

**Gordon Institute  
of Business Science**  
University of Pretoria

**Leveraging Communication Information Communication  
Technology systems (ICTs) as a driver of Innovation within  
the South African Healthcare Sector.**

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A research report submitted to the Gordon Institute of Business Science,  
University of Pretoria, in partial fulfilment of the requirements for the degree of  
Master of Business Administration

9 November 2015

## Abstract

South Africa is regarded as a developing country yet the gap in the Gini Coefficient presents realities of inequitable access to services including healthcare. “South Africa has a dichotomous demography of first and second economies” existing in this country and this has impacted the adoption of technologies in healthcare (Chikotie & Owei, 2008). The research study conducted aims to provide insight on the relationship between Information Communication Technology (ICT) and innovation on healthcare performance in South Africa.

The researcher attempts to contribute to the existing body of knowledge by: (1) Investigating whether communication within ICTs promotes innovation and whether this innovation in turn is significant to improving healthcare in South Africa; (2) developing a tenable multi-dimensional framework that can be utilised by healthcare providers to implement and align with the organisation’s strategy; and (3) providing specific recommendations for future researchers to improve management focus.

The study aims to make a significant contribution by providing healthcare organisations with a framework that is a useful resource to their management, to address the gaps in healthcare innovation and ultimately assist in achieving the National Development Plan (NDP) 2030 vision of providing sustainable quality healthcare to all South African citizens at an affordable rate.

The researcher adopted a mixed methodology to triangulate and interpret the subject matter more accurately. 35 Hospital Managers were surveyed and 15 Senior Executive Managers were interviewed from a large private South African Hospital Group to provide insight into the adoption of ICTs in healthcare organisations.

The researcher finds that communication within ICTs drives innovation and in turn is significant to improving healthcare in South Africa. If well executed, communication shall drive innovation which shall allow healthcare organisations the ability to maximise opportunities by improving their value propositions with an enhanced quality of care while rationalising cost. The performance of healthcare organisations is dependent on leadership competencies and a culture of innovation that has the ability to overcome the barriers of adoption and the ability to deal with change. The ICT Innovation Maturity Matrix (IMM) developed by the researcher proposes a degree of integration between ICT utilisation, innovation maturity and an organisation’s performance.

**Keywords:** Information Communication Technology (ICT); Innovation; Healthcare; Innovation Adoption; Knowledge Transfer; Organisational Design; Culture; Complexity Leadership.

## Declaration

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Masters of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted previously 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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Date:

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# Chapter 1: Introduction

## 1.1 Preamble

The global healthcare industry is currently confronted with three key challenges within its obligation to provide accessible affordable healthcare to all.

First is the requirement of cost reduction without compromising the quality of healthcare. The National Development Plan (NDP) 2030 has identified that one of the key challenges that South Africa faces is the sustainability of the quality of healthcare provided to South African citizens at an affordable level (both in the public and private sector) (National Planning Commission, 2030).

The second challenge encompasses the noteworthy increase in healthcare concerns. The productivity of an economy is dependent on a healthy workforce. The constraints that South Africa is confronted with are the disintegrating healthcare system and a rising disease malady. This is supported by Manuel, Ramaphosa & Altman (2010) who provide an alarming view of South Africa's health status in comparison to world standards. In accordance with the United Nation's Human Development Index (HDI), South Africa ranks 118th in the world with regard to the total health expenditure as a % of GDP and the healthcare system is ranked 132 out of 144 countries (public and private health expenditure) (Global Competitiveness Report, 2013). The status of healthcare in South Africa poses a threat to the economic growth of the country.

The third challenge is the technologically driven revolution that is shifting the healthcare industry's locus of control by impacts of disruption that is meant to support proactive healthcare reforms. Disruption in the healthcare industry includes self health and alternate methods of treatment as opposed to the traditional doctor patient visits and in-hospital stay. Technology is providing patients with growing expectations of enhanced service delivery that will force healthcare providers to adopt certain technologies to become more supportive of proactive treatment. The status of innovation in South African healthcare is not as advanced and as fast paced as in first world countries. South Africa is not at the forefront of innovation and the NDP 2030 has identified that technology can be utilised to solve some of the biggest challenges in healthcare (African Innovators Round Table, 2015).

To address these challenges, many scholars and industry experts are lobbying healthcare innovation as a prospective solution (Millar, 2013). Information Communication Technology Innovation is seen as the miracle of post modernity that seeks to improve

interconnectedness with the global healthcare fraternity and to identify global healthcare solutions and enhance service delivery in the healthcare value chain by evoking stakeholder transformation. Information Communication Technology refers to technologies applied to gather, share and distribute knowledge, and communicate within the healthcare eco-system (Gressgård, Amundsen, Aasen, & Hansen, 2014).

ICT not only supports firms in achieving operational excellence but to facilitate competitive advantage (Corso & Gastaldi, 2012). The South African government has stressed the development and implementation of an ICT strategy. The South African government is taking a keen interest in ICT, however collaboration and participation is required from the private sector (African Innovators Round Table Conference 2015).

## **1.2 Research Title**

Leveraging Communication via Information Communication Technology systems (ICTs) as a driver of Innovation within the South African Healthcare Sector.

## **1.3 Research Problem**

Most of the research conducted on healthcare innovation and ICT informs the benefits and constraints of adoption. Little research has been conducted on the association of ICT innovation and performance of healthcare (reduced cost and improved service delivery).

Research studies suggest that South Africa is the leading ICT developer in healthcare on the African continent yet it is poorly adopted in underprivileged communities (Gillward & Esselaar, 2004).

Although South Africa is regarded as a developing country, the gap in the Gini Coefficient presents the realities of inequitable access to healthcare by a large component of South Africans. "South Africa has a dichotomous demography of first and second economies" existing in the country and this has impacted on the adoption of technologies in healthcare (Chikotie & Owei, 2008).

To appropriately explore/exploit the opportunities from prevalent innovative technology, it is imperative for organisations to understand the productivity barriers and to implement and align an innovation framework with the organisation's strategy. Organisations should also transform their culture to be one that is ambidextrous to explore and exploit capabilities to foster a culture of innovation (O'Reilly & Tushman, 2013).

