastructure, storage and retrieval infrastructure and telecommunications.

2.6.5.2.1. Acquisition Infrastructure

Teleconferencing equipment with data digitizing capabilities such as fixed or mobile

phones, computers and image processors (cameras and monitors); text processors (scanners and fax machines) and any laboratory or radiology equipment (x-rays).

2.6.5.2.2. Storage and Retrieval Infrastructure

Any equipment that can compress, transmit and store data such as CD-ROMS, disks, CD's, tapes and cloud storage systems. Secure cloud storage services are indispensable when assuring that ethical practices are maintained and that regulatory guidelines are adhered to (Löhr et al., 2010).

2.6.5.2.3. Telecommunication Infrastructure

Telecommunication networks are crucial in facilitating the communication of these devices and ultimately the teleconference itself. Telecommunication networks include the internet, ATM (asynchronous transfer mode), satellite and ISDN networks for data communication. These must be able to securely support large volumes of patient data and the multimedia traffic of medical communications (Güler & Übeyli, 2002).

Stroetmann et al. (2011) added that electronic identifiers are key components in eHealth infrastructure due to their ability to identify all stakeholders in order to authenticate, protect and facilitate medical practices. Examples of States that have executed this well include Germany with the German Electronic Health card (eHC) which not only securely carries administrative information but also facilitates safe paperless healthcare transactions (Löhr et al., 2010). Mengesha and Garfield (2019) added that this this type of infrastructure needs to be compatible with medical practices to ensure that it plays a supportive and facilitative role for HCP. In doing so, also improves the innovation adoption and diffusion at later stages.

2.6.5.2.4. Evaluation Infrastructure

Infrastructure that aids in the post-implementation monitoring of efficiency and effectiveness of the implementation process is also recommended. Kidholm et al. (2012) concur in reporting that

> "If the objective of an assessment of telemedicine applications is to describe effectiveness and contribution to quality of care and to produce a basis for decision making, then the relevant assessment framework fulfilling this

> objective is a multidisciplinary process which summarises and evaluates information about the medical, social, economic and ethical issues related to the use of telemedicine in a systemic, unbiased, robust manner" (p. 46).

As a means to achieve this Kidholm et al. (2012) proposed MAST (Model for Assessment of Telemedicine Applications). Wildman, McMeekin, Grieve, & Briggs (2016) are in support of the objective when stating that evaluations of new technologies for health and social care services are fundamental as they allow for improvements in health care services.

World Health Organisation (2009) expresses how these assessments can produce relevant information to help develop the national telemedicine policy and strategy, furthermore, guide implementation processes and enable sustainability. The OECD (2017) has described how the evaluation of infrastructure and its utility has led to the improvement of health in care-receivers outcomes, through the development of disease registrations and statistical collections. In Switzerland, the Regulatory Impact Assessment (RIA) is commissioned for the socioeconomic evaluation of eHealth legislations (Stroetmann et al., 2011). Sadly, unlike Switzerland only 20% of countries that have a telemedicine industry, are reported to have telemedicine evaluation processes employed since 2006 (World Health Organisation, 2009). More would need to be done to ensure that this statistic is improved.

Nickelsen (2019) offered an alternative dynamic to infrastructure requirements. They defined infrastructure as a sociomaterial map between human and non-human interactions. Nickelsen (2019) declared that infrastructure includes numerous obstructing social dynamics and to address this complexity in eHealth, Andreassen, Dyb, May, Pope and Warth (2018) suggested that digitization requires a revision of how one conceptualises patient-doctor consultations, relational connections and social configurations in institutions. They coined the terms *respatializad, reconnections and reconfigurations*. Acceptance and understanding of the required paradigm shifts are necessary to facilitate sociomaterial infrastructure, a tool that facilitates forms of participation (Nickelsen, 2019). This ingenuity paves the way for human-none-human infrastructure collaborative spaces needed for a successful implementation process of telemedicine. It creates the interface on which human and none human infrastructure can interact to ensure cohesive and co-ordinated relations that create an ease in service provision.

2.6.5.3. Infrastructure Challenges

2.6.5.3.1. User operability

Overall, user operability of telemedicine tools and infrastructure is imperative for obtaining optimal value from its services, and if unknown may pose a challenge. A study conducted by Van Deursen and Van Dijk (2011) indicated that irrespective of the growing internet and online health content, users still remain incapable of enjoying full benefits of the data due to internet illiteracy. Operational and formal internet skills were shown to be deficient when using the internet for health-related purposes, and this was demonstrated across all ages (Van Deursen & Van Dijk, 2011). This may also later pose a hinderance in the adoption and usefulness of telemedicine tools.

2.6.5.3.2. Connectivity challenges

There are numerous infrastructural challenges that are specific to emerging markets. Araya Abrha Medhanyie et al. (2015) describe how network issues were one of the barriers of HCP-patient relations in maternal health in Ethiopia. Similarly in India, poor infrastructure such as unreliable power sources and connectivity prohibited the use of telemedicine systems by tele-centres (Chandwani et al., 2018). Emerging markets would have to ensure foundational infrastructure such as access to power, are secure prior to making advancements to health technologies such as telemedicine.

In summary, the infrastructure required should enable sound data collection processes, secure data processing, safe storage mechanisms, and reliable information sharing. Infrastructure should enable quality assurance that satisfies ethical and regulatory practices. Lastly, the assessment and evaluation of the success and failures of the implementation process is fundamental, so that improvements can be made to encourage the best value proposition and utility for the patient. This leads us to suggest that infrastructure is imperative in the founding of telemedicine.

2.6.6. Conclusion

The literature findings describe four main constructs which the author attributes as key constructs and crucial in the formulation of a successful telemedicine industry.

These constructs are compiled into what forms the basis of a comprehensive telemedicine framework (Figure 1). The interview findings in chapter 5 will build on this framework to establish a comprehensive telemedicine framework suitable for emerging markets.

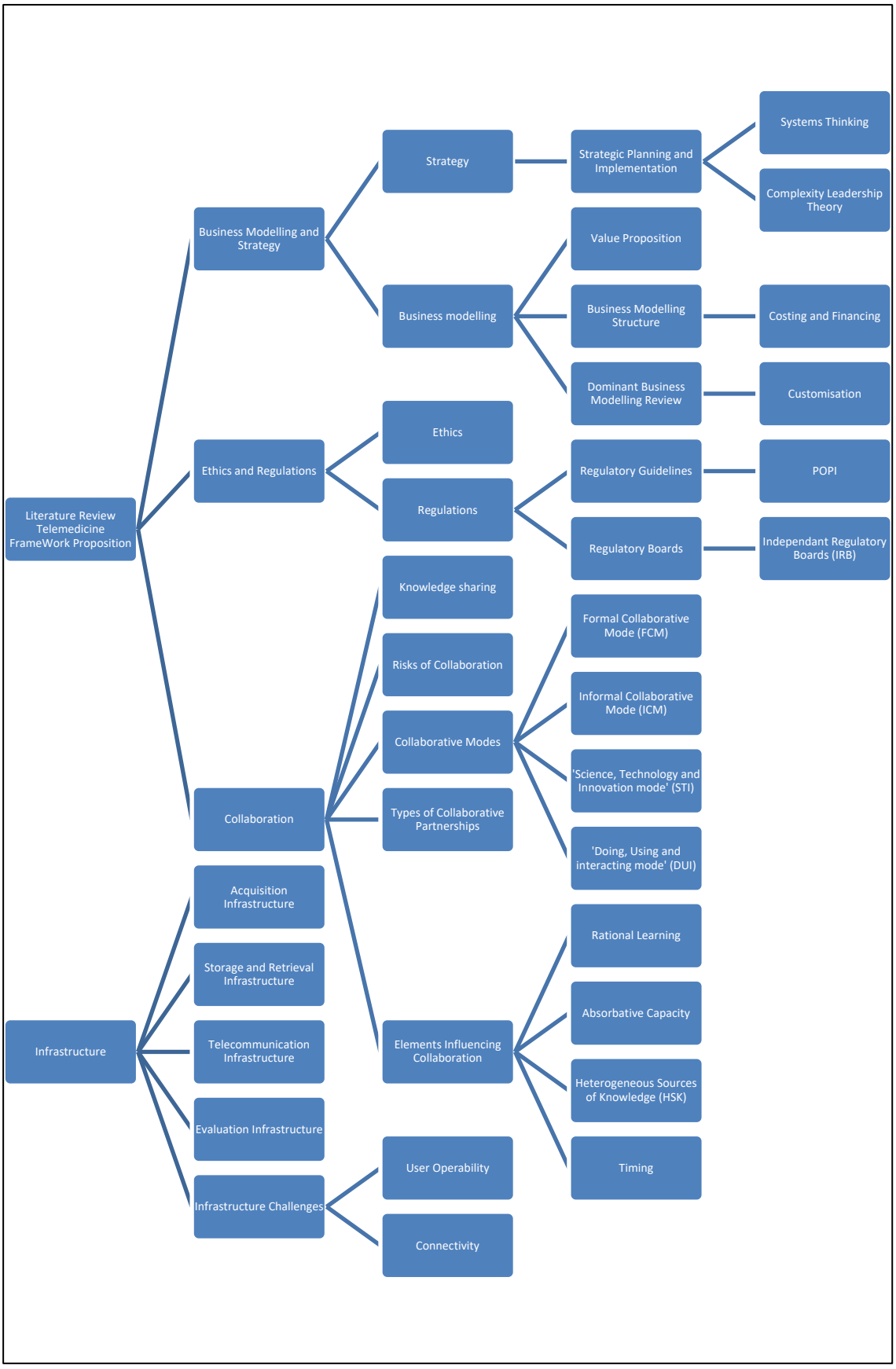

Figure 1 - Literature Review Telemedicine Framework Proposition

Chapter 3: Research Questions

This research aims to answer four research questions. These are:

3.1 Research Questions

Research Question 1: What type of business modelling and strategy is required for the successful implementation of telemedicine in emerging markets?

Research Question 1 seeks to determine whether telemedicine business models trailed and tested in other regions, can be borrowed and replicated in the South African setting; Or whether new business modelling and strategy formulation need be applied to suite the current local cultural climate. The research question will seek to establish which approach is best to propose and execute a winning value proposition offering from telemedicine.

Research Question 2: What role does collaboration play in the founding of a successful telemedicine industry in South Africa?

Research Question 2 aims to define how collaboration can be used to ensure multiple stakeholder engagement in addressing the wicked problem of telemedicine implementation, in the emerging market setting. Furthermore, it seeks to understand the nature of collaborative partnerships required and give insight on how knowledge sharing can ensure successful implementation is achieved. Lastly, it will seek to understand what elements influence collaborative partnership formation.

Research Question 3: What are the ethical and regulatory management considerations required for the successful implementation of telemedicine in South Africa?

The traditional healthcare practice is strictly regulated and deeply ethically inclined Research question 3, seeks to illicit whether or not a new health discipline like the telemedicine industry, needs to adhere to the traditional health ethics and regulatory prescriptions, or if new ethics and regulatory considerations need to be explored.

Research Question 4: What role does infrastructure play in the success of telemedicine in South Africa?

This research question aims to establish the type of infrastructure required in emerging market settings, for the set-up of a telemedicine sector. It also seeks to understand the anticipated infrastructural challenges once the industry has been established.

Chapter 4: Research Methodology

4.1. Introduction

This chapter explores the methodology and design employed in the study. World Health Organisation (2009) reports that telemedicine is not as well established in emerging economies in comparison to the more economically established states, furthermore, that more needs to be done in order to bridge this gap. Therefore, the study has adopted a qualitative, explorative and deductive approach in order to learn more about the industry, particularly in the emerging healthcare markets. Saunders & Lewis (2012) state that qualitative approaches are employed when there is insufficient knowledge about a topic or if the subject matter is new. Therefore, a qualitative and exploratory approach has informed the research method, research design, population selection, data collection and data analysis processes.

The process pursued was as follows: A data collection tool was designed from the findings in the literature review. This formed the bases of the research questions, furthermore, the interview questions used in the semi-structured telephonic interviews conducted with industry specialists. The data collection process was conducted using the Otter a.i software, which records and transcribes voice recordings into text. Thematic analysis of the notes was done using the Atlas TI software. The analysed data was then discussed, with the relevant new findings organised into a comprehensive telemedicine framework.

4.2. Rationale for choice of methodology

Chapter 1 described telemedicine as a 'developing' industry that is not yet well understood. Chapter 2 took to understand what is currently known about the industry and attempted to identify the gaps that suggested room for research i.e. what was not known. It was evident that there was a paucity of information about the industry particularly pertaining to emerging markets, which informed the choice of methodology and design of this study. Creswell (2003) describe qualitative research methods as exploratory in nature and as tools researchers use to make sense of an unknown or poorly described phenomena. Qualitative and exploratory research methods are used when the subject of study is new or when the industry research conducted has a limited scope (Creswell, 2003), such as within the telemedicine

industry in emerging markets.

4.3. Research Methodology and Design

The study therefore adopts a qualitative and exploratory method and design in order to better understand the telemedicine industry.

In the case of this study, an exploratory research approach was actualised through a data mining process where research was conducted in order to explore and gain understanding of the theoretical and philosophical underpinnings that define the telemedicine health industry. This process provided insight into the industries primary defining characteristics, key industry players and the common themes that permit its implementation and success. The findings were then used to inform the research and interview questions, furthermore, help inform the type of interviewees chosen for the data collection stage.

The interviewees originated from different parts of South Africa which informed the primary choice for telephonic interviews as the interview process approach, as opposed to face-to-face interviews. However, in instances where geographical proximities permitted, some of the interviewees requested for face-to-face interview processes. Semi-Structured interviews were then conducted using the interview questions defined in chapter 3 (Appendix 1). The semi-structured nature of the interview questions allowed for open ended style of questioning (Creswell, 2003), which offered depth to the subject matters discussed. It also ensured that none-leading questions were asked which permitted interviewees to answer freely and openly. This not only supported the exploratory nature of the research method but also ensured that reliable and none solicited information was offered. Lastly, in consideration of the limited duration of time set for completion of the study, a cross sectional study was selected (Saunders & Lewis, 2012).

4.3.1. Population and Unit of analysis

The population of choice was the South African private and public healthcare industry stakeholders, of origin and practice in any of the nine provinces. The population group included professionals that were involved in multiple sectors of the telemedicine industry. Sectors include telemedicine technology development, maintenance, sales, legal and ethical regulators. Owing to the research topic

focusing on an industry problem; the population of study comprised of South African leaders in the health profession whose responsibility is to set industry standards furthermore, aid in the development and shaping of industry norms. For reasons described in chapter 1, South Africa was the chosen country of study.

The unit of analysis chosen was key health industry stakeholders inclusive of entrepreneurs, executives, managing directors, tech developers, legal and ethics regulators, operational in telemedicine companies. In particular, this comprised of telemedicine entrepreneurs who provide services across the telemedicine value chain, an industry leader, a data privacy and protection specialist, an ethics specialist, an IT specialist and a telemedicine practitioner. The entrepreneurs provided services in the data collection, cloud service sector, pharmaceuticals, and the mobile application industry. These individuals were or had worked in the telemedicine industry and were therefore knowledgeable and had experience in the field, were also interviewed. For the purpose of protecting the identities of the respondents in the data analysis section, the respondents are referred to in accordance of the duties they perform in the industry (Appendix 7).

The unit of analysis was formed by a diverse group of interviewees who held different pivotal roles in the private and public sector of the health industry, as well as assumed prime positions in the telemedicine sector. The diversity in the interviewees selected allowed for heterogeneity in opinions and input that assisted the author in gaining an in depth understanding of all themes and complexities defining the telemedicine industry.

4.3.2. Sampling method and size

Owing to the digital health industry being a niche space, a sampling type that was purposive in nature was chosen. This resulted in the selection of a homogenous group of individuals with similar characteristics, attributes, values and interests. This was a subjective sampling technique, with a resultant effect of a non-probability sampling strategy that was loose, and with no frames as described above. A total of 13 key industry stakeholders were selected to form part of the purposive sample selected by the author. This was influenced by Saunders & Lewis (2012), whom suggested a population size between 12 and 30 for heterogenous samples. The South African telemedicine industry is small, comprising of very few stakeholders

which also influenced the population size selected. However, the number of interviewees was an estimate defined by the point at which data saturation points were reached.

4.3.3. Data collection tool

Saunders & Lewis (2012), propose that exploratory research is most effectively approached through searching academic literature in order to inform a data collection tool which will used to conduct informed interviews. Through the literature review process the author identified key themes and defining factors applicable to shaping a successful digital health space (Figure 1). These themes were: Business modelling and strategy, collaboration, ethics and regulation and infrastructure. These were sorted into four research questions, substantiated by a total of 16 interview questions (Appendix 1). These interview questions where used in the semi structured interviews with key industry stakeholders.

When describing the matching of paradigms and methods, Mackenzie and Knipe (2006) stated that interpretivist and constructive paradigms are developed from qualitative data collection methods. Therefore, data was collected via semi-structured interviews held via conferencing voice calls as well as face-to-face interviews, with interview periods that lasted at most an hour. The interviews were recorded (recording permission was granted by the interviewee) for decoding and transcribing retrospectively. Handwritten notes of important concepts and themes was also be taken to aid with the transcription process that proceeded. The interview process objective was to gain insight into what respondents considered pertinent factors or themes that define a successful digital health market, furthermore what they envision as a thriving South African telemedicine market.

Interviewees were invited via mail or telephonically, during which they were be briefed on the nature of the study. Upon agreeing to participate in the study and securing of the interview dates and times, an informed consent letter (Appendix 2) was mailed to the respondents for completion and submission prior to the conduction of the interview. This ensured that all ethical protocols are respected.

In support of ethical proceedings, respondents were reminded of the confidentiality clauses at the beginning of the interviews. Interviewees were informed that confidentiality would be ensured as no names would be reported in the research

publication, however anonymity was only limited to the research publication and not the data collection process, as they were encouraged to share information about themselves and their role in the industry, as defined under data collection. However, respondents were assured that the personal information disclosed would not be shared in the research publication. To add, respondents were also informed about the management of the data collected and about their right to opt out of the interview at any time they felt necessary. Lastly, they were notified about their right to recall their participation in the study at any stage of the study period.

4.3.4. Data collection

The data collection period was commenced after the receipt of ethical clearance from both the Gordon Institute of Business Science (GIBS) and the Department of Health at the University of Pretoria. The process was initiated with a pilot interview session whose aim was to test the integrity of the interview questions and to also train the interviewer/author to conduct effective interviews in preparation for the data collection sessions with the target interview group. One test interview was conducted, where the addressable challenges were corrected prior to the commencement of interviews with the industry stakeholders. The test subject was selected to fit the profile of the target interview group to ensure that accurate testing conditions were experienced. The information obtained in the test interview was transcribed and also incorporated into the final data used in the recommendations.

Upon commencement of the interviews with the target group, the respondents were first asked to share information about the positions they assumed in the industry, furthermore, share their understanding of telemedicine. This was done to give credibility to the research publication as it indicated that only the relevant stakeholders were interviewed. This was then followed by 14 interview questions pertinent to the themes found in the literature. The semi-structured nature of the interview allowed respondents to answer openly and freely, whilst setting the tempo of the interview. The author attempted to listen attentively and respectfully to ensure purposeful and constructive interviews were conducted. In summation of the interview, the respondent was offered the opportunity to make any concluding remarks or address any questions to the author (Saunders & Lewis, 2012).

The Otter A.I software was used to record the interviews. The software automatically

transcribes the recordings into text. The text was later checked in correlation with the voice recording for any errors, of which the required amendments were made. The cross-check process ranged from one to five hours per interview. During the interviews, codes and themes raised by respondents were flagged and recorded by the author and later supported with the data from the Otter A.I transcriptions and the literature findings, and used in the thematic analysis process.

Once theoretical data saturation as well as new code saturation was reached, the interview process was concluded. All interviews were tallied up and captured as recordings, transcribed text and as well as hand-written notes taken during interviews. The information was safely stored and analysed retrospectively using thematic analysis with support from the Atlas Ti software. The aim was to answer the research questions and achieve the objective of building a comprehensive framework for telemedicine in emerging markets.

4.3.5. Data analysis

The data analysis process was resumed once all interviews were concluded. The data was analysed using the Atlas ti software. It was processed and organised through a thematic analysis iterative process where codes were matched and grouped together under group codes (Appendix 3). These group codes where further aggregated into themes and sub-themes. In the final process, these themes were associated with the relevant research questions (Figure 2-9). New themes were also coded, categorised and classed consistent with the relevant research question (Figure 9). Clarke & Braun (2017) describe thematic analysis as "a method for systematically identifying, organizing, and offering insight into patterns of meaning (themes) across a data set" (p. 57). This process help give meaning to the data and assisted in the design of the comprehensive telemedicine framework for emerging markets (Figure 10).

Once each research question was fully populated with common and new themes, the results were discussed in relation to the their theoretical and business relevance. Using only the relevant findings, the data was reviewed in conjunction with the literature review findings and compiled to form chapter six. Chapter six was used to define a new industry model which makes recommendations of which elements are required for a successful telemedicine industry, furthermore, makes

recommendations for business and literature future studies. This analysis process is consistent with an deductive approach of the research purpose (Saunders & Lewis, 2012).

4.4. Validity and Reliability

The research aims to address the issue of validity and reliability through the employment of various actions. Trustworthiness is the principal that governs the validity and reliability of the research; therefore credibility, transferability, dependability and confirmability needed to be addressed as they form the basis of trustworthiness.