To summarise the research problem, South Africa is facing challenges in its obligations to provide affordable healthcare. ICT and innovation offer possibilities of advancements that can eliminate some of the challenges.

## **1.4 Research Aim and Objectives**

The status of healthcare in South Africa desperately needs assistance and there are opportunities to achieve the NDP 2030 aspirations through innovation initiatives within organisations to support the process of alleviating socio-economic pressures. The proliferation of ICTs has garnered great advancements in other sectors; however adoption in the healthcare sector is slow (Omachonu, 2010).

The study aims to provide guidance and a framework to healthcare providers:

- to implement and optimise ICTs;
- to implement and align an innovation framework within the organisation's strategy and;
- to implement an organisational design that promotes a culture of innovation awareness.

The primary objective of this research study is to explore the relationship between Information Communication Technology and innovation and their impact on healthcare performance in the private sector, with the view to extrapolating private sector findings and posing similar inferences on the public sector.

The secondary objective is to contribute towards developing a tenable multi-dimensional innovation framework that can be utilised by healthcare providers to implement and align innovation with the organisation's strategy.

## **1.5 Context of the study**

There are elements that require explanation in order to provide context to the identified research problem:

- Information Communication Technology systems (ICTs);
- Innovation and;
- Healthcare sector in South Africa.

## Information Communication Technology:

Information Communication Technology is an umbrella term that has been used by academic researchers since the 1980's and the range of definitions that have emerged and evolved has posed challenges for scholars to agree on an explicit meaning. One needs to consider the varied applications and context of the environment within which ICT is applied to appropriately classify the term ICT (Zuppo, 2012).

The researcher has investigated a number of definitions to contextualise the term within the scope of this research study.

For the purposes of this research study, Information Communication Technology shall refer to devices and networks/systems that are utilised as communication mechanisms in an organisation to conduct business (Zuppo, 2012). Joan Dzenowagis (2006) supports the view that ICTs is a key instrument for synchronising complex activities, promoting collaboration and encouraging information exchange among various stakeholders.

Information Communication Technology refers to technologies applied to gather, share and distribute knowledge, and communicate through the use of computers and networks (Gressgård et al., 2014).

According to World Health Organisation (WHO), the use of ICTs in healthcare is not only about technology but rather about a means to reach an anticipated series of consequences that contribute to the provision of better healthcare, treating and monitoring patients, training and educating learners and ensuring that adequate research is conducted to implement innovation successfully to improve service delivery (Dzenowagis, 2006).

Information and Communication Technologies shall be interchangeably referred to as either ICT or ICTs depending on the application of the term.

## Innovation:

Innovation can be defined as the intentional introduction and application within a role, group, or organisation, of ideas, processes, products or procedures, new to the relevant unit of adoption, designed to significantly benefit the individual, the group, or wider society (West, 1990). Although many versions of definitions have evolved subsequently, this definition encompasses all the elements relevant to this research study. Table 1 describes the different dimensions of innovation.

**Table 1: Dimensions of Innovation (Bessant, 2009)**

Product Innovation	Changes in the things (products/ services) that an organisation has to offer.
Process Innovation	Changes in the way in which products are created and delivered.
Position Innovation	Changes in the context in which the product/ services are introduced.
Paradigm Innovation	Changes in the underlying mental models which frame what the organisation does.

This research study will not be limited to a specific innovation dimension. The research will accommodate and incorporate innovation across all the above dimensions.

### Healthcare in South Africa:

Healthcare in South Africa is divided into the public and private sector. The public sector is currently resource constrained and under dire stress to deliver services to approximately two thirds of South Africa's population.

The private sector services the other one third of South Africa's middle to high income earners who belong to a medical insurance scheme.

## **1.6 Layout and Structure of the Research**

This research paper constitutes 7 chapters. The chapters are described as follows:

### Chapter 1: Introduction/ Background

This is the introductory chapter that outlines:

- The purpose and relevance of the study of ICTs and innovation in healthcare in relation to hospital financial and operational performance, in terms of reduction of costs and improvements to service delivery;
- A discussion of the contextual background elements of the research study, outlining the scope of the study;
- The formulation of the research problem statement;
- The significance of the study and the contribution to academia and the business world.

## Chapter 2: Literature Review

- This chapter illustrates a conceptual model that positions the literature review and;
- A critical evaluation of the literature reviewed that reveals the various arguments from researchers relating to the themes constructed in the conceptual model.

## Chapter 3: Research Hypotheses

This chapter contains a detailed explanation of the proposed research hypotheses that is the subject of the study.

## Chapter 4: Research Methodology

The research process followed encompasses:

- The study design including the paradigms, theoretical models and the qualitative, quantitative nature of the study;
- The research design including the population and sampling techniques used and; the research instrument/s used;
- The data collection procedures and the data analysis tools and techniques in relation to this study have been provided, followed by a discussion of the ethical considerations, the validity and reliability of this study.

## Chapter 5: Research Results

- This chapter provides a detailed account of the results and a summary of the empirical data collected to prove the hypotheses.

## Chapter 6: Interpretation of Results

- This chapter contains an interpretation of the results from the data analysis in order to draw inferences and make deductions that shall inform the objectives of this research study.
- The researcher shall confirm the results in this chapter back to the theory and literature in Chapter 2.

## Chapter 7: Conclusion

- This chapter emphasises the findings of the research study and provides specific recommendations to future researchers summarising the salient issues and areas that require further examination.

## 1.7 Organisational Identity

For purposes of this study; a large private hospital group formed the basis of the research. Due to anonymity and confidentiality; the researcher shall refer to the organisation as Large Hospital Group.