Credibility was ensured by internal and external validity. To start, Internal validity was ensured through the process taken to derive the interview questions. The consistency matrix was used in conjunction with the research questions to compile the interview questions (Appendix 6). This assured that the interview questions were synergistic with the research questions, maintaining consistency through the literature review, research methodology and the data collection.

Internal validity was also secured through the use of triangulation. “Triangulation is a powerful way of demonstrating concurrent validity, particularly in qualitative research” (Cohen, Lawrence & Morrison, 2012, p. 141). Multiple digital health respondents were sourced based on the profile and traits described under unit of analysis. Once selected, their suitability for the interview was scrutinised with respect to the roles they assume in their practice, their influence and contribution to the industry, their qualifications, and years’ experience in the field. A broad base of respondents’ transfers heterogeneity in these traits and therefore reduces the bias of results, such as the case with the selection process. The researcher also achieves environmental triangulation by selecting multi-provincial respondents. Prepared respondents can bias the information offered in the interview; therefore, internal validity was ensured by the elimination of pre-interview briefings as the interview questions were not shared before the interview. Lastly, to ensure that respondents were exhaustive in the information offered, prolonged interview periods were conducted. The maximum interview time was an hour with the average interview time around 25 minutes.

External validity was achieved through the selection of a purposive sample defined above. To add, a ‘thick description’ of the identified themes in the literature and findings was offered. The words 'thick description' allude to detailing and thoroughness in deciphering themes “The need for THICK DESCRIPTION and transparency cuts to the heart of validity issues in qualitative research” (Richards, 2009, p. 158). The researcher aimed to ensure the accurate description of interview findings in chapter five, and also matched these with the appropriate theoretical codes as this gives credit to the research findings. These concepts are described as content and construct validity as described by (Saunders & Lewis, 2012).

The researcher also strove to maintain standardised data collection methods as well as accurate and standardised coding techniques, in order to eliminate researcher and respondent bias. This gives credibility to the findings, allowing for replication and transferability of recommendations. Leaving an audit tail whereby all processes were documented, and the research process clearly demonstrated, offers a sound research method and assures external validity, credibility and dependability. Coupled with this, researcher flexibility in data collection, testing and analysis ensures confirmability. The author endeavoured to meet all these specifications.

Identification of bias and attempt to reduce or eliminate it are imperative for confirmability. This type of research bias is unavoidable and it informs the research topic selection process, the methodology chosen, the sampling technique and the research tools used for analysis of the data. Mack (2010) concurs by stating that selection criteria biases are inevitable as the research is informed by the subjectivity of the researcher. Any further bias in the research process was minimised.

The researcher attempted to achieve this by reducing sampling bias where it was possible. This was done by an avoidance of pre-interview notifications and post interview follow ups, by standardising the data collection instruments and lastly, declaring observer bias in the field notes.

4.5. Conclusion

In summary, the research method employs a qualitative, explorative and deductive approach. This was achieved through a literature review process with key theme identification. These findings informed the research questions and interview guide used for the 13 semi-structured interviews with industry leaders. Recordings of the

interviews were done on Otter a.i, a voice to text transcription application and a coding software (Atlas T.i) was used for thematic analysis of the data. The interview process data was then organised into codes, code groups, sub-themes and themes, which were used to answer the research questions. The information gathered through the literature review and interview process was compiled to inform a comprehensive framework telemedicine for emerging markets.

Chapter 5: Results

5.1. Introduction

This chapter gives insight into the data that was collected through the interview process. Interesting findings into what respondents thought were key elements required to achieve the successful implementation of telemedicine practices in emerging markets, were explored. The interview process findings were grouped into categories, themes, code groups and codes (Figure 2-9 and Appendix 3). The categories were informed by the research literature and follow the sequence of the research questions in chapter 3. This will also be used to organise the chapter to follow. Within each category are themes derived from the category descriptor and code groups which are defined by aggregate codes allocated in the interviews. The chapter discusses the interview findings in this order, presented through the lens of the interviewees, which are referred to in accordance of their role in the telemedicine sector (Appendix 4). Each section is summarised with the researcher's interpretation.

5.2. Category: Business model and Strategy

The initiation of any major project should be preceded by a process of rigorous planning and strategizing, to ensure its success. The strategic plan should ideally detail the conceptual plan of the project; prescribe an implementation plan and process; recommend the staffing, resource and partnership complement to ensure its successful rollout; and lastly, recommend a post-implementation strategy to ensure sustainability of the project. The telemedicine industry is no exception. According to the interview findings, considerations for a successful telemedicine industry include a tailored business model considerate of the National Health Insurance (NHI) and strategic planning with process mapping that is cognisant of the local climate to mention but a few. All of these factors have the objective of assuring value-adding services are provided to ensure optimum utility to its clients. The first category will explore the interview findings around business planning and strategy and the value successful implementation will bring to its consumers.

5.2.1. Theme: Telemedicine and the Utility of Telemedicine in emerging markets (South Africa as a case study)

In order to understand the importance of telemedicine and perhaps to further substantiate the selection of the research topic, the first approach would require the reader to understand the state of the South Africa health industry. An understanding of this will offer insight into the importance of axillary health services such as telemedicine, to augment the existing health services in order to have a far wider reach in health service provision. To this regard, the understanding of what telemedicine is and how it brings utility to the South African consumer will be explored first.

5.2.1.1. Understanding of telemedicine

Telemedicine is the provision of healthcare services in the out of hospital setting. The EMR specialist defines it as: "essentially the ability to provide a service remotely, be it something as sophisticated as an operation or something as simple as a consultation."(2:1). The telemedicine consultation platform entrepreneur added that there is simplicity to the practice which is often mis-understood. He added in saying that

> for a lot of people telemedicine is this sort of like highly abstract thing. Maybe people see somebody operating on somebody via a robot from somewhere else in terms of telemedicine, but honestly telemedicine can be as simple as a phone call to a doctor. (3:62).

The telemedicine healthcare provider (9:1) defined the nature of services that could be provided through telemedicine channels. These included consultations for diagnostic purposes and referrals to other specialists for further treatment. The ethics professional (15:1) added that it could also be used for provider to provider communications and for educational purposes. This is evidence that the telemedicine practice has wide range of uses if implemented efficiently, however, one further needs to understand what is required for this process to take effect.

The Data privacy specialist (8:1) states that there are numerous platforms on which the healthcare provider may interact with the consumer inclusive of online platforms and phone calls to facilitate the consultation. The above would however, require

connectivity to internet connectivity to operate (Telemedicine (niche) Entrepreneur, 11:1). The Mobile app entrepreneur (10.1) added that the use of telecommunications or the internet is mandatory for medical administrations of this nature. All conditions being ideal, the success of telemedicine is described by the cloud service and data storage entrepreneur, as the instance where remote consultations

> still remain and keep that engagement going in a way that you feel almost sitting in front of a doctor, because you want to have that fuzzy warm feeling when you go to your doctor. If you can still create that fuzzy warm feeling, then you have achieved. (13.30).

5.2.1.2. Utility of Telemedicine in South Africa

South Africa is twenty-five years post democracy. As the literature review has illustrated, its former years were rigged by the regime and policies of the apartheid era which enforced a national divide based on race or colour. People of colour found themselves on the discriminatory end of the spectrum, which defined their social class, their socio-economic success, right down to the nature of the health services they received. The aftermath of this era is still evident in today's society.

Inequity is evident in a number of areas in the sector as proposed by two of the thirteen interviewees which described a phenomenon called the "data or digital divide". This refers to the inequity in access to smartphones and affordable data coverage. The ethics specialist (15:13) reported that the digital divide issue is founded in social class prejudice and defines the nature and quality of the phone that one uses, whilst the telemedicine healthcare (9:29) provider referred to it as the inequity in access to data due to its expense. These are factors which are considered prohibitors in the access to services such as telemedicine and are perhaps a consequence of the South African political past. Irrespective of which the industry specialist (6:4) said due to the massive proliferation of video calls and conferencing, the South African digital economy is much more advanced than it was ten years ago, and that the market is ready for innovative tools like telemedicine. Overall, the issues of digital and data divide are considerations to be made in the business modelling and strategy category of this chapter.

Telemedicine has been described as a tool that can be used to rectify some of the

social injustices, particularly in healthcare, wrought by the apartheid regime. The tech billing specialist (5.2) sees opportunity for rural communities of South Africa, as they stand chance to benefit the most from telemedicine practices. The EMR specialist proposed that it "would basically equalise space in that an individual sitting in rural Eastern Cape could pretty much have access to the same type of service that somebody would have at a tertiary hospital in Johannesburg" (2:3). The Data collection entrepreneur added that it "means the standard of living of people increases by virtue of that (telemedicine) and therefore you are improving people's utility and as a society in general" (7:23). The Health tech IT consultant (12:15) further commented that it provides flexibility to the consumer as they do not have to travel for consults, therefore spend less time off work which inevitably improves economic productivity. Evidently, there is also macro-economic benefit in the use of telemedicine.

In general telemedicine brings utility to the South African consumers by offering the convenience of the ease of healthcare access for those living in remote regions (9:3), for educational purposes by providing support, mentorship and coaching for healthcare providers (15:5), by ensuring less time spent waiting in queues and seeking healthcare (12:13) and by saving on travel and logistic costs (14:31). As a result, thereof, the telemedicine consultation platform entrepreneur commented that

> For Africa, for our context, telemedicine is something that will really positively impact the lives Hundreds of thousands of people. And so, it is something that we really, really need to pay attention to considering. (3:64).

5.2.2. Theme: Business modelling

Business modelling is the process in which the business is shaped and its future carved. Great importance is placed on the business modelling process as it is the step that can either make or break the business. The process requires detailed analysis of the consumer needs, the environment of business and the requirements for business growth, survival and sustainability within that environment. Similarly, with big ventures such as in the telemedicine industry, a well thought through and executed business plan can reap great rewards.

The fourth industrial revolution is a force taking the world by storm. It comes with revolutionary customs that are set to change the working world of work. It is a new

era that requires a lens to guide and usher in the changes (Ethics Specialist, 15:38). Though some may be sceptical of the changes it proposes or feel threatened by its imminence (Telemedicine consultation platform entrepreneur, 3:36), one would still have to plan or plan to fail. There are a few areas of focus proposed by the interviewees, suggesting which elements should be discussed under business modelling. These will be discussed.

To start, when implementing a new project or business, one needs to access the environment in which the business would be operational. Macro and micro-economic factors would have to be considered. The data collection entrepreneur commented that because pricing is everything "you have to take into account the socio-economic dynamics of the country to determine your business model" (7:11). This will define your target market and determine how it is that you price your product. To the first element, the data privacy specialist commented that " outline who the market is, so are we targeting, either your upper class, either really wealthy, through your communication, or are we targeting your lower class, like bottom of the pyramid" (8:7) You do not want to price the intended consumer out the market. To the later element, "it has to be low margin, low priced to reach a significant scale and have maximum impact." (Data collection entrepreneur, 7:13).

Another element to consider is that the telemedicine service is a two-sided platform with healthcare providers on the one end and the patient on the other (Data collection entrepreneur, 7:39; Health tech IT consultant, 14:26). To ensure adoption and success, both parties need be catered to. In order to gain scale, both sides of the platform would need to be growing in numbers under proven efficiency conditions. Scale is something to be kept in mind but obviously the bigger you scale, the more you would have to consider on either side of the platform (data privacy specialist, 8:52).

As discussed in the literature review findings, South Africa’s healthcare system is polarized into private and public sector with the former being privately funded by medical aids or the user and the latter being state funded. At the time the interviews were conducted, the NHI was recently launched in South Africa, hence made for national news and topical debates. This may account as to why eight out of thirteen of the respondents mentioned the NHI in the interviews. The telemedicine consultation entrepreneur said, "I think South Africa will find itself needing

telemedicine, especially as you move towards NHI" (3:2). However, the billing specialist felt that the conversations pertaining to the NHI were fragmented and with no cohesion and consensus around its approach. In support of this, the EMR specialist stressed concerns about a readiness for the NHI, and concerns around ensuring that South Africa has a model that works and that takes care of the basics (2:17). The telemedicine consultation entrepreneur added that in order to resolve these matters, the government would have to spearhead that initiative (3:39). The NHI was therefore flagged as one of the considerations the business modelling process for telemedicine would have to address in order to ensure that the project is successful in the health era to come.

5.2.3. Theme: Strategy

Every business model should ideally be suited with an execution strategy or strategic implementation plan. Five out of the thirteen respondents commented on strategic planning at least once. The code groups created for this theme included process mapping, phased roll out, personalisation of services and as well as pricing models.

In addressing the issue of process mapping and a phased-roll out strategy, the data privacy specialist commented by saying:

> maybe that's the phase thing... so we start with Sandton users, and as you launch into different areas, you could really focus on how to tailor it and develop a tool for the different areas. (8:13).

This proposition implies that a smaller, more controlled rollout is preferred not only from a resource management perspective, but also from a managerial aspect. It also ensures that a tailored product that is suitable for the local market is designed, assuring that customer-centricity practices are upheld. The health tech pharmacy entrepreneur added that the objective of such a strategy would be to ensure that one is handling smaller sample sizes and studying the segment from all angles to ensure that the solution best meets the needs of the target group, furthermore, to enable customisation of the product (12:11).

Addressing the implementation of telemedicine through a phased-roll out in small sections, enables more accurate resource management practices. Billing models that interact directly with the service provider can be applied, with pricing models

applicable to the select region employed, further ensuring customisation of the components of the telemedicine service provided. The telemedicine consultation platform entrepreneur (3:7) proposed that government would have to liaise with each region's health provider directly for suitable billing practices, especially if the NHI were to be introduced.

In summary, telemedicine has been described to be a value-adding service, providing various forms of utility to the end user. Business modelling processes would need to incorporate the NHI bill, as well as take special considerations for the local health market. Similarly, the strategic planning processes should factor in pricing and scaling prospects as items to explore to ensure sustainability and success of implementation.

5.3. Category: Collaboration in telemedicine

The task of implementing such a massive project such as telemedicine requires multiple stakeholders to be involved. Collaboration requires drawing expertise and skills from multiple sectors and across industries to ensure successful implementation and efficient operations of the project. Collaborative stakeholders include the public sector, which is the government, be it through the provision of healthcare institutions or the prescription of regulatory guidelines; private companies offering different products and services; academic institutions for research purposes; international bodies to support any of the above service offerings; and lastly the healthcare and service users and providers. Collaboration is about getting people with different perspectives on the same page (Health tech IT consultant, 14:29), the building of relationships, and also to get a good understanding of other stakeholders so that the best solution is designed for the consumer (Ethics specialist, 15:24). It is a complex system which presents complexities in its management. To start, system complexity and stakeholder management will be explored, followed by unpacking of the roles assumed by the different stakeholders, closing off with the description of the public-private-partnership concept.

5.3.1. Theme: Complex systems

There are numerous stakeholders from various industries all with different expertise and skills. The collaboration of these stakeholders makes for a complex system. The

telemedicine industry specialist commented that:

> it's a complex system...different entities have solved different critical functions in healthcare, it is probably the most complex system. It's very unlikely you're going to have a single entity that's going to build its own care... Network and clinic network and essentially, building all the steps required to roll a telemedicine solution at national scale, it's almost impossible. I would say partnerships are essential to making this work because there's multiple units that are interactive. (6:24).

The data collection entrepreneur concurred by adding " it really is a complex system, it's a complex solution that has many forms and factors..." (7:65). She concluded in saying that a telemedicine platform cannot be built without networks and collaborations being formed (7:66).

5.3.2. Theme: Government

The government has a massive role to play in the formation of collaborative networks, primarily because much of the infrastructure and initiatives to initiate a project of this magnitude originate from the public sector. The health tech pharmacy entrepreneur indicated that " I think the government is ready, and government can actually run 80 % of the implementation. They have got the resources" (12:16). To add keeping the NHI in mind government collaboration is paramount (Data privacy specialist, 8:14).

The government plays a role in provision of regulatory bodies and provision of operational guidelines. At current, the government has established a health regulatory body called the Health Professional Council of South Africa (HPCSA), This regulates operations in the health sector, is used for HCP registrations and vetting, and furthermore deals with patient complaints (Africa, 2019). The scope of practice of this body in the telemedicine space, is however limited. With reference to her experience using telemedicine services, the telemedicine healthcare provider mentioned that she received guidelines issued by the existing regulatory body, however felt that more could have been done to support such users (9:20). She concluded this in saying "I think it if there was an independent telemedicine board it would be more credible for me, to know that there are a group of people who are practising this full time" (9:27). Overall, four of the thirteen respondents commented that a new independent telemedicine or regulatory board would be required. This is

perhaps the space in which the government can function in these collaborative spaces.

Government inefficiencies were considered a hinderance in collaborating with government. These inefficiencies lay in policy drafting, limited government expertise, a dominant skewed political agenda and in the issuing of government grants. The Telemedicine (niche) Entrepreneur referred to policy drafting inefficiencies as inefficiencies in 'agenda practices'. He responded that

> There are no experts that have been on the ground writing, information informing policy based on what shouldn't happened in my environment. They just went and took a document from the United Nations, changed every word that says African and wrote South Africa and changed a couple of words. That shows lack of expertise, lack of understanding. How do we then influence policy if you don't have the right grounding for policy to start with?. (11:21).

The telemedicine consultation platform entrepreneur concurred around governments limited scope of expertise, mainly pertaining to technological knowledge. He commented that "I don't think that a body of knowledge around the latest tech will not make any sense to the government, so the onus is actually on government to actually find people who know what they're talking about when it comes to technology" (3:41). It is therefore imperative for government to take the initiative and start designing their own telemedicine policies that are local centric. This will not only transfer skills and capabilities but also render knowledge that will assist in the management of its affairs. These incapability's indicate that these are areas that the government would need to form collaborative partnerships in, to ensure a full complement of skills that will assure that the implementation of telemedicine is a success.

With reference to the dominant skewed political agenda and the issuing of grants, the interview with the tech billing specialist had a recurrent narrative around concerns of the platform being hijacked by political agendas. In alluding to government involvement, he commented that " if it just becomes another voting political rhetoric storey, then we have lost the game" (5:14). The telemedicine (niche) entrepreneur implied that the governments grant issuing practices are biased and perhaps corrupt. These challenges would need to be addressed if government is to form collaborative partnerships with other stakeholders.

5.3.3. Theme: The Private Sector: Private and Academic institutions

The private sector provides the required expertise, skills, workmanship and manpower to get the project off the ground, furthermore, ensures the integration and seamless function of operations. Lastly, the private sector also generally seems to set the pace of digital disruption and innovation utility. The telemedicine industry specialist contributed that

> the private sector, and the private healthcare businesses will shoot ahead on their own and then, so will the NGOs. And then government will catch up in terms of opening up the legislation framework. (6:22).

Key stakeholders required in the telemedicine industry include (Appendix 5) : service providers such as doctors and nurses (2:38), health insurance companies such as medical aids (6:13), pharmaceutical and dispensing companies (3;26), medical institution or society or council (7:38), entrepreneurs (11:22), non-profit organisations (7:40), funders and investors (12:35), members of the public (15:42), telecommunications company (12:36), technology companies(13:18), research companies such as IBM (11: 9), universities (7:44), lawyers and people concerned about legal matters (10:17), independent regulatory and ethics boards, multinationals and billing services..."Have as many stakeholders as possible...I guess what I can say that, as many people as possible should be involved" (Health tech IT consultant ,14:20).

Academic Institutions are the breeding ground for fresh, new innovative solutions. They also house limited infrastructure and resources that could be used to propel the success of telemedicine stakeholders. In support of this the telemedicine (niche) entrepreneur commented that his company had partnered up with an academic institution, which benefited his company in numerous ways including creating an ease to market and access to limited or expensive resources. The data collection specialist added that "

> You could also explore working with Universities as well, because universities are a hotbed of new ideas. So, keeping a tab from a biotech, from a healthcare set, what's happening and what are people coming up with, will keep you at the forefront of innovation and technology so that is quite important. (7:44).

5.3.4. Theme: Private public partnerships (PPP)

The EMR specialist commented that in order to experience integration and the success of telemedicine, " a strong public private model needs to be formulated" (2:18) and how that can be achieved is through managing those networks (2:22). Management of the networks includes being intentional about the nature of collaborative partnerships that are formed, furthermore ensuring that there are shared objectives (ethics specialist, 15:28), amongst all stakeholders involved. The tech billing specialist responded that, " I will have a lot of faith if we can get the right people involved in that conversation. Getting the right people involved in the conversation and allowing the right voices to come to the front" (5:18). It is also about getting trusted brands involved, ones that are reputable in task execution and in quality work, as affirmed by the cloud service and data storage entrepreneur when saying, "I mean you probably need to have trusted names and trusted brands to back this up" (13:16). This was further backed by the telemedicine industry specialist when saying " you basically have to partner up with established providers of care in South Africa who have scaled in order to in order to achieve something that's going to attract mainstream" (6:11).

Six of the thirteen participants reported that mutual benefits are important in collaborative networks. This entails that all those involved in the partnership should be fairly compensated from the interaction and their input in the partnership. The EMR specialist commented

> So obviously, if we are looking at this partnership, and collaboration there has to be a very specific business model that is equitable to all parties. When I say business model is, you know, there has to be something in it for some private organisation, whether it's a one man IP shop, or you know, large technology company...Everybody wants to be able to add services and support but obviously you need to do it with an equitable return as well. (2:24).

The same sentiments were shared with government (health tech pharm entrepreneur, 12:8) and for the non-profit organisations (data collection entrepreneur, 7:25) compensation. Fair compensation increases the propensity of success in implementation.

There are a number of pros and cons listed by the various stakeholders that may

originate from the collaborative partnership space.