## Chapter 2: Literature Review

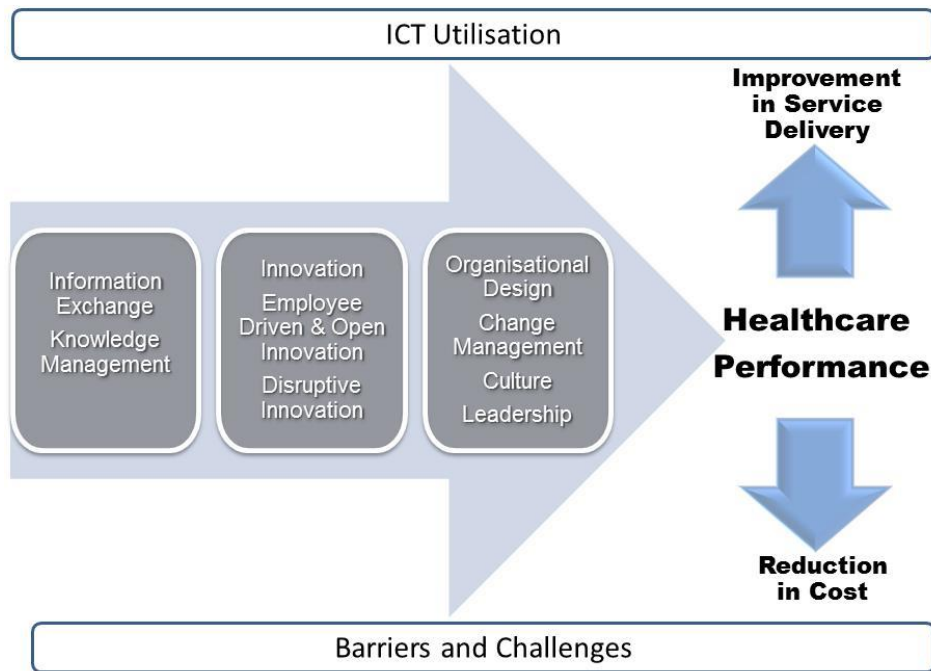
### 2.1 Introduction

The literature review in this chapter shall traverse through the key elements of the research study with the objective of justifying the construction of the research hypotheses in the chapter to follow.

Rosenberg (2012) puts forth such an imperative evolution revelation of world healthcare. Rosenberg highlights that healthcare in the future shall be data and customer driven, morphing into a service delivery model of healthcare concepts such as increasing self-diagnostics, self-monitoring, and self-medication. The transformation of the traditional healthcare model has created a shift from institution-centred care to citizen centred care (Almunawari & Anshari, 2011). In the evolving healthcare industry, the behaviour and expectations of patients in a digital era needs to be factored into service delivery. Where previously the activities of marketing initiatives were not considered as important to create value to the patient as a customer. Customer Relationship Management (CRM) can be defined as a strategy to retain and attract new customers (Kotler & Keller, 2012). In the healthcare industry, the behaviour and expectations of patients in a digital era needs to be factored into service delivery. CRM in healthcare includes the creation of networks between patients and healthcare providers with multi-way communication and information sharing mechanisms. Implementing data driven management systems and Information Communication Technology allow for more informed decisions to manage care and contributes to the reduction of total costs of a sustainable healthcare system as well as the ability to provide better quality of care and manage customer relationships (Almunawari & Anshari, 2011).

The researcher developed the following conceptual framework in Figure 1 to guide the literature review by review of literature topics covered by other scholars.

**Figure 1: Conceptual Framework of the Research Study**



In today's data era, ICT plays an enabling role to achieve operational excellence and competitive advantage (Corso & Gastaldi, 2012). The strategic decision making process is facilitated by knowledge management and transfer. ICTs expedite the knowledge management and transfer process (Corso & Gastaldi, 2012).

The successful implementation of ICTs shall incite innovation in healthcare organisations (Iakovidis, 2012).

## 2.2 Knowledge Management and Transfer

An organisation requires information that is translated into knowledge in order to obtain value. Goh & L.S. (2005) defines the construct of Knowledge Management as a generic process through which organisations generate value from knowledge. The study conducted by Myllärniemi, Laihonen, Karppinen, & Seppänen (2012) recognises the importance of inter-organisational knowledge resources.

While information and knowledge generates value, MacDonald, Bath, & Booth (2011) have researched the contrast between information overload vs. information poverty and have concluded in their findings that the lack of information within organisations has contributed to managers being unable to make strategic decisions. Information infrastructure and communication mechanisms are required to support good decision making practices. The healthcare industry has become a data intensive one and decisions are required to be driven by big data decision making principles.

## 2.3. Knowledge Transfer Inhibitors

Ansell (2007) posits that in order to use knowledge, it is imperious to understand knowledge transfer. While many researchers have outlined the significance of knowledge transfer, it is crucial to understand the factors that inhibit the delivery of such. Gupta and Govindarajan, 2000; Szulanski, (1996) indicate that the two main barriers of knowledge transfer is knowledge stickiness and knowledge ambiguity. The concept of knowledge stickiness is discussed by Szulanski (1996) as the inability or unwillingness to transfer knowledge. Cappetta, Jensen & Szulanski, (2004) also presented findings that support the origin of stickiness. Stickiness can come from organisational design. We shall discuss organisational design as a concept on its own. Many other researchers suggest that one of the organisational factors key to effective knowledge transfer is ICT systems (Sher and Lee, 2004; Sargeant, 2009).

Alavi and Leidner (2001); Sargeant (2009); Paswan and Wittmann (2009) established that ICT in healthcare organisations has the effect of accelerating knowledge transfer enabling rapid access to information and creating the potential for internal and cross organisation collaboration. Gressgård et al. (2014) supports the notion that the role of knowledge in an innovation process is an imperative one.

While the benefits of ICT has been researched in abundance, many scholars debate the richness of ICT as a knowledge transfer mechanism in the absence of face to face contact especially in environments such as healthcare. Roberts (2000) predicts that advanced ICT may provide enough contexts leading to the "death of distance."

Househ, Kushniruk, Carleton, & Cloutier-fisher (2011) have studied the impact of ICTs on social interaction and have concluded that although the advantage of using ICTs will be increased interactions (web conferencing, skype, etc), the level of social interactions may not be as strong.

Antecedent research studies suggest that the success of knowledge management transfer may also be affected by the introduction of innovation (Bandyopadhyay and Pathak, 2007; Liu and Liu, 2008). Maintaining effective knowledge transfer capabilities facilitates an advanced level of innovation (Gressgård et al. 2014). Knowledge transfer is positively related to innovation as a competitive advantage.

Alavi and Leidner (2001) express the potential of utilising ICT to systematise, expedite and enable cross-border knowledge transfer. The paramount benefits of ICTs are its reach, knowledge-sharing benefits and its ability to support innovation (Karunakaran, 2013).

## 2.4 Big Data and Decision Making

Increasing volumes of patient and organisational data that are available from a number of sources increases the complexity of the healthcare landscape (Chen & Storey, 2012). Big data is described by 4Vs:

- Volume of Data (large amounts of data available)
- Variety of Data (data available from a variety of sources and networks)
- Velocity of Data (the speed at which data is collected and converted into knowledge)
- Value of Data (the value created from the data collected) (SAS, 2012).

Big Data has provided institutions with the ability to utilise data to make real-time strategic and operational decisions (Gartner, 2015). Healthcare organisations have the opportunity to exploit big data technology as a valuable resource for data driven decision making as opposed to experience driven decision making (Arbor; Beard; Belle; Najarian; Navidi; Soroushmehr & Thiagarajan, 2015). Decision making in a critical sector like healthcare necessitates effective and efficient knowledge transfer. Riusala and Smale (2007) debate that a source of competitive advantage organisations have over its competitors is the opportunity to leverage off their intangible assets such as industry intelligence created by big data.

## 2.5 Innovation

Schumpeter, known as the father of innovation, describes the process of technological change as:

- invention (conceiving a new idea or process),
  - innovation (arranging the economic requirements for implementing an invention),
  - diffusion (whereby people observing the new discovery adopt or imitate it).
- (Chestbrough, 2003)

Innovation in healthcare continues to be an influential force in the pursuit to balance cost control and healthcare quality delivery (Omachonu, 2010).

Omachonu (2010) describes innovation in healthcare as two principal dimensions: environmental and operational dimensions. The dimensions are the contributing factors to the introduction of innovation in healthcare organisations is depicted in Table 2.

**Table 2: Innovation in Healthcare: Two Principal Dimensions:**

Operational dimensions:	Environmental Dimensions:
• the improvement of clinical	• organisational culture,
• efficiency,	• regulatory acceptance,
• effectiveness,	• partnerships and collaborations
• aging population,	
• nursing shortage,	
• patient satisfaction,	
• profitability,	
• patient safety,	
• improved quality and cost	

Source: (Omachonu, 2010).

For the purposes of this research the innovation dimensions will be discussed where applicable, however the study will not be focussed on any particular dimension.

Hansen & Birkinshaw (2007) present innovation as a sequence of events in a three step process: idea generation; idea development and diffusion of developed ideas. This process is called the Innovation Value Chain as depicted in Figure 2.

**Figure 2: Innovation Value Chain**



Source: (Hansen & Birkinshaw, 2007)

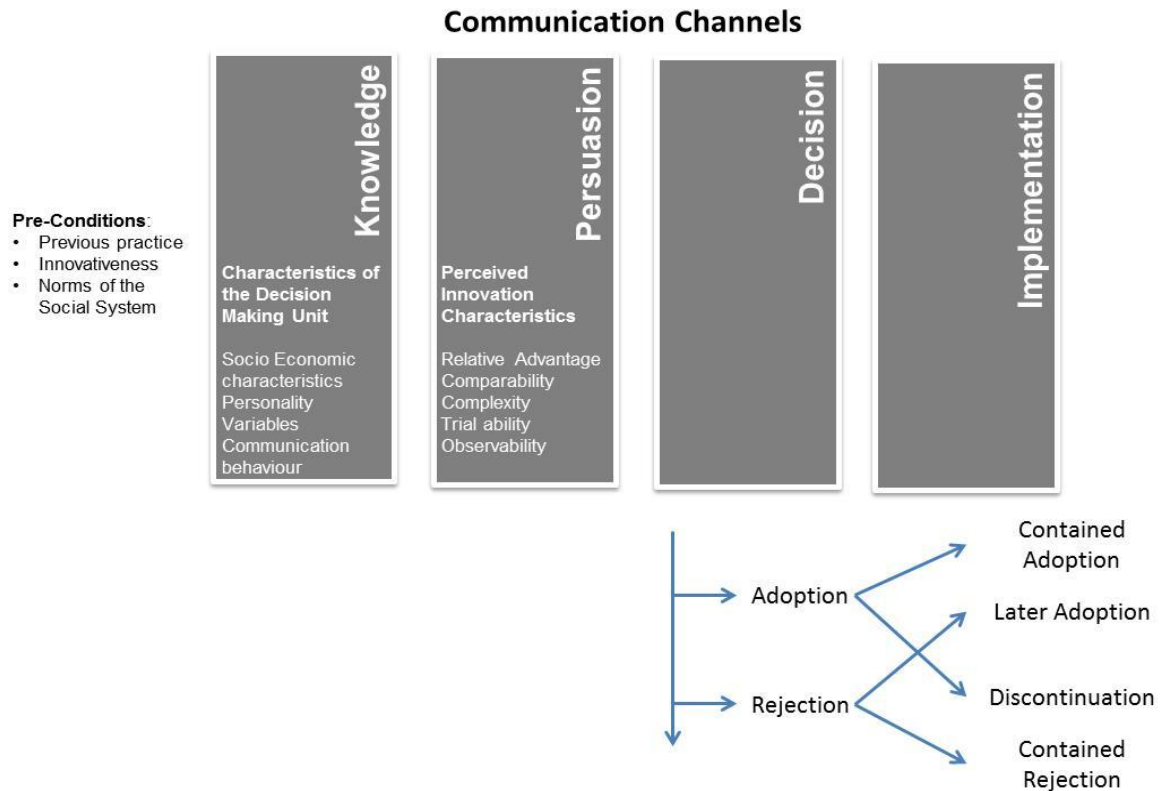
Rogers (2003) defines diffusion as the process by which innovation is communicated through certain channels over time among the members of a social system. Figure 3 below illustrates the diffusion process. The five attributes of innovation are: relative advantage, compatibility, complexity, trialability and observability.

The five steps involved in the innovation decision process are: knowledge, persuasion, decision, implementation and confirmation.