The pros include access to markets one may not have originally had access to (telemedicine (niche) entrepreneur, 11:14), the speed of market access (mobile app entrepreneur,10:10) and cost saving (health tech pharmacy entrepreneur, 12:18).

The cons include IP theft (EMR specialist, 13:22), information leaks (mobile app entrepreneur, 10:12), undue delays wasting time, raising implementation costs and tainting relations. The data collection entrepreneur elaborated on the latter saying:

> It is quite important because it can completely go wrong, it could increase the cost, increase the time because nobody can come to an agreement, you could find yourself in court having it out with your co-collaborators because you didn't define carefully who owns what IP and all of those things. So, if you didn't define the rules of engagement that could easily start falling away causing tension, so the relationship can really start falling apart. (7:32).

Management of these collaborative partnerships is therefore imperative to ensure that the intended objectives and outcomes are met. It is about relationship building, understanding the collaborators so that the best solutions are built (ethics specialist, 15:24). The health tech IT consultant added that, " It is not going to be technical thing is going to be very much as a social exercise" (14:29) to get people with different perspectives to have shared objectives and a shared vision, furthermore, to manage the complexities of the system. The success of telemedicine, however, relies on the formation of such networks.

In summary, although collaborative networks are complex, they are important for the establishment of successful telemedicine practices. Collaborative stakeholders include the public sector being government and the private sector, which are numerous stakeholders providing services along the value chain. Of importance is the role academic institutions play in collaborative networks. The rules of engagement are defined in public-private-partnership spaces. Although widely recommended by all respondents, there are challenges and cons that would be addressed with partnership formations.

5.4. Category: Ethics and Regulations

Ethics and regulations play an integral part in ensuring that post-implementation processes are proficient and sustainable. They ensure that the intended objectives of quality telemedicine service provisions are catered to, whilst enabling an adherence to the existing healthcare fraternity patient privacy traditions. The practice of ethical telemedicine and the strict regulation of service providers and products places the patient or customer at the centre of the centre of the business offering. Patient centred practices secure enterprises a going concern and promote sustainable business operations. This section will discuss the ethical and regulatory considerations as well as the recommended approach to ethical and regulatory implementations.

5.4.1. Theme: Ethics

Ethical considerations that need to be catered to include the collection and management of informed consent, when and how data is collected and as well as the population groups from which data can be collected, with children being the group of most concern. A few other factors raised were around resource management protocols. All respondents gave input on an approach to ethics and regulations, however most of the detailed responses were offered by the ethics and data privacy and protection specialist and are detailed below.

Resource management ethical considerations were proposed by the telemedicine (niche entrepreneur), who reported that, "ethical considerations would be upskilling people. So essentially having as many stakeholders as possible so people can gain new skills and capabilities" (11:23). Owing to the local demographics and the inequalities in socio-economic status illustrated above, the government must ensure that there is an added benefit over and above the telemedical scope of practice and offerings. It must ensure that it improves the overall economic wellbeing of the nation by upskilling and improving its peoples capabilities, which inevitably results in economic viability.

Other ethical considerations involve the collection and storage of informed consent. Obtaining informed consent entails the informing and counselling of a patient prior to the collection of their data or prior to an any procedures being performed. The patient

must be aware that they are sharing their data, how the data will be used, how the data would be stored, if any third parties are subject to use of the data and lastly how long that data will be kept. The telemedicine industry specialist commented

> The patient must be educated in terms of what we're doing and what we what we can do and what we can't do. And then to fully understand what giving content means. You know in the past it really has been kind of just sign this piece of paper, because he's just kind of kicking a box... more time needs to be spent with the patient in terms of giving the treatment. (2:36).

In saying, " True consent is actually when you are aware that we are collecting at the very least, this information in the background" (8:29), the data privacy specialist was implying that ethical data collection processes is inclusive of the information obtained even from axillary devices such as the IOT. The patient should be aware of such processes at all times.

Collection of data from minors and children is a sensitive topic and should be addressed with the most stringent of processes possible. The data protection specialist commented "it's all about how we ensure that we are collecting information, lawfully and that we are collecting the minimum amount that we require to protect children." (8:31). Involvement of guardians and caregivers and also how they share information around minors, should be regulated. The data protection specialist concluded in saying that issues like the age of consent should be standardized between the law makers and the health fraternity (8:30).

Lastly, the duration that data is stored is an important ethical consideration. The data privacy specialist said "once that business purpose has been fulfilled, we should essentially destroy that personal data. So, you can't keep data forever, and keep it forever if you don't need it anymore. Until you don't need it, you can use but at the point that you don't need it, you need to destroy it in the system" (8:33). Efficient management of data also prevents data leaks and breaches in data protection. Essentially, ethical considerations are multifaceted and include considerations around the ethical approach to upskilling of workmanship, to the processes of regulating true informed consent and data collection processes, particularly with children, and the duration the data is stored.

5.4.2. Theme: Regulations

Regulatory considerations include the management of the collected data; security concerns around protection of the data; ensuring that the technology used meets acceptable standards to assure the quality of telemedicine services is provided for in a secure manner; and lastly, the vetting of data handlers. This would need to be facilitated through policies and procedures tailored for this sector and enforceable by a governing body established to manage such affairs.

With respect to management of collected data, the Industry specialist reported that one would have to ask the following questions: " how is the data being used? What is it being used for? How long are we keeping that data?" (2:31). The management of stored data includes management of the security concerns and mitigation of the risk of data in a central repository. One would have to consider who manages the data, where the data is stored and how it is shared. The telemedicine consultation entrepreneur commented

> it would mean that potentially all the data will be sitting in one place, which is a security risk. You know, all the data about the patient if there is a central repository, you know, held by the NHI somewhere. That all the data is stored in, that forms a security risk. It means that should you decide to use cloud services that are hosted by a company that's based in another country that proposes a risk when you don't pay your bills and they switch off your subscription. (3:31).

To add, regulations around keeping the data in national territories to mitigate risk may be warranted. The EMR specialist added that there is a need for "data being resident within the republics borders and that's absolutely vital and ensuring that the necessary standards for securing data and storing data are met as a country out or in our financial services" (2:41).

Data protection entails security of the patient's personal information. This can be ensured through protective Infrastructure or through regulatory guidelines and policies. Protective infrastructure includes encryption of data (telemedicine consultation platform entrepreneur, 3: 48), block chain (telemedicine (niche) entrepreneur, 11:25) and firewalls to protect against hacking (mobile app entrepreneur, 10:19). Regulatory practices and bodies to ensure this and similar

regulations are enforced must be also considered. Seven of the thirteen respondents referred to POPIA/POPI as the preferred regulatory guidelines to manage such matters. The mobile app entrepreneur reported that "regulation is definitely well, I wouldn't say the absolute solution, but it would definitely help to protect data" (10:15). A regulatory board may be required to ensure that these laws and regulations are enforceable. Four of the thirteen respondent recommended the formation of a formal independent telemedicine regulatory board. The industry specialist commented

> I think there is sufficient protection in POPIA and from within SA-Med but as this grows, I would imagine that, you know, there would have to be a very specific telemedicine authority. Because I can certainly see this thing growing quickly, If it is done correctly, and they certainly will be gaps in compliance, certainly will be gaps in a whole lot of other areas and it would require a, a body to look after the actual specific interest of this...the telemedicine space. (2:39).

Ensuring and assuring the protection of patient data transfers trust to the consumer. Consumer trust of service providers is imperative. The ethics specialist reported that "if you storing the information, you don't want them to have access to that and use it inappropriately? So, the other thing is for people to trust the tool. They need to feel comfortable that you have ticked the boxes of taking care of them" (15:30). One such way to provide secure digital tools is through strict regulatory practices for technological tools and devices. The EMR specialist commented

> We need to understand, you know, what testing these devices have undergone? What are the requirements for calibration? So, we need registers for all these devices. And these need to be obviously also stored in repositories that are accessible by the organisations that are responsible for them. (2:44).

Lastly, practices around the vetting and assessment of providers and those handling client data, are crucial. Four of the thirteen respondents reported this an important element to consider. The data collection specialist added

> there is a lot of fraud happening even in the healthcare space, for example, dubious healthcare professionals and all of these things, so how do we ensure we have the right safeguards in these telemedicine solutions so that we

> address the issue of security that the patient is at all times protected and regulations speaks to that. (7:47).

An approach to this can perhaps be added as a recommendation by the POPI act and overseen by the independent telemedicine regulatory board.

In Summary, ethical considerations include the collection and management of informed consent, understanding when and how data will be collected and as well defining the population groups from which data can be collected, with children being the group of most concern. Regulatory considerations include the management of the collected data, protection of personal data, technological tool standardised assessments and checks, and lastly the vetting of data handlers.

5.5. Category: Infrastructure

Without the necessary infrastructure the implementation of telemedicine industry would not be possible. Infrastructure is the enabling factor that facilitates the engagement of patient and HCP. There are two forms of infrastructure reported being consultative and administrative. Below are the findings of the interview process:

5.5.1. Theme: Consultative Infrastructure

Consultative infrastructure are the tools that provide the platform of engagement between the patient and the HCP. These are tools that collect, store and allow for the sharing of patient data. Consultative infrastructure includes communication platforms such as smart phones or other connection devices and USSD service; connectivity or telecommunication networks; and data storage services such as cloud services.

5.5.1.1. Communication platforms

Seven of the thirteen respondents commented on the usefulness of smartphones in telemedicine. The data collection entrepreneur commented

> in Africa where we have a significant smartphone penetration, already you have to start thinking how you make sure you where the people you servicing are. Essentially, mobile is also quite a big discussion around, how are you going to implement this type of solution. (7:9).

Smartphones are evidently a facilitating tool for telemedicine practices, particularly considering there is a wide smartphone penetration. The issue is what happens when one does not have access to a smart device? How does the system still assure telemedicine access to these patients? The telemedicine consultation platform entrepreneur expressed the same concerns in saying " If you don't have a smartphone what are our options? So, the system needs to be inclusive and facilitate the inclusion of each type of patient" (3:61).

Two of the thirteen respondents did not see this as a challenge and proposed USSD usage as an alternative engagement tool. The health tech pharmacy entrepreneur responded " You can be able to interact with the system using USSD. So, they don't need data" (12:31). The data privacy specialist added that another solution "could be setting up toll free numbers that people could call, for example, to get advice" (8:48). This will be a free service that can be utilised by to those experiencing difficulty in access due to data costs or lack of smartphones. Lastly, Other communication platforms that facilitate telemedicine include televisions, monitors or screens (ethics specialist, 15:43).

5.5.1.2. Telecommunications and Connectivity

Collection of data is reliant on connectivity that is reliable and has wide coverage. Its primary role is to provide a network platform that allows for HCP-patient engagement. Ten of the thirteen respondents commented on connectivity. The data collection entrepreneur commented

> you have to concerned about the infrastructure and when I talk about infrastructure I'm particularly talking about "network" infrastructure. So, you can't talk about telemedicine and not talk about the network infrastructure. (7:4).

To add, the telemedicine (niche) entrepreneur commented " you need to speak about telecommunications. Because that really creates the backbone with internet access" (11:2). It also spans beyond the internet to include band worth and data access (ethics specialist, 15:44). The telemedicine consultation platform entrepreneur supported this when he commented

> The system has to be able to function on things like a three G-connection,

> because it's not everywhere that you will have wired internet. So, the connection needs to be stable for the transmission of video and audio across the internet stability is probably more important than anything else, to allow connection. (3:49).

It is evidence that network infrastructure provision comes in various forms and that it plays an integral part of the telemedicine service provision, but its establishment is only effective if it is reliable and has a wide reach in function. Three respondents reported importance of real-time solutions requiring real-time responses. The EMR specialist added that " Healthcare is such this one needs to have uptime at least ninety nine percent" (2:8). The telemedicine consultation platform entrepreneur adding

> So, it needs to be responsive, it needs to happen now. This, this idea of kind of what I call where, you know, you say something, and then it takes five seconds before it reaches the person that you just spoke to. That kind of thing is not, that's not how you how you ensure that the system is utilised. (3:47).

Efficiencies in the function of such systems, assist in making telemedicine a success and are elements to be considered.

5.5.1.3. Cloud Services

Once HCP-patient communication and engagement has occurred, one needs to assure that the collected information is safely secured and stored to enable a paper trail. Six of the respondents proposed that this is done through central repositories or cloud systems. The cloud storage and data storage entrepreneur commented " I think in terms of infrastructure it is not really a lot. I think that literally to have this platform built on the cloud" (13:25).

Cloud services provide a number of benefits, including ensuring an integrated and efficient service is provided. It is the foundation on which axillary services and products can be integrated to complete the service provided in telemedicine. It enables an ease of data sharing and communication. Lastly, as discussed above, data protection considerations should be coupled with cloud services.

5.5.2. Theme: Administrative Infrastructure

5.5.2.1. CRP and ERP systems

Administrative Infrastructure is the type of infrastructure that integrates the system service providers and allows for efficient and seamless system operations. There are numerous systems to be considered for integration into the system. The telemedicine consultation platform entrepreneur reported that these include queue management and booking systems (3:55), stock management systems (3:56), and the data collection entrepreneur added financial management and billing systems (7:59). There are pre-existing software systems that provide integrated services to firms to assist in the management of their enterprises, but they perhaps would need to be tailored to suite the health industry. The health tech pharmacy entrepreneur commented

> You just need a good system and definitely a good CRM and ERP system. CRM is Customer Relations Management system and ERP is Enterprise Resource Planning systems...Those systems already exist they already developed so you just buy them and then customise how you want to customise it. (12:26).

The purpose of such systems would be to coordinate the service providers to enable a coherent and ordered system that provides an uninterrupted service with minimal human error.

5.5.2.2. Contracts and Service level agreements

A new sub-theme under administrative infrastructure was added. The data privacy specialist reported that contractual agreements and service level agreements need to be considered as part of administrative infrastructure (8:44, 8:45). With reference to contractual agreements the data privacy specialist commented that " I think it's ensuring that the contracts and agreements that you have in place with any kind of partners in the environment, are like quite specific in terms of what service level you require form them" (8:44). Essentially contracts help to set out operating guidelines and allocate responsibilities to the different stakeholders.

With reference to the HCP's being held responsible and accountable for timeous

engagements on the platform, the data privacy specialist commented that, " You might want to send them service level agreements where they have to respond to a specific query within an hour or twenty four hour..." (8:45). Together the contractual agreements and the service level agreements unify and complete the telemedicine platform to ensure it delivers a well-orchestrated service with each stakeholder responsible and accountable for their duty, irrespective of the number of stakeholders involved.

In summary, infrastructure includes consultative infrastructure which is used to collect, store and share patient data. This is enabled by communication platforms, telecommunications and connectivity and cloud services. Administrative infrastructure integrates the system service providers and allows for efficient and seamless system operations. This comprises of CRP and ERP systems, which must be tailored to suite the industry. Lastly, contractual agreements and service level agreements should be considered as they ensure that each stakeholder is responsible and accountable for the roles they play in the industry.

5.6. Category: Challenges:

There were numerous challenges of concerns raised by respondents. These varied from infrastructural obstacles, affordability concerns, demographic and political issues, policy restraints, security and regulatory concerns, weather damage, theft and vandalism, technology adoption or change management challenges. Most of the challenges described by the respondent's stem from an unease around whether or not any of the obligations (each covered under different categories discussed above) promised by the telemedicine platform would be adequately and efficiently executed. However, new themes were also raised, of particular interest is the weather damage, theft and vandalism issue and the technology adoption and change management concerns. This section will cover only the new themes.

5.6.1. Theme: Weather damage, Theft and Vandalism

Three respondents reported property theft and damage a concern, with two referring to weather damage as also another element to be considered as a challenge. The EMR specialist commented that concerns around theft and vandalism are unique to the African market and need be factored in as an element to manage in the

implementation of telemedicine. He said

> Big problems with the city have often is theft of infrastructure, vandalism, those kinds of things. So, those are unique problems that you know unique to us as, as a country, and certainly a European model won't, simply because they don't have those kinds of problems. If you are putting down infrastructure and a facility there, you know as a given that nobody would attempt to even steal it or damage it, you now that here is very different. (2:13).

The data collection entrepreneur supported this in saying " right now we are dealing with vandalism, theft that is actually putting our network infrastructure under siege" (7:61). Protection against these assaults is an element that need be incorporated into the design of a telemedicine industry for emerging markets.

Telemedicine pioneers also need to be cognisant of not only weather damage but also the effect weather has on the quality of service provision. With respect to the latter, the telemedicine consultation platform entrepreneur asked " When it rains, what happens? How does that affect the quality of the consultation? Is it acceptable?" (3:58). Such matters and interferences would need to be catered to in the design of the platform. Lastly, the mobile app entrepreneur commented that "actual security of the storage against normal weather elements, rain damage, fire..."(10:24) needs to be secured in the planning process.

5.6.2. Theme: Technology adoption

Five of the thirteen respondents mentioned technology adoption challenges as an element to be noted, with one implying that it not a concern at all but if perhaps had he had to stake a peg in the ground, would say the challenge is not at the individual level but at an industry level due to delivery issues. The data collection entrepreneur said " One of the key issues in the telemedicine has to address is, one: adoption. So how do we effectively get people to adopt a telemedicine solution? " (7:37). This concern was dispelled by the health tech IT consultant in saying " So I don't think adoption will be much of an issue. It would come down to be the system and not a person issue" (14:3).

The elderly population were considered most susceptible to technology adoption challenges. The health tech pharmacy entrepreneur added that " it's going to take a

lot of time for the elderly to adopt that (telemedicine)" (12:5). In reporting on telemedicine utility through her experiences as a HCP, the telemedicine healthcare provider said " I thought a lot of people actually found it quite useful, especially the younger population" (9:33), adding that the older population often resorted to face-to-face call outs (9:34). The cloud service and data storage entrepreneur alluded to the age discrepancy in adoption as the elderly's lack in technology literacy and a lack in technology operational know-how. She said

> So maybe for your older generation you might have as issue with people let's say older than fifty-five, maybe sixty and up, where you do have people that genuinely need more treatment, and probably don't have a lot of skill. It's a logical skill. I mean I have my dad he is seventy-two years old there is no way he can work a smartphone; he can't even send a WhatsApp. (13:7)

In proposing a solution to address these adoption issues particularly in the emerging market setting, the telemedicine consultation platform entrepreneur said

> I think that the business model will actually have to include someone to facilitate the telemedicine consultation. And by that, I mean that for the average South African, the idea of taking your phone, for example and speaking directly to a doctor whilst possible, will probably not the easiest way to get widespread adoption. Maybe going to a centre where there's a convenient healthcare worker who can initiate the consultation on your behalf. (3:15).

This proposition may not only address some of the demographic issues around health and infrastructural access as described above but may also alleviate distress experienced by the elderly, induced by tech illiteracy and a lack of technological knowledge.

The telemedicine consultation platform entrepreneur further suggested an alternative consideration when addressing adoption challenges. He said,

> I think that, you know, we'll have to, we'll have to innovate both from a technology standpoint, making tools easier to use, making data easier to capture using things like voice, using things like quick touch buttons that can expand to become clinical notes, so you make it easier for people to adopt

> the systems. (3:12)

Creating a great user experience through simplifying the customer engagement tools and touch points will definitely go a long way in improving adoption challenges. This too is an important consideration in the design of a telemedicine platform.

5.6.3. Theme: change management concerns

A major challenge described is around the perception of telemedicine and how its implementation will affect its user. Resistance due to fears of change and how it will be integrated into the working environment have been expressed by the respondents. As a result, change management is described as an element one needs to consider as a challenge to be addressed in the implementation process. The health tech IT consultant said, " I think it's going to require a lot of changing mentality, a lot of change in enterprises" (14:30). The health tech pharmacy entrepreneur added " how do you manage change management? If you don't have organised groups of efficient people...it will be very difficult" (12:6).

The concerns around an innovative and disruptive system such as telemedicine, is that of creating job insecurities. The telemedicine (niche) entrepreneur said

> The problem is around creating jobs, who's bringing in the changes. So, some of the policy makers in government are scared of changes programme. That will have an impact definitely on what you are doing. It hinders progress. (11:3).

To add, the EMR specialist reported that it may create a precarious work environment, furthermore, create new dynamics which may affect performance. He said

> And then there is you know... we often forget the healthcare practitioners. How are they going to be dealing with this new space that they are now working in? In my work we found that it's often difficult making the transition from paper to electronic system. Now, we're putting in high tech, and top of that, and an electronic system as well. So, you know, we need to cater for how this technology would affect the end users, specifically the health care practitioners. (2:34).

To conclude, the business modelling and strategic planning processes detailing the implementation of telemedicine in telemedicine would have to include the management of people's expectations, fears and concerns. The roll out process will need to factor in a change management plan so as to facilitate adoption of telemedicine tools and practices.

5.7. Conclusion:

The interview guide was founded on the literature review findings. The four constructs defined in the literature review, formed the bases of the interview questions. Thirteen respondents from different telemedicine sectors were interviewed. The interview process confirmed some of the literature findings, however, new constructs were also found. The insights were specific to the local South African context, giving local experiential views to support the literature, therefore adding depth to the research process. The next chapter will seek to juxtapose the findings of both the literature review and the research interviews, in order to gain a more holistic picture of the research journey.

Chapter 6: Discussion of Results

6.1. Introduction

In this chapter the findings of the literature review are discussed in conjunction with those of the interview process. The findings will attempt to answer the research questions detailed in chapter 3. The order of constructs and concepts discussed will follow the sequence in chapter 2, 3 and 5, with each element unpacked by contrasting literature against research findings. Any new findings will be discussed as per the relevant construct discussed. The research findings give insight into the antecedents required for the successful implementation of a telemedicine industry in emerging markets. These will contribute to building the comprehensive framework presented in chapter 7.