The social components within an organisational structure is seen to either facilitate or impede diffusion where previous practices, perceived needs/ problems/ innovativeness and norms of the social systems are seen as key variables in the process. The decision step in the process is essential as this informs further action. It is key to understand the

diffusion process to leverage the strengths in an organisation and to tap into the potential barriers. This shall be discussed in detail in this chapter.

**Figure 3: Rogers Diffusion of Innovation (DOI)**



Source: (Rogers, 2003)

## 2.6 Managing Innovation in Organisations

Strategy is developed and managed at top management level and innovation tends to follow the same organisational direction (Anderson & King, 1991). Anderson (1991) criticises organisations that adopt a “top- down” innovation approach as this leads to organisational oversight to recognise and incorporate the views of operational staff to ensure that the innovation process is complete. Organisations cannot work in silos and manage information on an individual basis. This is further corroborated by Karunakaran (2013) in his discussion of Collaborative Information Behaviour. This insight led to a review of Employee Driven and Open Innovation.

### 2.6.1 Employee Driven Innovation

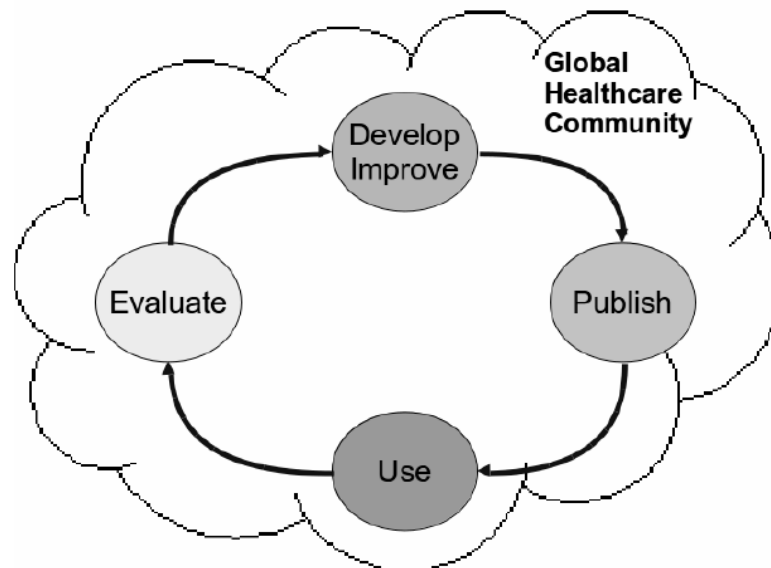
The concept of Employee Driven Innovation (EDI) is based on the premise that employees acquire specialised knowledge exclusive of management and this is a differentiator in the potential for employees to contribute to innovation solutions in an organisation (Gressgård et al., 2014). The application of ICT tools benefits the EDI process.

## 2.6.2 Open Innovation

Open innovation has seized the attention of many academic scholars from a varied range of disciplines across diverse industries. Many stakeholders play a role in innovation in an organisation and the ownership of knowledge contribution should not be limited. Traditional, closed, top-down approaches to implementation will no longer work for innovation that is essential for continuous improvement in healthcare systems. The healthcare industry has been indoctrinated by closed systems that have fostered inflexible, high and slow adoptive strategies (Molin, 2011). The fundamental difference between open and closed systems is the interaction with stakeholders external to an organisation that could contribute to the organisation's development. Companies should encourage and support the open innovation paradigm in order to adopt strategies that form a competitive advantage by creating innovation networks (ICTs) (Frey, Lüthje, & Haag, 2011).

An open source innovation model as illustrated in Figure 4 is required as a foundation for aligning and driving Information Communication Technology (ICT) innovation and adoption of a global healthcare community. The model in Figure 4 suggests that the process of developing improvements and executing them be an open process shared collaboratively.

**Figure 4: Open source process model**



Source: (Frey et al., 2011)

## 2.7 Quality Assurance and Data Security

Data security has become a threat to all industries to the interconnectedness and accessibility of data and systems. In order for organisations to ensure that all data is secure, quality assurance practices should be implemented. Open innovation should

have paramount consideration for data security implications. It is important to note that with the increased autonomy innate in open innovation comes greater accountability of the ICT community to ensure quality control and quality assurance (Molin, 2011).

Complete and accurate recordkeeping is especially important in multi-disciplinary healthcare systems where various healthcare professionals are involved in delivering healthcare aimed at achieving the best possible outcome for the patient. The completeness and accuracy of clinical recordkeeping impacts on the continuous management and monitoring of patient care. An increasing administrative burden on healthcare staff may impact on the quality of information.

The complex regulatory requirements faced by the healthcare industry together with onerous information communication technology (ICT) legislation requirements places great emphasis on data security, privacy and the management of information.

The Protection of Personal Information (POPI) Act was signed into law by the President of South Africa on 26<sup>th</sup> November 2013, however as at the end of October 2015 the President has not yet declared the date at which the POPI Act will become effective. Once the POPI Act becomes effective it is expected to have an impact on the manner in which organisations collect, process, secure, store and destroy personal information as it aims to protect the right to privacy contained in the Constitution. Organisations that breach the provisions of the POPI Act face potential fines, criminal convictions, civil action and damage to their brand and reputation. POPI affects the entire business as data is collected from multiple sources and is utilised by business processes and applications and subsequently stored in many locations / data repositories (Deloitte, 2014).

## **2.8 Disruptive Innovation**

Omachonu (2010) define disruptive innovations as innovation that transforms old systems into new systems, creating new market segments and adding value to the business. In sectors such as healthcare where knowledge is extensive, effectively leveraging open innovation denotes adopting disruptive change in business processes (Chesbrough, 2003). The locus of innovation is shifting to respond to external stimuli and this can be viewed as disruptive innovation. Although much research has been conducted on efficiencies that can be gained from healthcare innovation, the space to watch is disruptive innovation and the impact on the future of healthcare (Li, Westbrook, Callen, & Georgiou, 2012).

The demand for healthcare is becoming one where the customer controls the demand (eg. self-service units and treatment) and this could be a game changer for this industry. The implementation of ICTs in healthcare organisations has the ability not just to improve



quality in the current business processes though innovation, but to identify radical innovation (Li et al., 2012). While incremental innovations are necessary to provide improvements to existing products and services, radical and breakthrough innovation has the potential to steer healthcare providers ahead of its competitors. Organisations are fearful of radical innovation and this fear paralyses the launch and mobility of great ideas (Panne, 2003; Kuyatt, 2011).

Some of the latest and exciting innovation in the healthcare industry include (African Innovators Round Table, 2015):

- An electronic health record (EHR) that provides each individual with a secure, private lifetime record of their key health history and care that can be shared electronically with authorised health providers in support of the proliferation of ubiquitous connectivity required for continuity of care.
- Robotic Assisted Laparoscopic Prostatectomy that improves the overall quality of laparoscopic prostatectomy.
- Cancer Care: Leading medical technologies: Molecular Imaging, Computed Tomography, Magnetic Resonance, Ultrasound, Interventional and Diagnostic Oncology.
- Telehealth- a collection of means or methods for enhancing healthcare and health education delivery.
- mHealth (mobile health) is a general term for the use of mobile phones and other wireless technology in medical care.
- Electroencephalogram (EEG) can assist the visually impaired and the motor function impaired.

These are among the many disruptive innovations affecting the healthcare industry. Most recently, an innovation intervention that shall increase access to healthcare on a global scale is Gene-RADAR. Dr Anita Goel, a Harvard-MIT-trained physicist is at the leading edge of innovation that provides the ability to perform mobile testing of diseases including HIV, malaria, tuberculosis, and certain types of cancer. Gene-RADAR is a mobile tool the size of an iPad that provides diagnosis with a drop off blood or saliva and is cheaper than current tests (African Innovators Round Table, 2015).

Although there are substantial gaps in healthcare and the world of innovation is fertile, there are many challenges and factors that are impeding the diffusion of innovation and ICTs (Challenge et al., 2012).

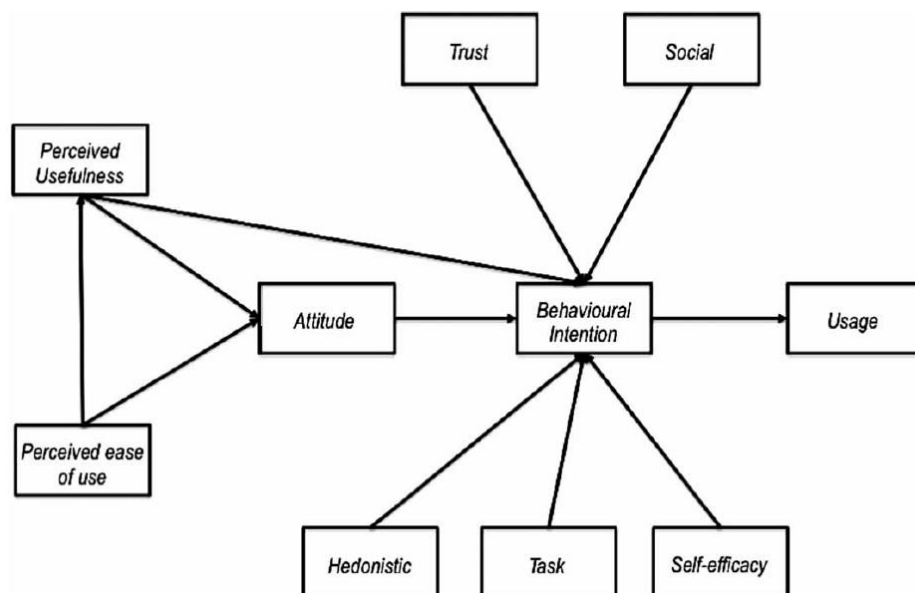
## 2.9 Challenges and Success Factors in Innovation Diffusion

Research spans across several theories to explain innovation adoption and resistance. The Diffusion of Innovation (DOI) is a widely used theoretical model which seeks to identify innovation communication (Rogers,1995). The Technology Acceptance Model (TAM) is a model that focuses on the attitudinal explanations of intentions to use a specific technology or service (Davis F, 1989). Other models include: The conceptual model of the problems in Front End Innovation (Hannola & Ovaska, 2011); the adoption categories (Rogers, 2003) and Berwick's (2003) diffusion influential factors.

### 1) Technology Acceptance Model (TAM)

The model focuses on the attitudinal explanations of intentions to use a specific technology or service (Davis F, 1989). The original TAM shows the interaction of the 5 variables in the model (Davis F, 1989). The perceived usefulness and perceived ease of use predict attitude toward using innovation. This in turn influences the user's behaviour intention to use the innovation and predict the actual use of the innovation (Davis F, 1989). There have been many extensions to the TAM model over time and the theory still remains influential in technology adoption predictability (Wentzel, 2012). The proposed extension to the TAM is shown in Figure 5.

**Figure 5: Wentzel's Extended TAM**



Source: (John P Wentzel, Krishna Sundar Diatha & VSS Yadavalli, 2013)

Wentzel (2013) studied a sample of “bottom of the pyramid” consumers to assess the appropriateness of “fit” of the enhanced TAM when considering the adoption of technology-enabled services. The findings can be related to the adoption of ICTs in the healthcare industry.

The findings of the research showed that attitude was found to be the most important construct in the model. A discussion of some of the barriers below:

#### **Functional Barriers:**

##### 1) Perceived Ease of Use (PEAU)

The end- user perception is the most important factor to the success of adoption of ICTs in healthcare. The implementation of ICT systems must be embedded by formal and informal change management processes. Generally information provided on most ICTs is in English. This is a deterrent to non-english speaking healthcare staff.

##### 2) Perceived Use (PU)

The value derived from the implementation of ICTs must be communicated. Self-efficacy is the confidence an individual has in his or her ability to use a specific technology (Agarwal et al., 2000). Healthcare providers view their academic background as a reason for the slackness in ICT skills (Chikotie & Owei, 2008).

##### 3) Risk Barrier

An organisation’s maturity for risk is fundamental to the adoption of ICTs. An organisation may have a risk averse attitude toward the possible structural or organisational changes resulting from innovation and toward the cost associated with innovation.