6.2. Discussion of results for Research Question 1

Research Question 1: What type of business modelling and strategy is required for the successful implementation of telemedicine in emerging markets?

Question 1 sought to decipher whether or not a new business model and a new strategic implementation plan tailored to suite the local market, was required for the successful implementation of a telemedicine industry. It sought to determine which elements would need to be included on the new business model and exactly how would this model should be rolled out.

6.2.1. Theme: Business Model

Peters et al. (2015) in the literature proposes a Complex Service Business Model (CompBizMod) which is a tool to analyse business models of complex service providers by assessing four features of business models. These features include: 1. Value proposition: value co-creation, transfer and capture 2. Business modelling structure 3. Information sharing 4. Dominant business model pattern reviews (Peters et al., 2015). Information sharing will be covered under collaboration. The other features will be discussed in detail.

6.2.1.1. Value proposition

This feature describes telemedicine utility, the type of value that will be created for stakeholders, furthermore, defines the methods employed by the business model to achieve this. Currell et al. (2003); Yeow & Goh (2015) define the value of telemedicine as its ability to provide remote healthcare services in order **to increase healthcare access, reduce costs and improve health facility efficiencies**. The interview process findings concur. They indicated that telemedicine brings utility to the South African consumers by offering convenience and an ease to healthcare access for those living in remote regions (telemedicine healthcare provider, 9:3), by ensuring less time spent waiting in queues and seeking healthcare (health tech pharmacy entrepreneur, 12:13) and by saving on travel and logistic costs (health tech IT consultant, 14:31). Additional insights reported its use for educational purposes by providing support, mentorship and coaching for healthcare providers (ethics specialist, 15:5). This was supported by World Health Organisation (2009) who advocate its use as an **educational and supportive tool for health providers** who also use it to advance health and wellbeing in their communities.

Telemedicine is used as a tool that could address some of the social injustices within healthcare, wrought by the apartheid regime. World Health Organisation (2009) described its ability to **assure equities in health access** particularly to the under-served communities. This could alleviate the distance decay challenge imposed by the geographical dispositions experienced by the poorer communities in South Africa and potentially other emerging markets. The EMR specialist elaborated by saying that it "would basically equalise space in that an individual sitting in rural Eastern Cape could pretty much have access to the same type of service that somebody would have at a tertiary hospital in Johannesburg" (2:3).

Lastly, the research findings describe how this may have an overall benefit to the overall **quality of life of individuals** and inevitably affect the nation as a whole. This was illustrated by the Data collection entrepreneur when he added that it "means the standard of living of people increases by virtue of that and therefore you are improving people's utility as a society in general" (7:23).

6.2.1.2. Business modelling structure

There are numerous elements to consider under business modelling structure, but

of most importance is the capital investments. Both the literature and the research findings propose a prudent governmental spend if the project is to be a success. Deloitte (2019) reported that health cost is spend projected to increase at an annual rate of 5.4 %, necessitating health capital efficiencies. The World Health Organisation (2009) added that capital cost should be kept at a minimum to ensure new project funding are made possible which in turn will add more value to the client. The research findings were in support of this by describing the need for a micro and macro-economic survey of a region as part of the implementation planning process, in attempts to manage start-up costs. Considerations also included minimizing costs to the consumer. The Data collection entrepreneur reported "you have to take into account the **socio-economic dynamics** of the country to determine your business model" (7:11). This will define your target market and determine how it is that you price your product. The data privacy specialist commented that one would need to" **outline who the market is**, so are we targeting, either your upper class, either really wealthy, through your communication, or are we targeting your lower class, like bottom of the pyramid" (8:7). She further added that once this is done the approach "has to be **low margin**, low priced to reach a significant scale and have maximum impact." (7:13). This suggests that telemedicine costs must be kept at a minimum for the benefit of patients, yet the **high volumes** ensure that operational costs are covered, and that revenue is optimised for the benefit to the service provider. All stakeholders gain. Business modelling pre-implementation planning is key as it ensures an economically viable telemedicine platform is actualized.

6.2.1.3. Information sharing

This section alludes the information shared amongst the various stakeholders that would participate in the collaborative efforts required for the implementation of telemedicine practices, details of which will be covered under collaboration.

6.2.1.4. Dominant business model pattern reviews

The medical field is described to have a value-adding type of business model (Hwang & Christensen, 2008), however the fusion of health with technological tools, as the case with telemedicine, requires that a new type of model be applied (Peters et al., 2015). In describing innovation and digital disruption in the literature review, Teece (2010) described how the more radical innovations become, the more likely they will need a new business model to fit. To add, (Hwang & Christensen, 2008) suggested

that due to its complexity and uniqueness, a disruptive innovation such as telemedicine would need to be coupled with a disruptive business model to reach its objectives. The interview findings concur. According to the interview findings, considerations for a successful telemedicine industry include a tailored business model that is mindful of the National Health Insurance (NHI), furthermore, consider a strategic planning process that is also tailored to suite the local climate.

The **NHI is a new construct** with eight out of thirteen of the respondents mentioning it in the interview process. There were mixed responses around this construct as it is still an unestablished concept in South Africa. The telemedicine consultation entrepreneur said, "I think South Africa will find itself needing telemedicine, especially as you move towards NHI" (3:2). However, the billing specialist felt that the conversations pertaining to the NHI were fragmented and with no cohesion and consensus around its approach. In support of this, the EMR specialist stressed concerns about a readiness for the NHI, and concerns around ensuring that South Africa has a model that works and that takes care of the basics (2:17). The telemedicine consultation entrepreneur added that in order to resolve these matters, the government would have to spearhead that initiative (3:39). The NHI was therefore flagged as a key consideration to incorporate into or to define a dominant business model applicable for telemedicine in South Africa. Doing so is expected to ensure that the project is successful in the new health era to come.

Lastly, another new construct raised in the interview findings included the acknowledgment of telemedicine as a **two-sided platform**, with healthcare providers on the one end and the patient on the other (Data collection entrepreneur, 7:39; Health tech IT consultant, 14:26). To ensure adoption, scaling and success, both parties would need be catered to. Management of these stakeholders is achieved through facilitating telemedicine practices, ensuring efficiency in utility and assuring that its pilot is prosperous to scale. A solid business and implementation plan as described above may certify this.

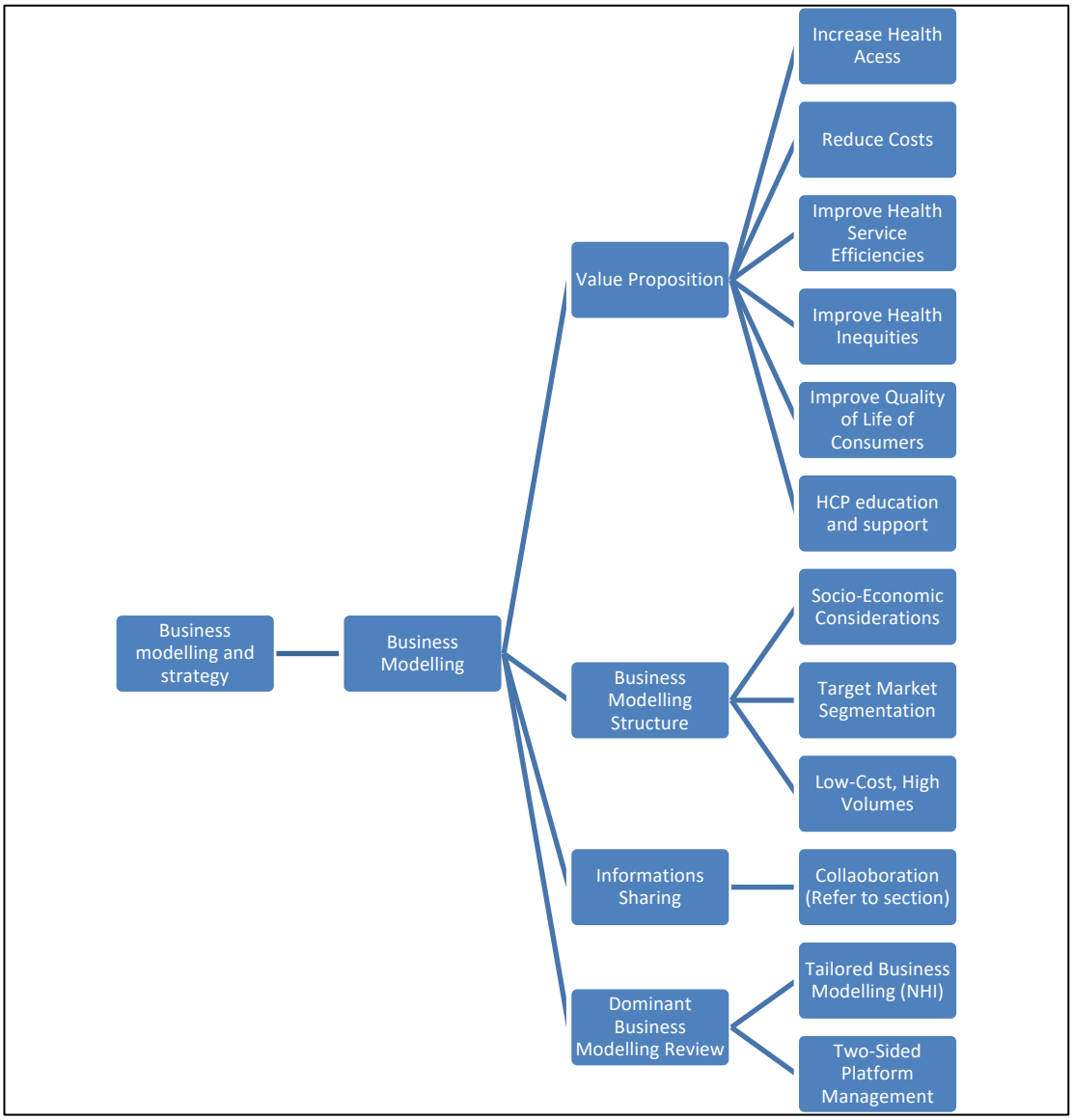

Figure 2 - Summary of Results for Research Question 1: Business Modelling Theme

6.2.2. Theme: Strategy

Once a customised business plan that is accommodative of the NHI, has been drafted a suitable implementation strategy needs to be designed to match. Although the literature review did not propose a particular type of strategy, it suggested that every business model should ideally be suited with an **execution strategy or strategic implementation plan** to ensure efficient and successful execution. It further proposed that lessons could be drawn from **Systems Thinking and Complex Leadership Theory** to construct a suitable strategic plan. Systems Thinking Theory unpacks the CAS to understand the micro and macro components of the system, making solution finding more probable. Complexity Leadership Theory prescribes an

approach to an orderly systems re-organisation and engagement that will actualise the innovative and adaptive change required for success, furthermore, it proposes the formation of **adaptive spaces** to actualise the emergent change.

The interview findings not only implied the importance of this construct as five out of the thirteen respondents commented on strategic planning at least once, but it also made propositions as to which strategic approach was most suitable for the South African telemedicine market. The suggestion was that once the socio-economic assessments have been conducted and the target markets have been identified with a suitable costing structure to match; and once the value propositions have been established, **a strategic roll-out of the product** should be actioned.

The health tech pharmacy entrepreneur suggested that the objective of such a strategy would be to ensure that one is handling smaller sample sizes and studying the segment from all angles to ensure that the solutions best meets the needs of the target group, furthermore to ensure localisation (**customisation)** of the product (12:11). Segmenting the market allows an ease in governance, furthermore a more controlled product implementation process. The telemedicine consultation platform entrepreneur commented that segmenting the target market ensures that government would have the ability to transact with each HCP with ease, which is of importance with the roll-out of the NHI. This enables the deployment of a suitable **pricing model** to match to each sample size, further adding value for the end user. A phased-out roll out can also assist in detecting failures and areas of improvement. Failure in one location does not translate into failure of the whole project.

Strategy as a 'plan of action' is used in the pursuit to achieve an objective (Casadesus-Masanell & Ricart, 2010), so if the objective is value-adding services to clients with a success implementation, perhaps this is advisable strategic plan.

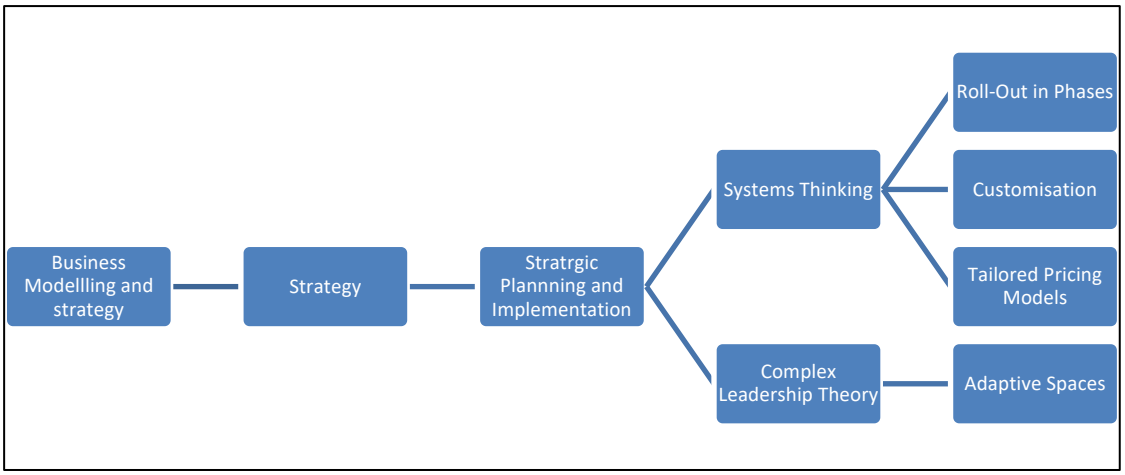

Figure 3 - Summary of Results for Research Question 1: Strategy Theme

In summary, the health industry is a large-scale system rigged with wicked problems. It is only through strategic foresight and planning coupled with a suitable business model can one make sense of the complexities in the sector and begin to solve them. The process of sieving through the complexities, finding solutions for complex problems and deciphering a suitable business plan matched with a strategic process, utilises the teachings from systems thinking and complexity leadership theory. As stated by Atun (2012) "systems thinking can help address the linear and reductionist approaches which prevail in health systems, by enabling testing of new ideas in social systems" (p. 5). This brings us to our next construct, collaboration.

6.3. Discussion of results for Research Question 2

Research Question 2: What role does collaboration play in the founding of a successful telemedicine industry in South Africa?

This question sought to define how collaboration can be used to ensure multiple stakeholder engagement in addressing the wicked problem of telemedicine implementation, in the emerging market setting. Furthermore, it sought to understand the nature of collaborative partnerships required and give insight on how knowledge sharing can ensure successful implementation is achieved. It aimed to establish which stakeholders did respondents considered key in this new venture creation. Lastly, the question also sought to understand the pros and cons of collaborative partnerships and the elements that influence collaborative partnership formation.

The first acknowledgement made by respondents and also discussed in the

literature, was that telemedicine industry is a multi-faceted and complex system. Waddock et al's. (2015) definition of large-scale systems and complex adaptive systems is inclusive of the telemedicine industry. Such systems are rigged with wicked problems. Webber (1986) offered a description on wicked problems, saying they are complex, uncertain, ambiguous and contrastive with no single approach to their management. Some of the wicked problem identified in the health sector include the lack of equitable access to health services, costs incurred in accessing health services and inefficiencies experienced in the process of acquiring health services.

In order to address some of the complexities and these wicked problems, there is a need for formation of collaborative networks to facilitate new product development and promote product performance (Najafi-Tavani et al., 2018). The data collection commented that a telemedicine platform cannot be built without networks and collaborations being formed (7:66). These collaborative networks enable new knowledge gathering and sharing, stimulating creativity and ultimately promoting innovation (Wang & Hu, 2017). The health tech IT consultant added that, " It is not going to be technical thing is going to be very much as a social exercise" (14:29) to get people with different perspectives to have shared objectives and a shared vision, furthermore, to manage the complexities of the system. However, the success of telemedicine relies on the formation of such networks. The World Health Organisation (2009), concurs in saying "Collaboration, participation, and capacity building are fundamental to the success and sustainability of telemedicine initiatives" (p. 24).

The respondents and the literature review reported that there are various types of collaborative partners needed for the success of this project. These included public-private partnerships and partnerships between academic institutions and the industry stakeholders.

6.3.1. Theme: Public partner: Government

Respondents reported that the **government is a major contributor** in the formation of collaborative networks, particularly because much of the infrastructure and resourcefulness to initiate a project of this magnitude originate from the public sector. Furthermore, because the NHI is a governmental initiative and is a major influencer in the telemedicine industry and its implementation processes. The health tech

pharmacy entrepreneur indicated that " I think the government is ready, and government can actually run 80 % of the implementation. They have got the resources" (12:16).

However, there is still room for improvement, especially within the infrastructure sphere. UNICEF (2017) urged that the "government should selectively invest in accelerated investment in infrastructure, especially for the poorest provinces where opportunity costs for accessing health services are high" (p. 16). The telemedicine consultation platform entrepreneur concurred around governments limited scope of expertise, mainly pertaining to technological knowledge. He commented that "I don't think that a body of knowledge around the latest tech will not make any sense to the government, so the onus is actually on government to actually find people who know what they're talking about when it comes to technology" (3:41). These are areas that the government would need to form collaborative partnerships to ensure a full complement of skills that will assure that the implementation of telemedicine is a success. This was supported by the literature which also stressed the importance of government collaboration with other stakeholders. Najafi-Tavani et al. (2018) reported that these parties, otherwise called 'collaborative innovation networks', may include suppliers, customers, academic institution, the government and competitors

6.3.2. Theme: Private partners

The **private sector provides the required expertise, skills, workmanship and manpower** to get the project off the ground, furthermore, ensures the integration and seamless function of operations. Each stakeholder plays a unique and different role. The research findings reported that key private partners stakeholders required in the telemedicine industry include (Appendix 5): service providers such as doctors and nurses (2:38), health insurance companies such as medical aids (6:13), pharmaceutical and dispensing companies (3;26), medical institution or society or council (7:38), entrepreneurs (11:22), non-profit organisations (7:40), funders and investors (12:35), members of the public (15:42), telecommunications company (12:36), technology companies(13:18), research companies such as IBM (11: 9), lawyers and people concerned about legal matters (10:17), independent regulatory and ethics boards, multinationals, billing services...to name but a few. To add, Dahan et al. (2010) suggested multi-national (MNE) and non-governmental organisation

(NGO) collaborations as a means of new value creation by delivering both social and economic value to developing countries.

Academic institutions such as universities (7:44) are also a vital partner in the collaborative channel as they provide a unique set of skills expertise to the collaborative network. They are required for innovation and development, and the formation of a collaborative space to allow the co-exitance and co-dependence of supportive axillary tools, IOT and Gadgets, which assist in the management of care receiver and giver values and challenges (World Health Organisation, 2009). A great example of this is illustrated by Chandwani, De and Dwivedi (2018) in describing how a UI collaborative innovative network between Sanjay Gandhi Post Graduate Institute for Medical Sciences, an academic hospital and the rural community, resulted in the successful and sustainable implementation of a tailored telemedicine initiative in rural India. The emerging economy states are unique and require pre-meditated and strategic collaborative efforts in order to ensure that the large-scale change is effectuated and successful.

6.3.3. Theme: Public-Private Partnerships

Private-public partnerships, international and cross-industry collaborations are necessary for the success of such new venture creations (Haus-Reve et al., 2019; Santoro et al., 2018). Collaboration is achieved through "combining knowledge, technologies, and other resources across organisational boundaries" (Davis & Eisenhardt, 2011, p. 160). This is done to facilitate the **sharing of knowledge** between two or more parties within the supply-chain network (Davis & Eisenhardt, 2011), done with the intent of achieving supply chain and R&D initiatives (Wang & Hu, 2017). Wang & Hu (2017) described a partial mediating role between collaborative innovation activities and innovation performance and concluded that the pairing of the two can offer firms a competitive advantage. Therefore, in this setting, the ultimate objective of the PPP is to ensure that collaborative innovation initiatives lead to successful project implementation processes, particularly in emerging markets.

The EMR specialist commented that in order to experience integration and the success of telemedicine, " a strong public private model needs to be formulated" (2:18) and how that can be achieved is through managing those networks (2:22).

Management of the networks includes being intentional about the nature of collaborative partnerships that are formed, furthermore ensuring that there are **shared objectives** (ethics specialist, 15:28), amongst all stakeholders involved. The tech billing specialist responded that, "I will have a lot of faith if we can get the right people involved in that conversation. Getting the right people involved in the conversation and allowing the right voices to come to the front" (5:18). It is also about getting **trusted brands** involved. However, to start one needs to understand the role of each stakeholder, so as to assure that each stakeholders skill and expertise adds value and is utilised appropriately if or when needed.