#### **Psychological Barriers:**

##### 4) Image Barrier

Training and creating awareness with end-users is key to removing the psychological barriers. Engaging and including end-users can have immense progressive impact on adoption of ICTs. One of the main advantages of the approach is sustainability through ownership, trust and commitment by end users (Juciute, 2009).

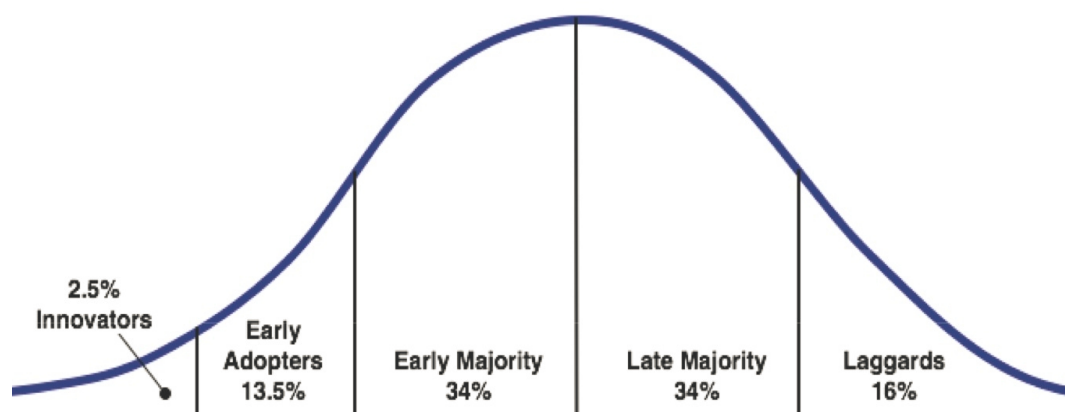
### 5) Traditional Barrier

A massive mind set shift is required to change in order for technology to be adopted and this comes with the inculcation of a culture that acts as a change agent.

## 2) Adoption Categories (Rogers, 2003)

Adoption is an individual process detailing the series of stages one goes through from first hearing of a product to finally adopting it. The adoption categories are key to influencing healthcare organisations' adoption of ICTs. Figure 6 shows the adoption categories

**Figure 6: Adoption Categories**



Source: (Rogers E, 2003)

- Innovators are the first individuals to adopt an innovation. The early adopters are associated with individuals willing to take risks.
- Early adopters are typically individuals and organisation's with advanced education of technology and other megatrends.
- Early Majority are these individuals that adopt new technology after some time. They tend to be slower in the adoption process.
- Late Majority: adopt after the average member of the society. These individuals approach innovation/ technology with a high degree of scepticism.
- Laggards: these are the last to adopt. These individuals have an aversion to change.

## 3) **Conceptual model of the problems in Front End Innovation** Hannola & Ovaska (2011)

Hannola & Ovaska (2011) represents a conceptual model of the problems in Front End Innovation in Figure 7. Communication channel challenges and inefficiencies

have been recognised as an impediment to communication in this innovation process.

**Figure 7: Conceptual model of the problems in Front End Innovation**

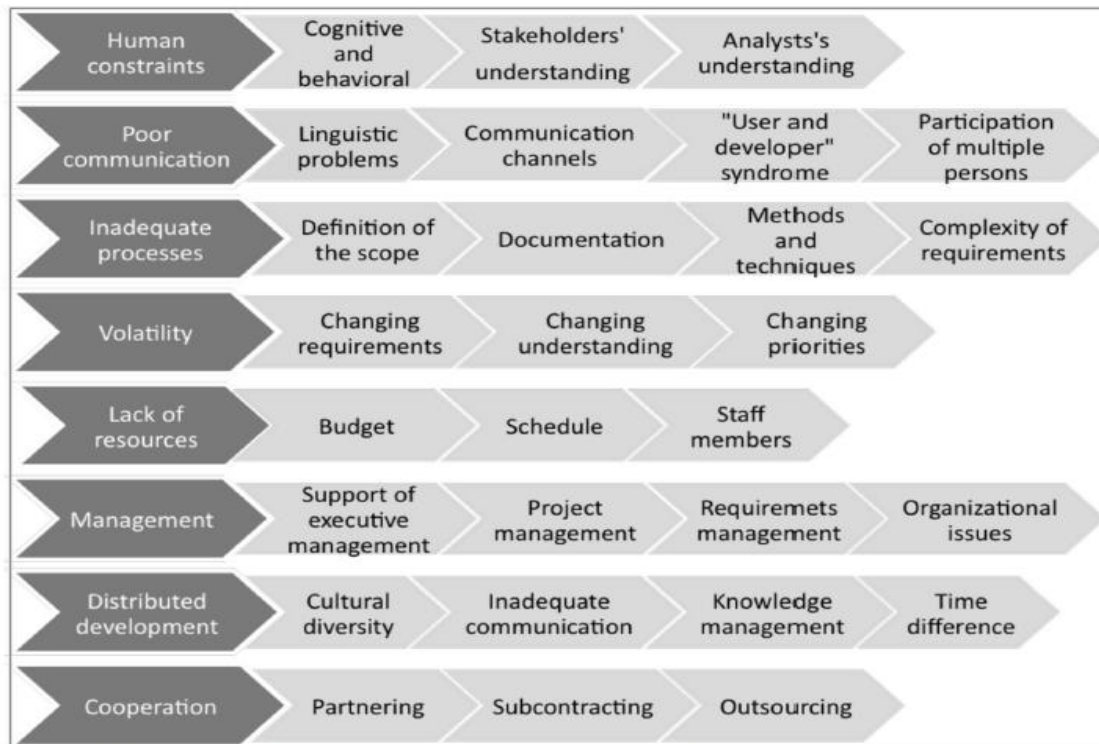


FIGURE 1 Conceptual model of the problems in the front end of innovation in IS

Source: (Hannola & Ovaska, 2011)

In addition, Berwick (2003) discusses the challenges of innovation diffusion. He identifies three influential factors viz: the perceptions of the innovation, the characteristics of the individuals who may adopt the change, and contextual and managerial factors within the organisation. The theory suggested by Berwick (2003) conceives seven recommendations for healthcare organisations to consider when executing innovation ideas: find sound innovations, find and support “innovators,” invest in “early adopters,” make early adopter activity observable, trust and enable reinvention, create slack for change, and lead by example. Although Berwick’s recommendations are principally sound, a critique thereof would be the requirement for a communication tool underpinning the model.