The literature review offered some interesting insights that the research findings did not illustrate. The literature added that there are factors to be considered with collaborative innovative networks and with the management of stakeholders. These factors either negatively or positively affect the formation of partnerships, hence stand chance to influence the outcomes of the collaborative effort. These constructs are important to understand as they define the modes of interaction that define the collaborative space. These include two forms of **collaborative modes**, which are defined as Formal and Informal collaborative modes. The **formal collaborative modes (FCMs)** are defined as formal arrangements between collaborating parties, often involving contractual and legal binding documentations; whist **informal collaborative modes (ICMs)** are non-contractual and loosely defined relations between the collaborative innovation networks (Santoro et al., 2018). ICMs are more flexible and are often preferred to FCMs. Haus-Reve et al. (2019). argued that collaborations can either originate from the **'Science, Technology and Innovation mode' (STI)** or from the **'Doing, Using and interacting mode' (DUI)**, furthermore, argued that either DUIs or STIs should be selected for collaboration, as concurrent use has not shown to yield additional benefits. STIs are often experienced with universities and research institutions and are found to be more explorative and radical in nature, as the objective is to add to the body of knowledge and develop new products; Whilst DUIs are found in the supply-chain networks, are exploitative and incremental in nature and are defined by experimental iterations and experience (Haus-Reve et al., 2019). The above interactive modes are important to understand as they define the scope and depth of the interactive relations involving various stakeholders across various sectors. They assist in deciphering which types of collaborative partnerships need to be formed, where, how and why.

The literature also describes **intrinsic factors** that influence interactions. These include **rational learning (RL) and absorptive capacity.** Rational learning is an antecedent to innovation and is considered a dynamic capability as it allows for interorganisational knowledge exchange and learning, therefore enabling for market knowledge acquisition and market insights which help improve the firms performance (Najafi-Tavani et al., 2018; Smirnova et al., 2018). Absorptive Capacity is an internal capability that is required for the capitalisation, processing and usage of acquired knowledge (Najafi-Tavani et al., 2018). The other intrinsic factor is **heterogeneous sources of knowledge (HSK)**, which defines the diversity of the knowledge and skills shared, adding variety and value to the collaborative partnership (Santoro et al., 2018).

Extrinsic factors are covered by the research findings and these include **shared value** amongst partners, where partners should be fairly compensated from the collaborative interaction and their input in the partnership. Six of the thirteen participants reported that **mutual benefits** are important in collaborative networks. Such benefits need not always be monetary but fair trade and transactions may occur amongst stakeholders, so long as there is value for all involved. The same sentiments were shared with government (health tech pharm entrepreneur, 12:8) and for the non-profit organisations (data collection entrepreneur, 7:25) compensation. Fair compensation increases the propensity of success in implementation.

There are a number of pros and cons listed by the various stakeholders that may originate from the collaborative partnership space. To start, **the cons** include increased vulnerability by knowledge leakage which can lead to **intellectual property theft** and imitations (Smirnova et al., 2018), supported also in the research findings by the mobile app entrepreneur who stressed the issue of information leaks (10:12), furthermore by the EMR specialist who reported IP theft as a risk (13:22). To add controversy, Wang & Hu (2017) proposed that knowledge has more value undisclosed among supply chain partners. Other cons raised included **raising overhead costs** due to partnership engagement activities (Shi et al., 2019). Shi et al. (2019) further added that multicultural collaborative partnerships as well as collaborations may result in **conflicting ideas** which may pose a challenge and invariably affect the efficiency and performance. This is supported by the data collection entrepreneur elaborated in saying:

> It is quite important because it can completely go wrong, it could increase the cost, increase the time because nobody can come to an agreement, you could find yourself in court having it out with your co-collaborators because you didn't define carefully who owns what IP and all of those things. So, if you didn't define the rules of engagement that could easily start falling away causing tension, so the relationship can really start falling apart. (7:32).

The pros include access to markets one may not have originally had access to (telemedicine (niche) entrepreneur, 11:14). Shi et al. (2019) concur when they report the benefits of the collaborative efforts vary from gaining access to new technological knowledge which may improve operational efficiencies and remedy existing challenges. Other benefits include an increase in the **speed of market access** (mobile app entrepreneur,10:10), of which Najafi-Tavani et al.(2018) consent in adding that it is a means to gain market knowledge offering market insights that provide new idea formation and stimulate innovative capability for the purpose of new product development. Lastly, collaboration is a means to save on costs whilst accessing the market (health tech pharmacy entrepreneur, 12:18), with Wang & Hu (2017) adding it as a means of **mitigating risk, reducing costs** and shortening time to market. World Health Organisation (2009) further added that collaboration allows for improvement of reliability and sustainability of programs. Ultimately, collaborations, if done right, offer firms a competitiveness advantage (Santoro et al., 2018).

In closing, collaboration is considered an important element in the founding of telemedicine practices. Success, however, is defined by numerous factors such as the nature of stakeholders involved, intrinsic and extrinsic factors that influence the stakeholder collaborative success and as well as the known pros and cons of such collaborative partnership formation. Stakeholder management is imperative to ensure that the most appropriate type of partnerships is formed at the right time and under the most appropriate of conditions, and to encourage collaborative innovation networks that promote innovation performance.

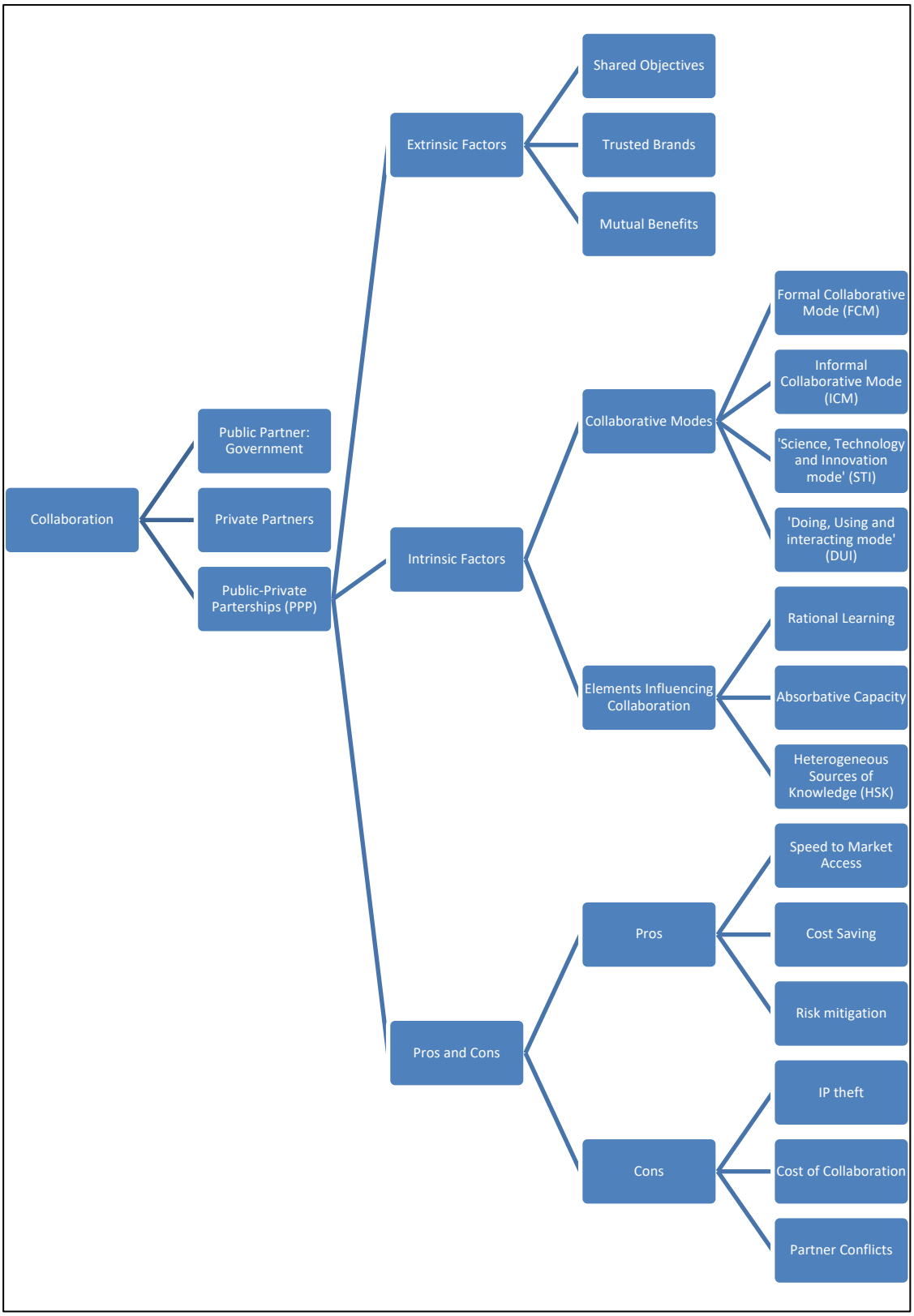

Figure 4 - Summary of Results for Research Question 2: Collaboration Theme

6.4. Discussion of results for Research Question 3

Research Question 3: What are the ethical and regulatory management considerations in the successful implementation of telemedicine in South Africa?

Research question 3, sought to illicit whether or not a new health discipline like the telemedicine industry, needs to adhere to the traditional health ethics and regulatory prescriptions, or if new ethics and regulatory considerations need to be explored.

Patient data protection is a human right (Seddon & Currie, 2013), furthermore health data is the most personal of all forms of data (Currie & Seddon, 2014). So, the establishment of a telemedicine platform with multiple stakeholder management of patient data and information, should be strictly regulated with patient data protection protocols maintained. Both the literature and the interview findings concur with specialised and stringent e-service regulations. The interview findings go as far as to propose the establishment of a regulatory board designed to manage only telemedicine ethical and regulatory practices. This chapter will explore the recommendations from both the literature and interview findings.

To start, an understanding of the current regulatory practices in South Africa is needed. The main governmental role is to provide the basic resources required for the function of health services, allocate an annual health budget to service the sector as well as provide the legislative and governing practices. Regarding the latter, government plays a role in the provision of regulatory bodies and provision of operational guidelines. The government has established a health regulatory body called the Health Professional Council of South Africa (HPCSA), which regulates operations in the health sector, is used for HCP registrations and vetting, and furthermore deals with patient complaints (Africa, 2019). With relation to e-health services, the Parliament of the Republic of South Africa (2013) drafted regulatory guidelines to ensure that patient data is protected. This is the Protection of Personal Information Act (POPI) act, and its objectives range from the protection of client personal information, to the issuing of a code of conduct for institutions for the management of patient information and the establishment of an information regulatory body to oversee these clauses. This is, however, not yet enforceable by law. Irrespective of the above, the research findings indicate the need for more

personalised and directive regulatory practices. It is therefore imperative that the government take the initiative to start designing their own telemedicine policies that are local centric.

This was specified by the Industry specialist who commented

> I think there is sufficient protection in POPIA and from within SA-Med but as this grows, I would imagine that, you know, there would have to be a very specific telemedicine authority. Because I can certainly see this thing growing quickly, If it is done correctly, and they certainly will be gaps in compliance, certainly will be gaps in a whole lot of other areas and it would require a, a body to look after the actual specific interest of this...the telemedicine space. (2:39).

The literature concurs with Löhr et al. (2010) saying, the establishment of telemedicine services necessitates for client e-health security and privacy protocols. The 2018 lawsuit against the social media platform Facebook, which was sued for billions of dollars over the Cambridge Analytica scandal for the sharing and misuse of confidential client information (Lee, 2018), is exemplary of what could go wrong if regulatory practices are not catered for. Similarly, "Policy makers had to learn that privacy, confidentiality, liability and data protection all need to be addressed in order to enable a sustainable implementation of and use of eHealth applications" (Stroetmann, Artmann, & Stroetmann, 2011, p. 1351).

6.4.1. Theme: Ethics

These regulatory bodies are responsible for the invention of numerous governing principals and policies for use by innovative products and services. These are established to ensure the ethical rooting of the medical fraternity is upheld whilst transparent, patient-centred health services are provided (Löhr et al., 2010; Nunes et al., 2009). Whilst the literature findings describe only the pros and cons of ethical protocols, the interview findings described in detail the various ethical considerations to be tailored for the local market. This was inclusive of resource management and the government’s responsibility in the upskilling of the community; the collection and management of informed consent; descriptors of when and how data is collected; and as well as the population groups from which data can be collected, with children being the group of most concern.

Given the juvenility of emerging markets economic stances, coupled with the scarcity of resources and skilled labour, the government has the responsibility of leveraging off such initiatives to aid in the development of its people and invariably that of the economy. The Telemedicine (niche entrepreneur), who reported that, "ethical considerations would be **upskilling people**. So essentially having as many stakeholders as possible so people can gain new skills and capabilities" (11:23). This is a new finding not stated in the literature review.

Other ethical considerations specific to the **collection and management of patient data** described in the research, included the accurate manner of obtaining **informed consent**. This entails the informing and counselling of a patient prior to the collection of their data or prior to an any procedures being performed. It also includes the patient being aware that they are sharing their data, knowing how the data will be used and stored and for how long that data will be kept, lastly, being informed of any third parties subject to use of the data. The data privacy specialist reported that " True consent is actually when you are aware that we are collecting at the very least, this information in the background" (8:29). The above is also applicable to the use of axillary devices such as the IOT.

The research findings stressed that special considerations need be applied for the **protection of children's data**. The data protection specialist commented "it's all about how we ensure that we are collecting information, lawfully and that we are collecting the minimum amount that we require to protect children" (8:31). Telemedicine platforms would need to be embed strict regulations around the identification of children and minors, the onboarding of children's data, and its storage and its sharing. An approach to this can perhaps be added as a recommendation by the POPI act and overseen by the independent telemedicine regulatory board.

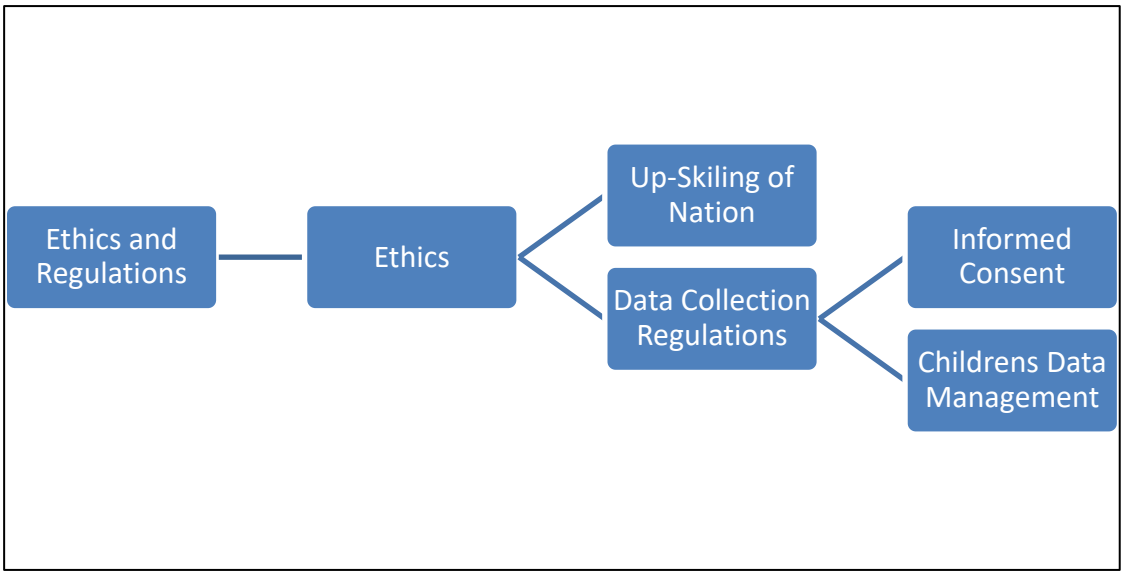

Figure 5 - Summary of Research Question 3: Ethics Theme

6.4.2. Theme: Regulations

Regulatory considerations include the management of the collected data, security concerns around protection of the data, ensuring that the technology used meets acceptable standards to assure the quality of telemedicine services in a secure manner and lastly, the vetting of data handlers.

The management of collected data is of upmost importance. Seeing that collected data will sit on cloud-services, specified frameworks and regulatory practices would need to be designed to accommodate this service. The interview findings also proposed that cross-border **management of cloud data** would need to be examined. The EMR specialist proposed that there is a need for "data being resident within the republics borders and that's absolutely vital and ensuring that the necessary standards for securing data and storing data are met as a country out or in our financial services" (2:41).

In the context where multiple stakeholders are involved for trans-border health data management, Seddon & Currie (2013) suggested the need for a conceptual framework that addresses the regulatory and compliance challenges in the cloud eco-system.

Research findings explored data protection methods that ensure secure data management. This included **protective infrastructure** such as encryption of data (telemedicine consultation platform entrepreneur, 3: 48), block chain (telemedicine

(niche) entrepreneur, 11:25) and firewalls to protect against hacking (mobile app entrepreneur, 10:19). To add, as a means of ensuring regulations are enforced, regulatory practices and bodies where mentioned. Seven of the thirteen respondents referred to **POPIA/POPI** as the preferred regulatory guidelines to manage such matters, however four of the thirteen respondents recommended the establishment of a formal **independent telemedicine regulatory board** to foresee such affairs.

With respect to **the securing of digital tools**, The EMR specialist commented

> We need to understand, you know, what testing these devices have undergone? What are the requirements for calibration? So, we need registers for all these devices. And these need to be obviously also stored in repositories that are accessible by the organisations that are responsible for them. (2:44).

The literature review reported several regulatory guidelines proposed by the US government. Although these are currently also not enforceable by law in the States, South Africa could draw from them, where they could perhaps be tailored to suite the local markets. Examples are provided by the FDA (Food and Drug Administration), a US federal agency which sees to the establishment of guidance documents that regulate numerous products including medical devices (FDA, 2019). The FDA published two advisory guidelines which saw to the integration of risk management protocols and the monitoring of cybersecurity threats in medical devices. (Yuan et al., 2018). The latter is supported by the Technical Information Report (TIR) 57, designed by private organisations to monitor the global standards for medical device cybersecurity (Instrumentation, 2016).

With all this said and done, the Telemedicine (niche) Entrepreneur recognised challenges and inefficiencies with replication of polices from abroad. He referred to policy drafting inefficiencies calling them, inefficiencies in 'agenda practices'. He responded that

> There are no experts that have been on the ground writing, information informing policy based on what shouldn’t happened in my environment. They just went and took a document from the United Nations, changed every word that says African and wrote South Africa and changed a couple of words. That shows lack of expertise, lack of understanding. How do we then influence

> policy if you don't have the right grounding for policy to start with?. (11:21).

Therefore, the proposition is that It is imperative therefore for government to take the initiative and start designing their own telemedicine policies that are local centric.

Concerns around stakeholder management in the securing of data privacy, were raised in both the research findings as well as the literature. The data collection specialist reported

> there is a lot of fraud happening even in the healthcare space, for example, dubious healthcare professionals and all of these things, so how do we ensure we have the right safeguards in these telemedicine solutions so that we address the issue of security that the patient is at all times protected and regulations speaks to that. (7:47)

Similarly, the literature commented that stakeholder monitoring is as imperative as the management of patient data. It spoke from the perspective of monitoring regulatory bodies, saying regulatory board supervision is important because 'regulatory capture' is a threat in instances of conflicts of interests (Nunes et al., 2009). From either perspective, the practices around the vetting and the assessment of providers, both HCP and regulatory board members, and all others handling client data, are crucial. To address the former, a recommendation by the POPI act, overseen by the independent telemedicine regulatory board is proposed. The latter can be managed through the establishment of **independent regulatory agents (IRA)** that play a role of an external regulator, keeping all stakeholders honest and accountable (Nunes et al., 2009).

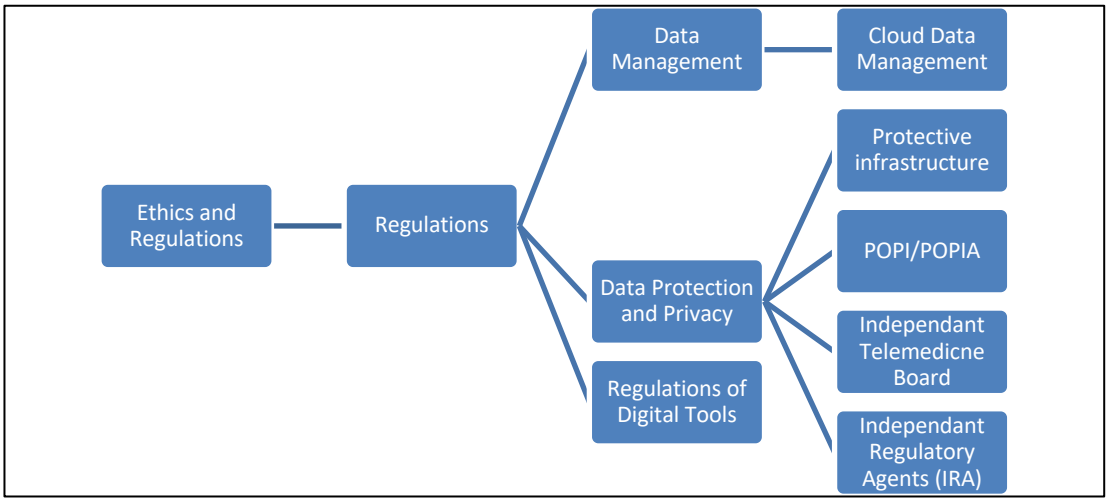

Figure 6 - Summary of Results for Research Question 3: Regulations Theme

In closing, all levels of the industry need to be monitored to ensure compliance to regulatory guidelines (Seddon & Currie, 2013). Both Ethical and regulatory practices must be catered to with new regulations and guidelines designed to suite the local market telemedicine industry. The objective of which is to ensure safe and secure patient personal data management as well as patient privacy because patient data privacy and protection is a human right that mandates for regulatory governance and ethical processes in the healthcare sector (Deborah Lupton, 2017).

6.5. Discussion of results for Research Question 4

Research Question 4: What role does infrastructure play in the success of telemedicine in South Africa?

This research questions objective was to establish the type of infrastructure required in emerging market settings, furthermore, to establish the role telemedicine plays in the industry. It also intended to understand the anticipated infrastructural challenges once the industry has been established.

Infrastructure is an integral part of the successful implementation of telemedicine. According to Aldossary et al. (2017), health infrastructure is a pre-requisite for the successful implementation of telemedicine. Without sufficient infrastructure to support the advancement of innovative health initiatives such as telemedicine, healthcare practices would falter to the detriment of those it serves, particularly the underserved communities. As a result, UNICEF (2017) urge that the "government

should selectively invest in accelerated investment in infrastructure, especially for the poorest provinces where opportunity costs for accessing health services are high" (p. 16). The infrastructure required should enable sound data collection processes, secure data processing, safe storage mechanisms, and reliable information sharing. Löhr et al. (2010) confirms when stating that there is a need for infrastructure and equipment that facilitates the acquisition of patient data, efficient and safe storage of the data and also protected sharing of information amongst stakeholders. Such infrastructure should meet quality assurance that satisfies ethical and regulatory practices. Lastly, the assessment and evaluation of the success and failures of this infrastructure is fundamental.

6.5.1. Theme: Consultative infrastructure:

6.5.1.1. Data Acquisition Infrastructure

Güler & Übeyli (2002) describe that this include: teleconferencing equipment with data digitizing capabilities such as fixed or mobile phones, computers and image processors (cameras and monitors); text processors (scanners and fax machines) and any laboratory or radiology equipment (x-rays). The interview findings indicated that **smartphon**e usage is a facilitating tool for telemedicine practices due to its wide-spread penetration in Africa. Seven of the thirteen respondents commented on the usefulness of smartphones in telemedicine. However, a unique challenge for emerging markets was that of smartphone or data access inequalities, otherwise referred to as the digital divide (ethics specialist, 15:13) and the data divide (telemedicine healthcare, 9:29) respectively. These could leave some clients unserved. In such cases, the research findings suggested the use of a **toll-free service** accessible by call, not necessarily requiring a smartphone (data privacy specialist, 8:48), or the use **USSD**, where no data is required (health tech pharmacy entrepreneur, 12:31).

The literature review described the importance of **Telecommunication network**s in facilitating the communication of devices and ultimately the teleconference itself. Güler & Übeyli (2002) described telecommunication networks to include the **internet**, ATM (asynchronous transfer mode), satellite and ISDN networks for data communication. In the research findings, ten of the thirteen respondents commented on connectivity. The telemedicine (niche) entrepreneur commented "you need to

speak about telecommunications. Because that really creates the backbone with internet access" (11:2), whilst the ethics specialist added that it spans beyond the internet to include band worth and data access **(Broadband Data)** (15:44).

The establishment of telecommunications is only effective if it is reliable and has a wide reach in function. Güler & Übeyli (2002) reported that such telecommunications must be able to securely support large volumes of patient data and the multimedia traffic of medical communications. Furthermore, three respondents commented on the importance of real-time solutions requiring real-time responses. The EMR specialist said that "healthcare is such that one needs to have uptime at least ninety nine percent" (2:8), with the telemedicine consultation platform entrepreneur in support by saying

> So, it needs to be responsive, it needs to happen now. This, this idea of kind of what I call where, you know, you say something, and then it takes five seconds before it reaches the person that you just spoke to. That kind of thing is not, that's not how you how you ensure that the system is utilised. (3:47).

Once again, the availability of telecommunication lines that operated efficiently with a wide reach and high up-time, was identified as a unique challenge for emerging markets. However, not one without a solution. The telemedicine consultation platform entrepreneur proposed a possible solution for such sates, when he commented

> The system has to be able to function on things like a three G-connection, because it's not everywhere that you will have wired internet. So, the connection needs to be stable for the transmission of video and audio across the internet stability is probably more important than anything else, to allow connection. (3:49).

6.5.1.2. Storage and Retrieval Infrastructure

Güler & Übeyli (2002) describe storage and retrieval infrastructure as any equipment that can compress, transmit and store data such as CD-ROMS, disks, CD's, tapes and cloud storage systems. Löhr et al. (2010) added that secure cloud storage services are indispensable when assuring that ethical practices are maintained and that regulatory guidelines are adhered to. Six of the respondents commented central

repositories or cloud systems as the means to store patient data in e-service platforms**. Cloud services** provide a number of benefits, including ensuring an integrated and efficient service is provided. They are is the foundation on which axillary services and products can be integrated to complete the service provided in telemedicine. They enable an ease of data sharing and communication.

One construct that was explored in the literature review and not raised in the interview findings, was the need for electronic identifiers or **authentication tools** to uniquely identify all stakeholders for their authentication in order to facilitate their medical practices and services in a protected and secure manner. Löhr et al. (2010) gave an example of the German Electronic Health card (eHC) which does only securely carry administrative information but also facilitates safe paperless healthcare transactions.

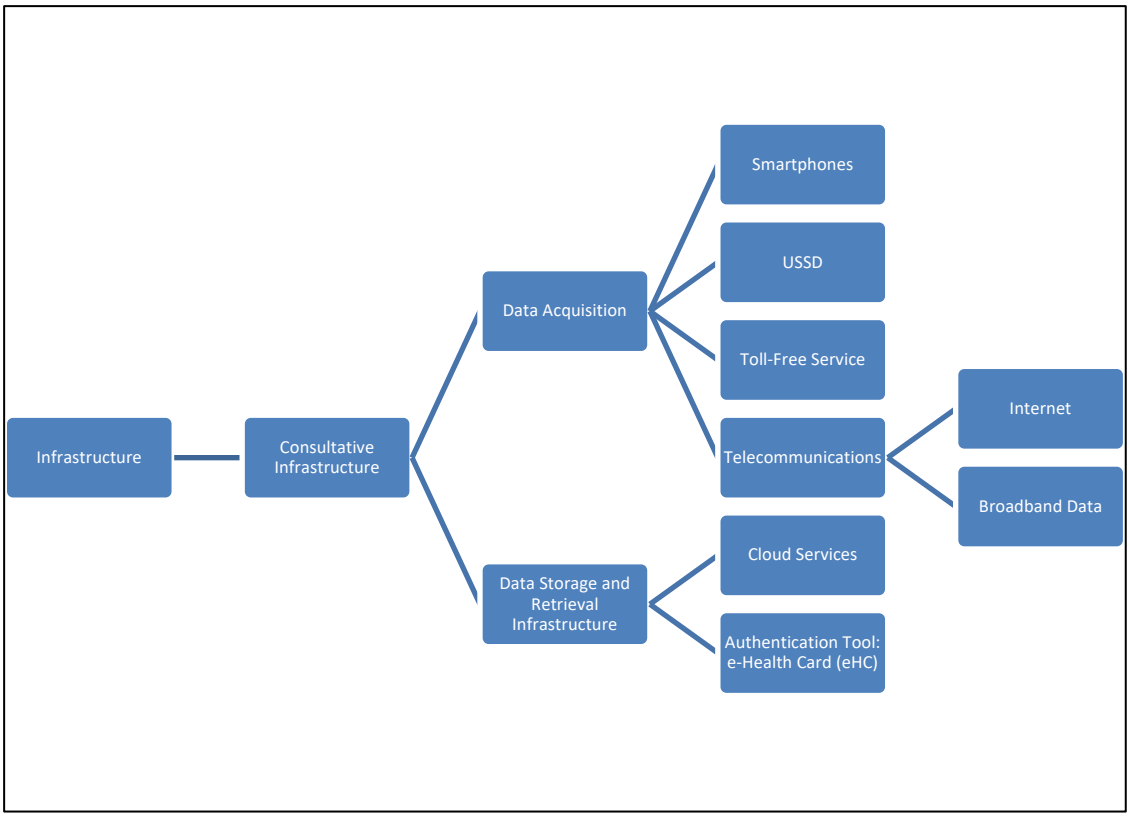

Figure 7 - Summary of Results for Research Question 4: Consultative Theme

6.5.2. Theme: Administrative infrastructure

6.5.2.1. Integrative Infrastructure

Administrative Infrastructure is the type of infrastructure that integrates the system

service providers and allows for efficient and seamless system operation. There are numerous systems to be considered for integration into the system. The research findings propose the use of existing software systems that provide an integrated service to firms to assist in the management of their enterprises, however these would need to be tailored to suite the relevant health industry or health service. The health tech pharmacy entrepreneur commented

> You just need a good system and definitely a good **CRM and ERP system**. CRM is Customer Relations Management system and ERP is Enterprise Resource Planning systems...Those systems already exist they already developed so you just buy them and then customise how you want to customise it. (12:26).

Such software systems are used to integrate numerous elements of the health service vale chain. The telemedicine consultation platform entrepreneur reported that these include que management and booking systems (3:55) and stock management systems (3:56). The data collection entrepreneur added that it is also inclusive of financial management and billing systems (7:59). The purpose of such systems would be to coordinate the service providers to enable a coherent and ordered system that provides a seamless service with minimal human error.

6.5.2.2. Evaluation Infrastructure

These systems and technological tools would need to be evaluated for efficacies, quality of the e-health services provided, furthermore assessed for areas of improvement and for learning. Wildman, McMeekin, Grieve, & Briggs (2016) support this objective in stating that economic evaluations of integrated new technologies for health and social care are fundamental as they allow the review of improvements to health care service processes. World Health Organisation (2009) added in saying that these evaluations may help generate reliable data to develop national telemedicine policy and strategy, guide implementation processes, and enhance the potential for transferability of projects.

Kidholm et al. (2012) reported that:

> If the objective of an assessment of telemedicine applications is to describe effectiveness and contribution to quality of care and to produce a basis for

> decision making, then the relevant assessment framework fulfilling this objective is a multidisciplinary process which summarises and evaluates information about the medical, social, economic and ethical issues related to the use of telemedicine in a systemic, unbiased, robust manner. (p. 46).

As a consequence, the literature suggests **MAST (Model for Assessment of Telemedicine Applications)** (Kidholm et al., 2012). In Switzerland, the Regulatory Impact Assessment (RIA) is commissioned for the socioeconomic evaluation of eHealth legislations (Stroetmann et al., 2011a). Sadly unlike Switzerland, since 2006 only 20% of countries that have a telemedicine industry are reported to have evaluation (World Health Organisation, 2009). More would need to be done to ensure that this statistic is improved. As a result, this is an element that would need to be integrated into the telemedicine development in emerging economies.

6.5.2.3. Contractual Agreements and Service Level Agreements

An additional construct was explored in the research findings. This was raised by the data privacy specialist who reported that **contractual agreements and service level agreements** need to be considered as part of administrative infrastructure (8:44, 8:45). Contracts help to set out operating guidelines and allocate responsibilities to the different stakeholders, whilst service level agreements keep the stakeholders accountable for the services provided. Together the contractual agreements and the service level agreements unify and complete the telemedicine platform to ensure it delivers a well-orchestrated service with each stakeholder responsible and accountable for their duty, irrespective of the number of stakeholders involved.

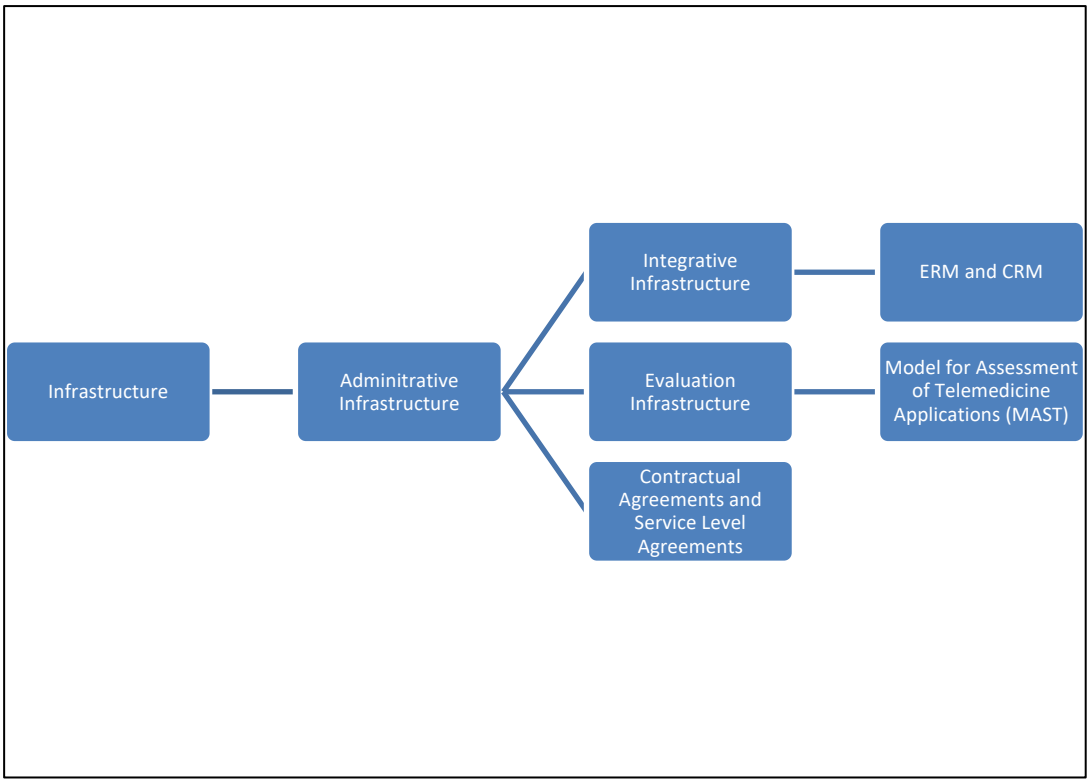

Figure 8 - Summary of Results for Research Question 4: Administrative Infrastructure

In summary, the infrastructure required should enable sound data collection processes, secure data processing, safe storage mechanisms, and reliable information sharing. Infrastructure should enable quality assurance that satisfies ethical and regulatory practices. Lastly, the assessment and evaluation of the success and failures of the implementation process is fundamental, so that improvements can be made to encourage the best value proposition and utility for the patient.

6.6. Discussion of results for other constructs and findings

The interview findings described a few pertinent views around some of the challenges which respondents felt would need to be catered for in the development of a telemedicine platform in South Africa, and perhaps would need to be considerations for other emerging markets. These findings fall into three themes which are: weather damage, theft and vandalism issues, technology adoption challenges and change management concerns.

6.6.1. Theme: Weather damage, Theft and Vandalism

Three respondents reported property theft and damage a concern, with two referring to weather damage also another challenge to be considered as a challenge. The EMR specialist commented that concerns around theft and vandalism are unique to the African market and need be factored in as an element to manage in the implementation of telemedicine (2:13). Protection against these assaults is an element that needs be incorporated into the design of a telemedicine industry for emerging markets. Similarly, poor weather conditions may also damage infrastructure or affect the quality of services provided (telemedicine consultation platform entrepreneur, 3:58). The mobile app entrepreneur commented that "actual security of the storage against normal weather elements, rain damage, fire..."(10:24) needs to be secured in the planning process.

6.6.2. Technology adoption challenges

Technology adoption challenges were raised in the literature findings, but mainly with respect to smart design and implementation processes. The research findings explore adoption challenges with five of the thirteen respondents mentioning technology adoption challenges as an element to be noted and addressed with the roll-out planning processes.

The sub-themes raised included the age discrepancy in technology adoption with the elderly being described as poor adopters. In reporting her experience with providing telemedicine consultation services, the telemedicine healthcare provider said, " I thought a lot of people actually found it quite useful, especially the younger population" (9:33), adding that the older population often resorted to face-to-face call outs (9:34). The cloud service and data storage entrepreneur alluded to the age discrepancy in adoption as the elderly's lack in technology literacy and a lack in technology operational know-how (13:7).

The literature placed emphasis on user operability, describing it as the key problem leading to adoption challenges and technology illiteracy, adding that it is as an issue experienced across all ages, not just in the elderly. Van Deursen and Van Dijk (2011) indicated that irrespective of the growing internet and online health content, users still remain incapable of enjoying full benefits of the data due to internet illiteracy. Operational and formal internet skills were shown to be deficient when using the

internet for health-related purposes, and this was demonstrated across all ages.

Two propositions were suggested as solutions to the adoption challenge in emerging markets. The first proposition is to make telemedicine tools easier to use which will invariably improve the user experience. The telemedicine consultation platform entrepreneur said

> I think that, you know, we'll have to, we'll have to innovate both from a technology standpoint, making tools easier to use, making data easier to capture using things like voice, using things like quick touch buttons that can expand to become clinical notes, so you make it easier for people to adopt the systems. (3:12).

Creating a great user experience through simplifying the customer engagement tools and touch points will improve adoption challenges.

The other proposition was specified for the emerging market health industry. In proposing a solution to address these adoption issues, the telemedicine consultation platform entrepreneur said

> I think that the business model will actually have to include someone to facilitate the telemedicine consultation. And by that, I mean that for the average South African, the idea of taking your phone, for example and speaking directly to a doctor whilst possible, will probably not the easiest way to get widespread adoption. Maybe going to a centre where there's a convenient healthcare worker who can initiate the consultation on your behalf. (3:15).

An example of how this could be executed in such markets was offered by the literature review. Chandwani, De and Dwivedi (2018) describe how a UI collaborative innovative network between Sanjay Gandhi Post Graduate Institute for Medical Sciences, an academic hospital and the rural community, accomplished successful and sustainable implementation of a tailored telemedicine initiative in rural India. This system relied on intermediary HCP or community workers to facilitate to teleconference between the remote specialist and the patient. This proposition does not only address some of the demographic issues around health and infrastructural

access but may also alleviate the distress experienced by the elderly induced by tech illiteracy and a lack of technological knowledge.

6.6.3. Change management Concerns

This construct is closely related to the former. However, it speaks to the end-user perception of telemedicine practices and the acceptance in the change in management practices. It is influenced by the fears and uncertainty translated by the change imposed by the implementation of telemedicine. The health tech IT consultant said, "I think it's going to require a lot of changing mentality, a lot of change in enterprises" (14:30). There are concerns around how this innovative and disruptive system will create job insecurities, furthermore, add to the precarious work environment. The telemedicine (niche) entrepreneur said

> The problem is around creating jobs, who's bringing in the changes. So, some of the policy makers in government are scared of changes programme. That will have an impact definitely on what you are doing. It hinders progress. (11:3).

The business modelling and strategic planning processes detailing the implementation of telemedicine would have to include the management of people's expectations, fears and concerns.

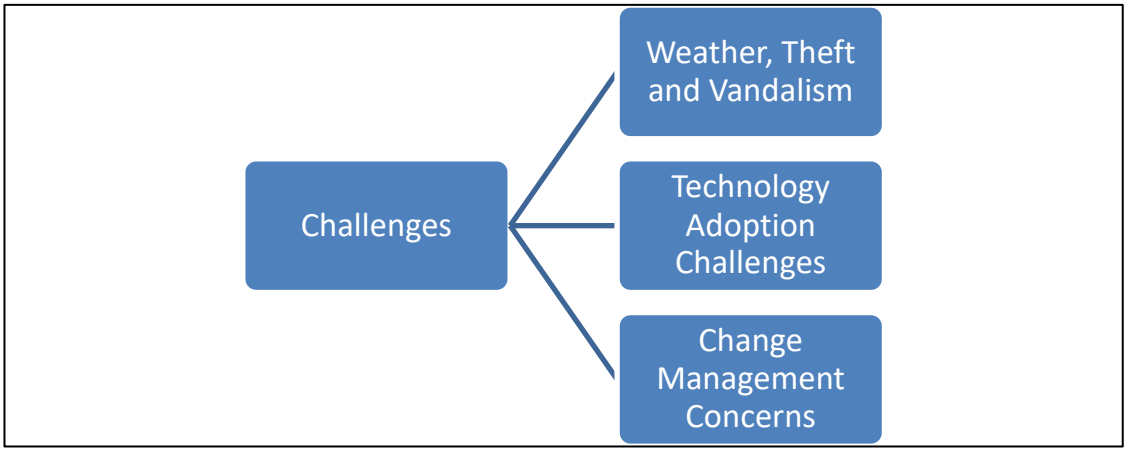

Figure 9 - Summary the Challenges Encountered with the implementation of Telemedicine

Chapter 7: Conclusion

7.1. Introduction

The research methodology follows a deductive approach. The literature review sought to find out what is known about the telemedicine industry. Data mining revealed four main constructs which are discussed in detail in chapter 2. These were business modelling and strategy, ethics and regulations, collaboration and infrastructure. A basic framework detailing these constructs was compiled (Figure 1). The research interviews sought to understand the telemedicine industry from a local perspective and sought to build on the literature findings. Both the literature and the interview findings were organised into a comprehensive framework that proposes the elements required to build a comprehensive telemedicine framework for emerging markets, with the South Africa as a case study. The findings are presented in the Figure 10 and are discussed in this chapter.

7.2. Business Modelling and Strategy:

The conceptual phase of business development requires a solid business plan suited with an implementation strategy to ensure that the projects prosperity. The telemedicine industry is innovative and seeks to disrupt the traditional practice of medical consultations and services. Therefore, it requires a specialised business model and strategic implementation plan. Chrisetensen and McDonald (2015) define a disruptive business model as one that is distinct from competitors and market traditions yet offers an organisation a competitive advantage. Casadesus-Masanell & Ricart (2010) further added that disruptive business models are a way of offering innovative ways of interacting with the customer whilst creating and capturing value and making a profit. To that end, the first construct described by the research and the literature findings in establishing the success of telemedicine in emerging markets, is business modelling and strategy.

7.2.1. Business Modelling

The health industry has a value-adding business model (Hwang & Christensen, 2008), so in accordance with its predecessor, the telemedicine industry should have a business model that is customer-centric and upholds its customer value

proposition. Understanding the customer pain-points and how a product or service will deliver value to the end-user is imperative (Teece, 2010). This is established through the value proposition (Peters et al., 2015). The research findings propose that those of telemedicine industry are:

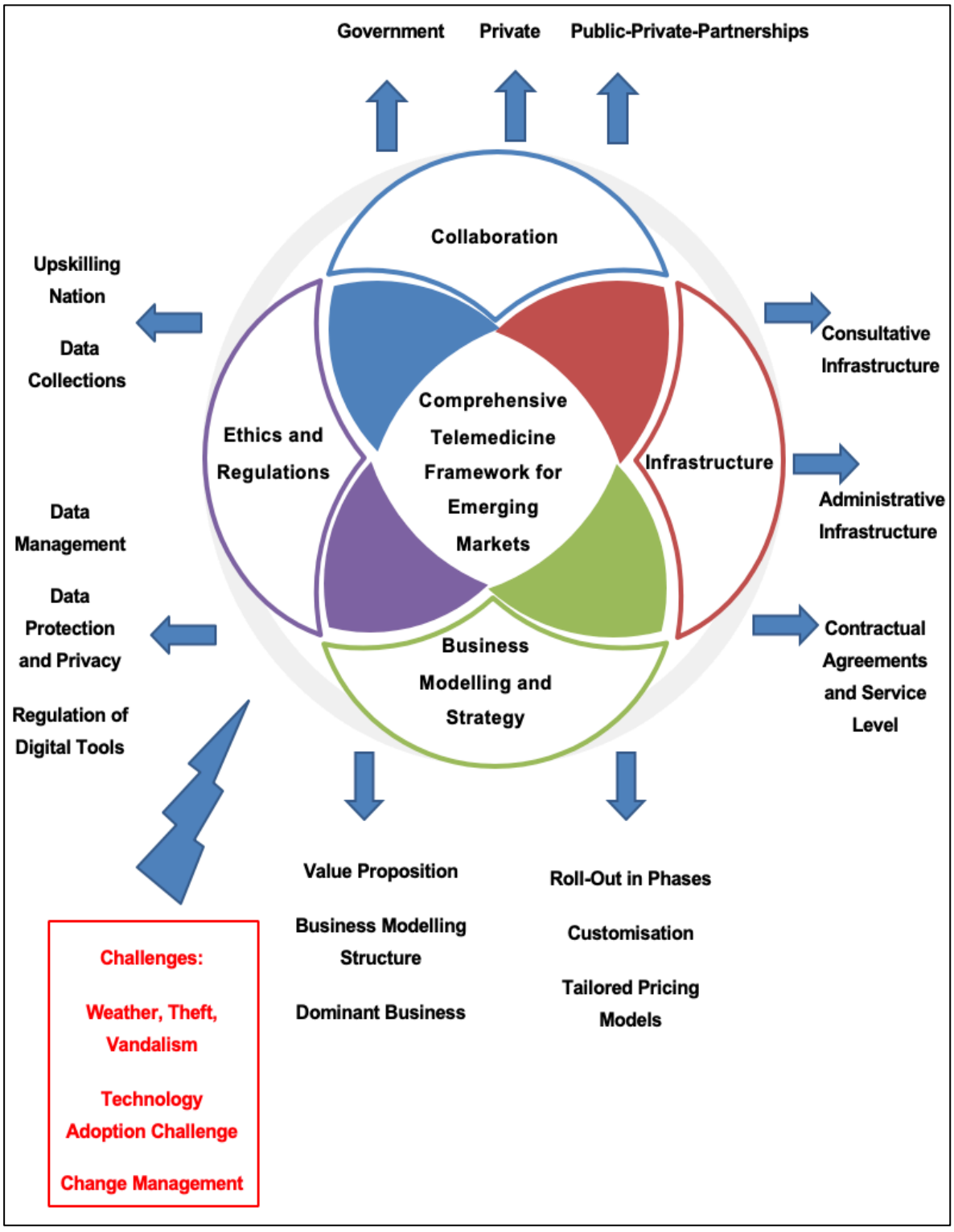

Figure 10 - A Comprehensive Telemedicine Framework for Emerging Markets

7.2.1.1. Value Proposition

7.2.1.1.1. Increase in Health Access

Health qualifies as a basic human need and right and it informs one of the Sustainable Development Goals (SDG) (WHO, 2018), as a result the framework proposes that the value of a telemedicine industry is to provide health access to all that need it, irrespective of distance in geographic location to health institutions. This value proposition addresses the issue of health inequities as evidenced by the EMR specialist who commented that it "would basically equalise space in that an individual sitting in rural Eastern Cape could pretty much have access to the same type of service that somebody would have at a tertiary hospital in Johannesburg" (2:3).

7.2.1.1.2. Reduce Costs

The next value proposition is that telemedicine assists in reducing the cost of seeking healthcare. It does so by creating an ease of access to health services, invariably saving on travel costs which results in lower health expenses for the end-user. The Russo, McCool and Davies (2016) study on the Veterans Affairs (VA) healthcare system illustrated how the use of Telemedicine results in reduced travel distance, saving travel time and reduced costs.

7.2.1.1.3. Improve Health Service Efficiency

Inefficiencies experienced by resource limitations create undue bottle necks in the system which invariably lead to longer waiting times and human error in management. Yeow & Goh (2015) described a positive telemedicine impact on allocative efficiency pertaining to select resources and processes by illustrating that it results in improved administrative efficiencies in health institutions, reduced waiting times, easier hospital admissions and by matching HCP and patient with accuracy. Wootton et al. (2005) further illustrated that telemedicine offers improved quality of treatment to underserved populations, furthermore, enables more rapid and accurate diagnosis improving the quality of treatment.

7.2.1.1.4. Health Care Provider to Healthcare Provider Communication

Telemedicine creates an ease of patient transfer amongst specialists. It provides a platform on which HCP's may communicate patient information in order to facilitate

consultations and management practices (telemedicine healthcare provider, 9:1). This value proposition is to the benefit of HCP, as it assists in support of more junior HCP or those in remote regions in need of consultative advice (World Health Organisation, 2009). Invariably it also adds value for patients as they stand to benefit from more accurate and directive management practices (Wootton et al., 2005). World Health Organisation (2009) added that clinical support is one of the four pertinent attributes of telemedicine, the other three including remote access to healthcare services, incorporation or use of technological tools, and the intent of improving health outcomes. The ethics specialist reported that telemedicine can be used for educational purposes by providing support, mentorship and coaching for healthcare providers (15:5), whilst the literature gives an example of a success story of how this is established in India. Chandwani, De and Dwivedi (2018) describe how a UI collaborative innovative network between HCP specialists from Sanjay Gandhi Post Graduate Institute for Medical Sciences, an academic hospital and the rural community health workers, resulted in the successful and sustainable implementation of a tailored telemedicine initiative in rural India. To this end, this is considered one of the elements of the value propositions provided by telemedicine practices in emerging markets.

7.2.2. Business Modelling Structure

In order to ensure that value is created and that the above described utility is fully provided by telemedicine services in emerging markets, the business modelling structure needs to be tailored to the local market. The framework proposes that the model needs to consider the socio-economic viability of the target market, as well as a costing structure that is suitable to that market. These elements will be explored.

7.2.2.1. Socio-Economic considerations

South Africa's political past rooted in apartheid and discriminatory practices, led to a nation divided and defined by socio-political and socio-economic differences. "Socio-economic status, race, insurance status, and urban-rural location were associated with access to care, with black Africans, poor, uninsured and rural respondents, experiencing greatest barriers" (Harris et al., 2011, p. 1). This resulted in health inequities that the current governments political will and tenure still address today. Ram'irez & Selin (2014) discussed the relevance of retrospective and prospective

sense making when conducting future foresight studies for problem solving in order to design solutions for the healthcare sector. The proposition is that South Africa leverage off socio-political and socio-economic decisions to influence its future by envisioning and planning the most suitable and probably future. As a result, the data collection entrepreneur commented that "you have to take into account the socio-economic dynamics of the country to determine your business model" (7:11). This defines how you cost your product. The proposition was that considerations around costing were imperative.

7.2.2.2. Low-Cost, High Volumes

Pricing of telemedicine services should be tailored to suite the local markets affordability, whilst still ensuring capital costs are catered for. Profits for service providers will be covered through offering high-volumes, whilst cost efficiencies for patients, will be ensured by offering low-costs. The data collection entrepreneur reported that "it has to be low margin, low priced to reach a significant scale and have maximum impact" (7:13). Such business model structures ensure that scale is reached whilst servicing both sides of the platform, a platform that comprises service providers as well as the patients.

7.2.3. Dominant Business Model Review

The topical feed in South Africa is the establishment of the National Health Insurance (NHI). The NHI is said to have multi-sector affects in the health industry, inclusive of all e-health services. It will inform how all health systems are run. The NHI was therefore mentioned by eight out of thirteen of the respondents, suggesting that the establishment of a telemedicine industry needs to cater to the NHI. The proposition was that the business model for telemedicine needs to ensure a readiness for the NHI, furthermore that all stakeholders need to have a cohesive and collaborative spirit when dealing with any NHI related matters. The telemedicine consultation entrepreneur said, "I think South Africa will find itself needing telemedicine, especially as you move towards NHI" (3:2).

7.2.4. Strategy

7.2.4.1. Strategic planning and implementation

An approach to business modelling implementation determines a project's success, therefore needs to be made priority in new venture development. Teece (2010) reported that the more radical the innovation, the less likely traditional business models will fit, warranting for a newly defined strategy and business models. The research proposed a strategic approach for telemedicine use in South Africa by suggesting a phased-out roll-out of telemedicine tools.

7.2.4.1.1. Roll-Out in Phases

The research findings proposed that each region needs to be manged separately and differently. The proposition is that telemedicine services need to the tailored to a specific region with all business elements customised for the region. This is inclusive of the payment systems fitted for the affordability of those in the region. The health tech pharmacy entrepreneur added that the objective of such a strategy would be to ensure that one is handling smaller sample sizes and studying the segment from all angles to ensure that the solutions best meets the needs of the target group, furthermore to ensure localisation of the product (12:11). This minimises implementation risk. This approach ensures that all complexities are managed at a smaller scale and addressed without the overall system taking strain. It is concordant with the systems thinking teachings which propose that systems thinking can simplify the complexity that rigs health systems, by not only analysing the parts of the sum, but also the sum of all the parts, making identifying and solving for both micro and macro challenges more probable.

Systems thinking can improve the quality of the assessments made on all parts of the system (Peters, 2014).

7.3. Collaboration

7.3.1. The Public Partner: Government

The government plays a major role in the pioneering of new venture projects. The government is described to be resourceful, experienced and having the capabilities

and capacity to manage large scale or complex systems such as that of the telemedicine industry. The health tech pharmacy entrepreneur indicated that "I think the government is ready, and government can actually run 80 % of the implementation. They have got the resources" (12:16). To add, keeping the NHI in mind government collaboration is paramount (Data privacy specialist (8:14). To that end, they are needed to spear-head the initiation this project.

The main role of the government would be to head the regulatory boards that foresee the regulations of practices in the sector. This would include the drafting and enforcing of ethical practices and laws that govern the industry. Although the literature reports an existing regulatory board, the HPCSA, four of the thirteen respondents commented that a new independent telemedicine or regulatory board would be required. Therefore, the framework proposes the establishment of an independent telemedicine board.

7.3.2. The Private Partner

The private sector provides the required expertise, skills, workmanship and manpower to ensure efficiency in the roll-out of telemedicine practices. There numerous stakeholders that play different roles in the sector. Collaboration between HCP, technologists, medical service providers such as medical aids, hospital and clinics, legal teams and academic institutions are required for the success of telemedicine. The framework proposes that a platform that facilitates the ease of collaborating and doing business is necessary for emerging markets.

7.3.3. Private-Public Partnerships (PPP)

A collaborative platform is established to help manage partnerships and to ensure a cohesive and directive environment that promotes successful outputs for telemedicine in emerging markets. The framework proposes that public-private partnership platforms need to ensure that there are shared objectives amongst all partners, that only trusted brands are sourced for partnerships, and that all partners must reap mutual benefits from the collaborative network. The framework also suggests that the management of the platform must assure the protection of stakeholders from undue consequences of collaboration, such as protection from IP theft and undue delays costing time and raising implementation costs. All the above is enabled through extrinsic and intrinsic factor satisfaction.

7.4. Ethics and Regulations

Ethics and Regulations are the cornerstone to ensuring safe and honest medical practices. These elements are equally valued in the establishment of telemedicine.

7.4.1. Ethics

The research findings suggested two forms of ethical considerations to be prioritised. The first suggestion was that it ensures the up skilling of the people of South Africa, and the second was for the ethical regulations of data collections.

7.4.1.1. Upskilling the Nation

Emerging economies are often rigged with multiple complex issues, some of which include the lack of resources and skilled personnel to man the available positions. To add, emerging economies frequently have a history of poor social, political and economic strife and in order to accomplish sustainable transformation, these issues will need to be made priority. As a result, the telemedicine (niche entrepreneur) proposed that, "ethical considerations would be upskilling people. So essentially having as many stakeholders as possible so people can gain new skills and capabilities" (11:23). Doing so not only improves the livelihood of its people but also adds to the growth of the economy. The proposition is the telemedicine practices would need to equip its employees with the right skills and tools to engage adequately and appropriately with the system, so as to ensure that not only are superior services are provided, but also to ensure employee satisfaction and growth.

7.4.1.2. Data Collection Regulations: Informed Consent

Strict regulations around the collection of informed consent and the gathering of data need to be mandated. Informed consent requires that all patients be counselled around the purpose of information collection, potential use of data, where the data would be stored and for how long, lastly, if there would be any third parties whom would have access to the data. Indirect collection of data through the IOT tools will also need to be communicated.

7.4.1.3. Children's Data Management

The framework proposes that data collection of children’s information needs to be

more strictly regulated, this is inclusive of laws governing guardian and caregivers sharing of minor's information. To add, laws standardising the age of consent will have to be established for telemedicine. Perhaps, it should be mandated that children's data protection and privacy specialists be appointed to manage these affairs.

7.4.2. Regulations

Regulatory practices include drafting regulatory guidelines for the management of the collected data, protection of personal data, and acceptable standards for technologies used meets.

7.4.2.1. Data Management

The framework suggest that impetus should not only be placed on the collection methods of data but also on how the data is managed post collection. Considerations around where and how data is stored and transferred would need to be constituted. The proposition is that central repositories would need to be strictly monitored to assure privacy and data protection, furthermore that such repositories be kept within the borders of the state, to further mitigate risk. As illustrated in the literature review by Seddon & Currie (2013), where multiple stakeholders are involved for trans-border health data management, a conceptual framework which addresses the regulatory and compliance challenges in the cloud eco-system would need to be formulated. This was supported by the EMR specialist who added that there is a need for "data being resident within the republics borders and that's absolutely vital and ensuring that the necessary standards for securing data and storing data are met as a country out or in our financial services" (2:41). So, the proposal is that data management regulations be drafted and specialised for emerging market conditions.

7.4.2.2. Data Protection and Privacy

Patient data privacy and protection is a human right mandating for regulatory governance and ethical processes in the healthcare sector (Deborah Lupton, 2017). Data protection entails security of the patient's personal information. Therefore, this element proposes that laws and regulations be enforced to ensure the protection and privacy of patient's personal information. This is done through the establishment of protective Infrastructure or through regulatory guidelines and policies.

Protective infrastructure referrers to security software and infrastructure such as the encryption of data, block chain, and firewall software to protect from the hacking of information. These would have to be coupled with protective laws and regulations that are enforceable by law. Seven of the thirteen respondents referred to POPIA/POPI as the preferred regulatory guidelines to prescribe these laws, with four of the thirteen respondents recommending the formation of a formal independent telemedicine regulatory board to oversee these affairs. The proposition is that this regulatory board would manage the drafting and implementation of ethical and regulatory practices, furthermore, ensure that the POPIA/POPI and other similar laws and regulations are enforceable.

7.4.2.3. Regulations of Digital Tools

Digitalisation requires the use of numerous digital tools and technologies such as cloud services, mobile technologies, IOT, social media to name but a few (Srai & Lorentz, 2019). The IOT is a major axillary specialist area in telemedicine and plays a supportive role facilitating telemedicine services. The appropriate use of these IOT tools, input to ensure a value adding service for patients but the out-put requires some strategic insight, business modelling and management (Casadesus-Masanell & Ricart, 2010; Hwang & Christensen, 2008; Rachinger et al., 2018). Deloitte (2019) demonstrates that safety of IOT-enabled medical devices has been of concern over the last 10 years. Cyber hacks have caught telemedicine firms unawares, pressing for urgent developments in patient data privacy and security practices. As a result, the framework proposes that regulations around the use of digital tools need to also be mandated. Only secure digital tools that continue the data privacy protection cold chain are to be used in the telemedicine sector. These tools need to prevent harm, transfer and maintain patient trust.

The framework proposes that vested interest is needed in the strict regulation of practices for technological tools and devices. The EMR specialist commented

> We need to understand what testing these devices have undergone. What are the requirements for calibration? So, we need registers for all these devices. And these need to be obviously also stored in repositories that are accessible by the organisations that are responsible for them. (2:44).

The literature findings describe regulatory bodies such as the FDA, a US federal

agency which sees to the establishment of guidance documents that regulate numerous products including medical devices (FDA, 2019). It drafts advisory guidelines which see to the integration of risk management protocols and the monitoring of cybersecurity threats in medical devices. Similarly, the framework proposes the establishment of such a system tailored for emerging markets digital tools.

7.5. Infrastructure

Infrastructure is obligatory in the founding of a telemedicine industry. Infrastructure is the enabling factor that facilitates the engagement of patient and HCP, furthermore, sees to the management of the out-comes of engagement. There are two forms of infrastructure described by both the literature and the interview findings, these are consultative and administrative infrastructure.

7.5.1. Consultative Infrastructure

Consultative infrastructure is inclusive of data acquisition infrastructure, which is used to facilitate HCP-patient consultations and extract information from the patient. This includes teleconferencing equipment, text processors and any laboratory or radiology equipment. The research findings indicated that smartphone usage is a facilitating tool for telemedicine practices in Africa due to its wide-spread penetration, as evidenced by seven of the thirteen respondents who commented on the usefulness of smartphones in telemedicine in emerging markets. The framework, therefore, proposes that smartphones be the main tool engagement for emerging markets. However, with the objective of maintaining equity in health access, USSD and a toll-free call are proposed as alternatives by the framework.

Smartphones are reliant on telecommunications for operability. Telecommunications includes the internet, ATM, satellite and ISDN networks. In emerging market settings, the internet is proposed to be the main source for telecommunications. However, it would need to also function on mobile data such as 3 G to extend reach for those without internet access. In summary, the framework proposes that telecommunication lines with high up-time, wide reach and with the ability to transmit large files of data, are required for a successful industry.

7.5.2. Storage and Retrieval Infrastructure

Storage and Retrieval Infrastructure refers to any equipment that can compress, transmit and store data. Six of the respondents commented central repositories or cloud systems as the means to store patient data on e-service platforms. Therefore, the framework proposes that the telemedicine industry be built on a cloud-service (cloud storage and data storage entrepreneur, 13:25). Regulations and management of the cloud system are proposed under the ethics and regulations section.

7.5.3. Administrative Infrastructure

Administrative infrastructure integrates the system service providers and allows for efficient and seamless system operation. Similar in function to the collaborative platform described under PPP, this is a software that provides a means to manage stakeholder engagements and interactions. The framework suggests that emerging markets need a tailored enterprise and customer management system to manage affairs of engagement for all stakeholders.

7.5.4. Evaluation Infrastructure

The telemedicine framework for emerging markets proposes that a system that evaluates and monitors the outputs of implementation practices is required. These assessments can produce relevant information to help develop the national telemedicine policy and strategy, furthermore, guide implementation processes and enable sustainability (World Health Organisation, 2009).

7.5.5. Contractual Agreements and Service Level Agreements

The last element added under administrative infrastructure is the proposition that attention needs to be paid to contractual agreements and service level agreements, that hold all stakeholders involved accountable and responsible to their commitment to the provision of superior and quality telemedicine practices.

7.5.6. New Constructs

Special considerations for emerging market economies telemedicine practices, were proposed. The first was management of infrastructural damage caused by weather,

theft or vandalism. Perhaps, the management of this element would be to have an allocated maintenance team that oversees the prevention, maintenance and the restoration of properties subject to such damage. Other concerns entailed issues around the management of adoption challenges and change management. The framework proposes that a team that educates, supports, promotes and educates about telemedicine, should be established to address these post-implementation trials. Of particular importance, is the proposition to establish a system that facilitates and mediates digital consultations for remote regions.

7.6. Summary of the Comprehensive Telemedicine Framework for Emerging Markets

The comprehensive telemedicine framework for emerging markets is established to ensure successful implementation of telemedicine practices in emerging markets. The literature findings proposed four main constructs mandated for telemedicine implementation, these were supported in the research findings. These four constructs are: business modelling and strategy, ethics and regulations, collaboration and infrastructure. Research findings added that the tailored business modelling and strategic planning is required to suite the local market, furthermore that special considerations in the implementation phases would need to be catered to for emerging markets. These concerns were around the management of weather, theft and vandalism issues, technology adoption challenges and change management concerns. With most constructs the framework proposes that management teams or governing bodies that regulate the sector be established to guide, operate and regulate the area of interest. The objective is that the overall co-ordination of the different parts, be cohesive and collaborative to ensure that the system functions seamlessly and efficiently to promote success in its operations.

7.7. Recommendations for Managers

The literature review and interview data findings prescribe an understanding of the business context prior to an implementation of new business proposals. The recommendation is that prior to the design of a suitable business model and strategic plan, the local context must be studied and understood, so as to best construct the best plan for implementation. In the emerging economy markets, all factors

influencing the health sector, need to be fully understood. This is inclusive of the socio-political and economic states, the relations between private and public health institutes and as well as the end user needs for which the product is designed. Managers therefore need to conduct extensive pre-implementation research into the sector to tailor make the most suitable business model.

The founding of a telemedicine industry is a massive venture. Its founding requires the interaction of multiple stakeholders and service providers with different capabilities and capacities. The recommendation is for managers to understand and embrace collaborative efforts to leverage off each partners strengths and capabilities to ensure the best outcome form collaborative efforts. Lessons on how to maximize the benefits of collaborative networks are described above.

Lastly, managers need to recognise that the founding of new projects does not only entail its planning and design but should be followed through with post-implementation practices to enable the evaluation of successes and to identify areas of improvement. This can be accomplished through the establishment of governing boards and personnel's, or through the devising of regulatory rules and guidelines. This is imperative as it assures that ethical and quality services are provided, which ultimately secure sustainability of the project.

7.8. Recommendations for Future Research

The recommendations for future researchers include:

Telemedicine is a new industry. There is limited research conducted in this scope of practice, therefore the recommendation is that more needs to be done in trying to understand it. Any form of research that pertains to telemedicine will help in adding to the body of knowledge in this arena.

There is a need for further research to be conducted in the areas pertaining to business modelling for the health sector. The health industry is a specialised and sensitive industry that does not always fit the typical business modelling structures of other industries. Understanding how business modelling can be better suited for the industry may assist in an approach in tailoring it for the telemedicine industry.

The health industry in South Africa is complex. It has many influencing factors that

one needs to understand, when researching health related matters. There was a paucity of information on the factors that influence healthcare in South Africa. More so, on how time and all its elements has shaped the South African health sector. If one is to understand the current context in health, this information is necessary, and is therefore a recommendation for future research.

7.9. Research Limitations

There are a few limitations related to the research methodology of which the reader should be made aware.

Saunders & Lewis (2012); Zikmund et al. (2013) reported that due to the subjective nature qualitative research, it is prone to have numerous biases. This research study may therefore be affected by the biases of the researcher.

Owing to the digital health industry being a niche space, a sampling type that was purposive in nature was chosen. This resulted in the selection of a homogenous group of individuals with similar characteristics, attributes, values and interests. This was a subjective sampling technique, with a resultant effect of a non-probability sampling strategy which may further transfer bias.

The sample size selected represented individuals from different sectors operational within the health sector, however each pool had only one representative. This may not be a large enough sample size to reflect statistical significance or give an objective view. However, it provides sectoral heterogeneity and variance in opinions.

The sample selected comprised of key stakeholders in the health profession, excluding other sectors or other stakeholders that are not considered to have a key role of influence within the industry, yet may be equally as impactful or powerful. This may result in the neglect of information that could significantly affect the outcomes of the research.

Qualitative research is unable to quantify the proposition. It only gives insight into the constructs of study and not the extent to which they influence. However, it would be erroneous to correlate the extent of positive quantification of research with the credibility of the research done. Therefore, this point is nullified.

Lastly, readers cannot replicate the research unless the exact conditions under which the research was conducted are applied. It also cannot be generalised from sample to population. This implies that the research is therefore specific for a particular time, place, scenario or environment and is not applicable in others. This may pose a challenge in achieving the objective of the study, which is to design a comprehensive and perhaps usable framework that is transferable to other emerging economies.

7.10. Conclusion

The telemedicine industry is an example of a complex system wrought with wicked problems. Application of the Complexity of Wicked Problems Theory in large Scale Systems to telemedicine, provided a better understanding of its challenges and facilitated in the drafting of a comprehensive framework that proposes some solutions to these challenges. The literature review defined four main constructs which were deductively explored in the research interviews, further detailing themes that were customised for the local market. The themes and sub-themes gave insight into how South Africa as an emerging economy can go about planning and implementing telemedicine practices, given its unique challenges. These findings were compiled into a Comprehensive Telemedicine Framework, with the hopes that such findings are replicable to other emerging market industries.

Appendix

Appendix 1: Research Questions and Interview Schedule

Introductory Questions:

1. Please introduce yourself and briefly describe your role and involvement with telemedicine.
2. What is your understanding of telemedicine?
3. How do you think the South African Demographics and local culture will influence the implementation telemedicine platforms in South Africa?

Research Question 1: What type of business modelling and strategy is required for the successful implementation of telemedicine in emerging markets?

1. What do you think are the strategic and business modelling pre-requisites for a successful telemedicine industry in South Africa?
2. Do you think a new and innovative business model is required to ensure telemedicine success in our setting, or do think we can borrow from regions where it has been trailed and tested? Explain.
3. How do you think the telemedicine service will bring utility to the South African consumer?

Research Question 2: What role does collaboration play in the founding of a successful telemedicine industry in South Africa?

1. How do you think stakeholder collaboration will facilitate the successful implementation of telemedicine in South Africa?
2. What do you think are the pros and cons of collaborative partnerships in this new venture development?
3. What type of collaborative partnerships do you think are required in the implementation of telemedicine platforms in South Africa?

4. What elements are important to consider in collaborative partnerships? (i.e timing of the collaborations)

Research Question 3: What are the ethical and regulatory management considerations in the successful implementation of telemedicine in South Africa?

1. What ethical and regulatory considerations must be taken into account with the implementation of telemedicine in South Africa?
2. How do you think stakeholders address these considerations?
3. Who do you think are the relevant stakeholders to ensure the legal, ethical and regulatory practices in telemedicine SA?

Research Question 4: What role does infrastructure play in the success of telemedicine in South Africa?

1. What consultative (data collection, storage, sharing) infrastructure do you think is required for the success of telemedicine in South Africa?
2. What administrative infrastructure do you think is required for the success of telemedicine in South Africa?
3. What challenges do you foresee in the implementation of telemedicine practices in South Africa and how do you think we address these?

Other:

Any other thoughts you would like to add?

Appendix 2: Informed Consent (PIC 4)

PATIENT OR PARTICIPANT'S INFORMATION CONSENT DOCUMENT FOR ANONYMOUS INTERVIEWS

Researcher's name: Doreen Monakise

Student Number: 18370782

Department: MBA

University of Pretoria: Gordon Institute of Business Science

Dear Patient / Participant / Student / Learner / Parent / Client **.....**

Defining a comprehensive telemedicine framework for emerging market healthcare industries.

I am a **2ND YEAR** student/s in **MBA** in the Department of **GIBS** University of Pretoria. You are invited to volunteer to participate in our research project on **Defining a comprehensive telemedicine framework for emerging market healthcare industries.**

This letter gives information to help you to decide if you want to take part in this study. Before you agree you should fully understand what is involved. If you do not understand the information or have any other questions, do not hesitate to ask us. You should not agree to take part unless you are completely happy about what we expect of you.

The purpose of the study is to conduct a qualitative research report studying emerging market healthcare innovation through The Complexity of Wicked problems theory lens.

We would like you to participate in a telephonic interview. This may take about **60** minutes.

The researcher will conduct telephonic semi-structured interviews as a means of data collection, using the questions on the interview schedule as a guide. Confidentiality and anonymity will be ensured as the data will be kept in a safe place and the names of participants will not be used in the write up of the research. **Should you feel the interview has sensitive questions, you need not answer these questions.** In the event of questions asked, which will cause emotional distress, then the researcher is able to refer you to a competent counselling.

Also please note that the researcher will be available to help you with any concerns or enquiries you may have.

The Research Ethics Committee of the University of Pretoria, Faculty of Health Sciences,

telephone numbers 012 3541677 / 012 3541330 granted written approval for this study.

Your participation in this study is voluntary. You can refuse to participate or stop at any time

without giving any reason. Once you have participated in the study, you can recall your consent. We will be able to trace your information and refrain from its use in the research. However, this is prior to the final stages of the research write up.

Note: The implication of completing the interview is that informed consent has been obtained from you. Thus, any information derived from your form (which will be totally anonymous) may be used for e.g. publication, by the researchers.

We sincerely appreciate
your help.

Yours truly,

Dr. Doreen Monakise

WRITTEN INFORMED CONSENT

I hereby confirm that I have been informed about the nature of this research.

I understand that I may, at any stage, without prejudice, withdraw my consent and participation in the research. I have had sufficient opportunity to ask questions.

Respondent: _____

Researcher: _____

Date: _____

VERBAL INFORMED CONSENT *(Only applicable if respondent cannot write)*

I, the researcher, have read and have explained fully to the respondent, named

_____ and his/her relatives, the letter of introduction. The respondent indicated that he/she understands that he/she will be free to withdraw at any time.

Respondent: _____

Researcher: _____

Witness: _____

Date: _____

Contact number of the Researcher: **Research Supervisor:**

Doreen Monakise Meena Ambaram

083 627 9739 meena.ambaram12@gmail.com

18370782@mygibs.co.za

Appendix 3: Code Name and Grouping

Table 1 - Code Name and Grouping

Code Group Name	Code Name	Groundedness	Number of Groups
Telemedicine	understanding of telemedicine	13	1
	success of telemedicine	5	1
Utility of Telemedicine	utility of telemedicine	12	1
	ques	8	1
	pros	8	1
	health access	17	1
	ethics	4	2
	cost saving	9	1
	convenience	5	1
Tech Adoption	youth	2	1
	User experience	2	2

	trust	4	1
	tech adoption	8	1
	elderly: adoption	3	1
	change management	4	2
Business Modelling	two tier health model	2	1
	scale	3	1
	niche project designs	4	1
	NHI	11	1
	integration of health services	9	1
	implementation cost saving	4	1
	grants	4	1
	equity	5	1
	education	5	1
	business modelling	17	1

	4IR	2	1
Strategy	strategic planning	6	1
	process mapping	4	1
	phased roll out	4	1
	personalisation	3	2
	low price, high volumes	4	1
	localisation of solution	23	1
	learning form others	10	1
Government	organising body	7	1
	government inefficiencies	5	2
	government	3	1
Private Stakeholders	university institutions	2	1
	stakeholders	52	1
	independent	4	1

	telemedicine board		
PPP	trusted brands	3	1
	speed to market	3	1
	PPP	3	1
	mutual benefits	6	1
	market access	2	1
	IP theft	3	1
	intentional collaborations	7	1
	complex system	4	2
	collaboration	19	1
Data Protection	vetting	4	1
	regulations	18	1
	POPI	7	1
	guidelines	7	2

	data storage	2	1
	data protection	13	2
	data privacy	2	2
	block chain	4	2
	authentication	3	1
Ethics	informed consent	5	1
	guidelines	7	2
	existing relations	2	1
	ethics	4	2
	data collection	7	1
	child data collection	2	1
	approach to regulation	12	1
	accountability	7	1
Administrative Infrastructure	staff	2	1

	practice management system	4	1
	billing	4	1
	administrative infrastructure	9	1
Administrative Infrastructure	USSD	3	1
	User experience	2	2
	smartphone access	8	1
	real time use	5	1
	infrastructure	22	1
	data coverage	4	2
	connectivity	15	1
	Cloud services	6	1
	block chain	4	2
Challenges	weather elements	2	1

	theft	4	1
	system mistrust	6	1
	policy restraints	3	1
	personalisation	3	2
	government inefficiencies	5	2
	data protection	13	2
	data privacy	2	2
	data coverage	4	2
	cultural diversity	5	1
	costs	7	1
	cons	7	1
	complex system	4	2
	change management	4	2
	challenges	18	1

Appendix 4: Respondent to Code Group

Table 2 - Respondent to Code Group

	EMR specialist	Telemedicine consultation platform entrepreneurs	Tech Billing specialist	Telemedicine Industry specialist	Data collection entrepreneur	Data privacy specialist	Telemedicine Healthcare provider	Mobile App Entrepreneur	Telemedicine (niche) Entrepreneur	Health tech pharmacy entrepreneur	Cloud service and data storage Entrepreneur	Health tech IT consultant	Ethics Specialist
administrative infrastructure	1	4	0	2	1	3	2	1	0	2	1	1	0
business modelling	7	9	4	6	7	6	6	1	4	2	2	4	7
challenges	9	7	8	5	12	4	5	7	9	5	1	3	8
consultative infrastructure	8	12	2	3	9	5	5	2	4	6	4	3	5
data	7	7	3	4	3	4	4	4	4	3	4	3	6

protection													
ethics	6	9	2	1	2	10	3	0	1	1	2	2	7
government	1	2	3	0	0	0	0	0	2	1	1	1	4
PPP	3	0	3	3	10	4	1	4	7	4	3	2	4
private stakeholders	4	4	5	6	13	6	3	2	3	3	2	3	4
strategy	5	8	4	4	5	5	2	3	3	3	2	6	4
tech adoption	1	5	0	0	2	1	2	0	1	2	3	2	2
telemedicine	1	3	1	2	1	1	1	1	1	0	3	1	2
utility of telemedicine	3	6	3	5	8	6	6	2	1	7	3	3	7

Appendix 5: List of Relevant Stakeholders

Table 3 - Relevant Stakeholders

Public Stakeholder	Private Stakeholder	NGO	Academic Institutions
Government	Doctors/HCP	Non-profit Organisation in any role of the value chain	Public and Private
Government institutions: public hospitals and clinics	Nurses		
Regulatory Boards	Health Insurance and Medical Schemes		
	Pharmaceutical and Dispensing Firms		
	Entrepreneurs		
	Investors and Funders		
	Members of the Public		
	Independent Regulators Bodies and Boards		

	Multi-Nationals		
	Legal Teams		
	Billing Services		
	Telecommunications		

Appendix 6: Consistency Matrix

Table 4 - Research Questions and Interview Schedule

Research Question	**Literature Review**	**Data collection tool** **(Semi-Structured interview Questions)**	**Analysis**
RQ1: Does the founding of a successful telemedicine industry in South Africa require a new business model and new strategy formulation?	(Hwang & Christensen, 2008); (Teece, 2010); (Peters et al., 2015); (Srai & Lorentz, 2019); (Rachinger et al., 2018); (Christensen et al., 2015); (Atun, 2012); (Casadesus-Masanell & Ricart, 2010)	4. What do you think are the strategic and business modelling pre-requisites for a successful telemedicine industry in South Africa? 5. Do you think a new and innovative business model is required to ensure telemedicine success in our setting, or do think we can borrow from regions where it has been trailed and tested? Explain. 6. How do you think the	Thematic Analysis

		telemedicine service will bring utility to the South African consumer?	
RQ2: Does collaboration facilitate the successful implementation of telemedicine in South Africa?	(Santoro et al., 2018); (Smirnova et al., 2018); (Najafi-Tavani et al., 2018); (Dahan et al., 2010); (Wang & Hu, 2017); (Advisors, Forum, Corporation, & School, 2007);	5. How do you think stakeholder collaboration will facilitate the successful implementation of telemedicine in South Africa? 6. What do you think are the pros and cons of collaborative partnerships in this new venture development? 7. What type of collaborative partnerships do you think are required in the implementation of telemedicine platforms in South Africa?	Thematic Analysis

		8. What elements are important to consider in collaborative partnerships? (i.e. timing of the collaborations)	
RQ3 : Is ethics and regulatory management an important element to consider for the success of telemedicine in South Africa?	(Seddon & Currie, 2013); (Yuan et al., 2018); (Deborah Lupton, 2017); (Wildman et al., 2016); (Petersen & DeMuro, 2015); (Information Regulator (South Africa), 2013); (Löhr et al., 2010);	4. What ethical and regulatory considerations must be taken into account with the implementation of telemedicine in South Africa? 5. How do you think stakeholders address these considerations? 6. Who do you think are the relevant stakeholders to ensure the legal, ethical and regulatory practices in telemedicine SA?	Thematic Analysis

RQ4: What role does infrastructure play in the success of telemedicine in South Africa?	(Mengesha & Garfield, 2019); (Araya Abrha Medhanyie et al., 2015); (Chandwani et al., 2018); (Kidholm et al., 2012); (Stroetmann, Artmann, & Stroetmann, 2011b); (Nickelsen, 2019); (Aldossary et al., 2017); (Güler & Übeyli, 2002);	4. What consultative (data collection, storage, sharing) infrastructure do you think is required for the success of telemedicine in South Africa? 5. What administrative infrastructure do you think is required for the success of telemedicine in South Africa? 6. What challenges do you foresee in the implementation of telemedicine practices in South Africa and how do you think we address these?	Thematic Analysis

Appendix 7: Description of Participants

Participants	Position	Organisation Size	Industry	Race	Gender	Experience
EMR Specialist	Head of Solutions, strategic business development	Large	Health Tech	Asian (Indian)	Male	17 Years in Technology, 10 years at current firm Electronic Medical Records (EMR), Practice Management
Data Collection Entrepreneur	Chief Executive Officer and Founder of an emerging AI Company	Small	Artificial Intelligence, Voice recognition products	Black	Male	8 years' experience, Integrated Intelligence of Technological Tools, Intelligence systems, Multiple industry focus including health technology, Tech entrepreneur and inventor, Data collection
Tech Billing Specialist	Consultant	Large	Health Billing/Collections	White	Male	3 years' experience, Medical administrations and

						Collection using technology
Telemedicine Industry Specialist	Chief Executive Officer and Founder of a Medical Booking platform	Large	Health Tech	Asian (Indian)	Male	Online Booking Platform, Health Marketplace, Health practice Integration, Telemedicine, Industry Specialist, Digital healthcare industry stakeholder
Telemedicine Consultation Platform Entrepreneur	Medical Doctor, Co-Founder of a Practice management Platform	Small	Healthcare	Black	Male	Practice Management System, Clinical data management, Clinical support and education, Telemedicine
Data Privacy Specialist	Data Protection Officer	Large	Multiple Sector	White	Female	8 years' experience, Data Privacy and Protection, Fellow in information privacy, Member of the International Association of Professionals

						(5 years as an advisor member)
Telemedicine Healthcare Provider	Medical Doctor	Small	Healthcare	Coloured	Female	Medical Professional using telemedicine to provide healthcare services
Mobile App Entrepreneur	IT Consultant, Entrepreneur	Small/Start-up	Multiple Industries (IT Consultant) Health Tech (Entrepreneur),	Black	Male	7 years' experience as a mobile applications Developer, IT specialist
Telemedicine (Niche) Entrepreneur	Founder of an AI, Banking and Technology Company	Small/Start-up	Telemedicine (Niche Markets: providing services for the blind)	Black	Male	3 years' experience in AI and technology, Owner of IP for niche market services/products provided
Health Tech Pharmacy	ICT (Information and	SME	Multiple Industry	Black	Male	4 years' experience Occupational Health and Pharmaceutical ICT services:

Entrepreneur	Technology) Entrepreneur					providing services to mines/miners, Collaborations with government for medical ICT service provisions,
Cloud Service and Data Collection Entrepreneur	Founder of a Cloud Services Company,	Large	Multiple Industries	White	Female	Former employee of a multinational ICT listed company. In collaboration with the former firm providing cloud service support, emerging market, SME (small, medium enterprise) ICT support, telemedicine cloud service support
Health IT Consultant	IT professional and Consultant, Director of a Healthcare Consulting firm	SME	Health Tech, Multiple Industries	Black	Male	12 years' experience IT professional. HCP, laboratory, Health institution ICT support. Strategist and Implementor of ICT services

Ethics Specialist	Ethics Consultant	SME	Bioethics, Medical Ethics, Risk Management, Public Health			Telemedicine law regulations (3 years' experience), Ethics and Regulations advisor, law and regulation drafting

Appendix 8: Ethical Clearance

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Health Sciences

The Research Ethics Committee, Faculty Health Sciences, University of Pretoria complies with ICH-GCP guidelines and has US Federal wide Assurance.

- FWA 00002567, Approved dd 22 May 2002 and Expires 03/20/2022.
- IRB 0000 2235 IORG0001762 Approved dd 22/04/2014 and Expires 03/14/2020.

29 August 2019

Approval Certificate
New Application

Ethics Reference No.: 557/2019
Title: Defining a comprehensive telemedicine framework for emerging market healthcare industries.

Dear Dr D Monakise

The **New Application** as supported by documents received between 2019-07-19 and 2019-08-28 for your research, was approved by the Faculty of Health Sciences Research Ethics Committee on its quorate meeting of 2019-08-28.

Please note the following about your ethics approval:

- Ethics Approval is valid for 1 year and needs to be renewed annually by 2020-08-29.
- Please remember to use your protocol number (557/2019) on any documents or correspondence with the Research Ethics Committee regarding your research.
- Please note that the Research Ethics Committee may ask further questions, seek additional information, require further modification, monitor the conduct of your research, or suspend or withdraw ethics approval.

Ethics approval is subject to the following:

- The ethics approval is conditional on the research being conducted as stipulated by the details of all documents submitted to the Committee. In the event that a further need arises to change who the investigators are, the methods or any other aspect, such changes must be submitted as an Amendment for approval by the Committee.

We wish you the best with your research.

Yours sincerely

Dr R Sommers
MBChB MMed (Int) MPharmMed PhD
Deputy Chairperson of the Faculty of Health Sciences Research Ethics Committee, University of Pretoria

The Faculty of Health Sciences Research Ethics Committee complies with the SA National Act 61 of 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 and 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes, Second Edition 2015 (Department of Health)

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