Academics have widely explored the role of ICT on the healthcare sector but limited research has been conducted on ICT and the manager’s perspective. Chikotie & Owei (2008) from a South African context, in their recent research combined all the theories of innovation adoption, as described above, and proposed a pragmatic framework from their research to determine why ICT adoption in South has been so sluggish. Figure 8

represents the framework that Chikotie & Owei (2008) proposed. It includes both the perspective of management and patients.

**Figure 8: Perceptions toward ICT Adoption:**



Source: (Chikotie & Owei, 2008).

Dissemination of innovation is extremely difficult in most organisations (Berwick, 2003). ICTs promote active cross functional participation in the innovation process which aligns the expectations of all stakeholders. This alignment creates ownership, enthusiasm and commitment to successful implementation of innovation ideas in an organisation. In this research study, there will be focus on key innovation dissemination factors and the formulation of a strategic innovation framework.

In order for organisations to overcome some of the barriers of innovation diffusion, it is necessary to prepare the eco-system appropriately with strategic direction.

## 2.10 Organisation Design and Culture

Ultimately an organisation should build innovation energy and an organisational design to support the use of knowledge and intellectual property of the organisation (Tidd & Bessant, 2009). This research study shall endeavour to explore and recommend an optimal organisation design to foster an innovation culture. (Tidd & Bessant, 2009) describes an organisational structure as visible artefacts of innovation culture.

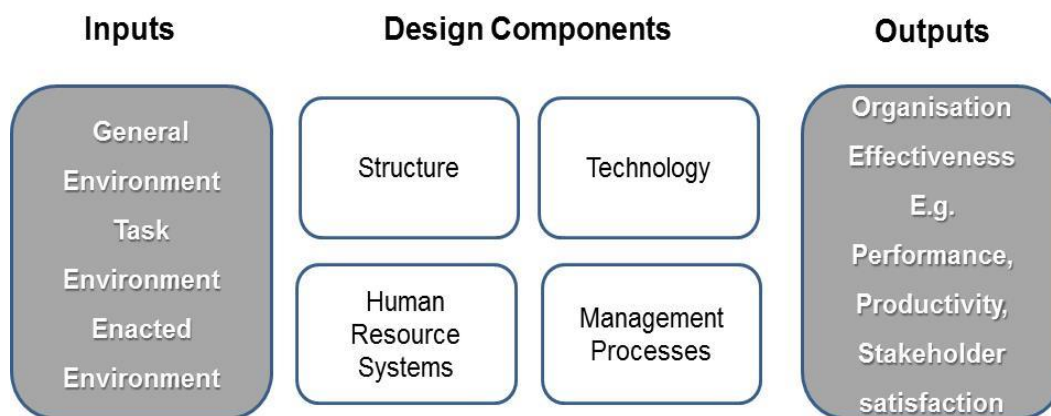
Cevahir, Uz Kurt, Rachna, Kumar, Halil, Semih, Kimzan, Gozde (2013) accurately points out that numerous academic studies have been conducted in the field of organisational culture and the correlation with innovation. Uz Kurt's research took a step further in

assessing the significance of innovations and organisational on firm performance. Although this research would provide validation of positive correlation between organisation culture, innovation and firm performance, the study was limited to a specific industry in a specific geographic location (the banking sector in Turkey).

Various measurement tools may be utilised to measure an organisation's innovation status (Gamal, Salah, & Elrayyes, 2011; Margot, 2014). Birkinshaw's Innovation Chain model shall be utilised to define questions within the research design to represent the organisation's innovation culture. This will inform the research study regarding innovation and improvements in quality of healthcare.

Avey, Eenan & Rennan, (2010) conducted a study to research the explicit and implicit business models within healthcare with the objective of understanding innovation management in the healthcare environment. The findings of the study have shown that although collaboration is a universally well accepted strategy practice, the structure of the organisation will dictate the business models required to facilitate innovation. Cummings & Worley (2013) describe the components of an organisations design as per Figure 9:

**Figure 9: Organisational Design**



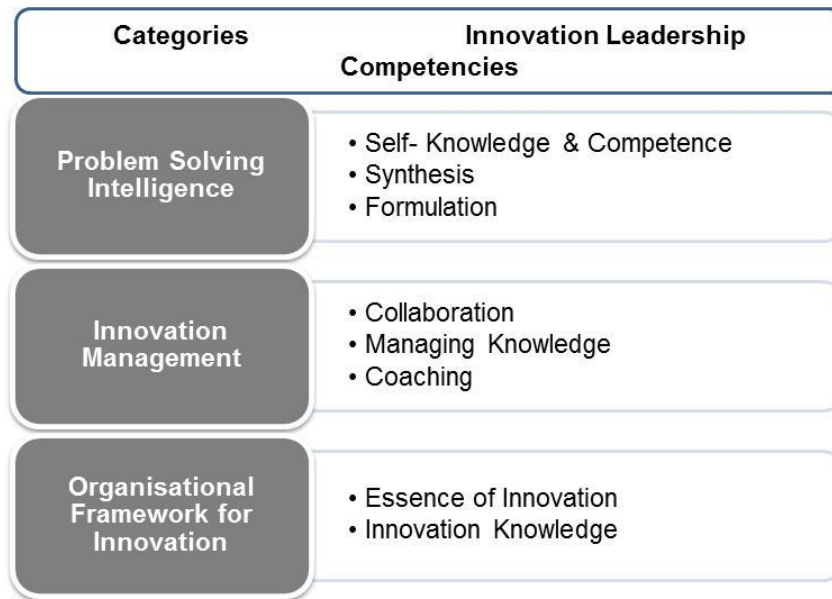
Source: (Cummings & Worley, 2013)

Culture has been widely theorised as an influential factor on an organisations performance. Leadership plays a key role in the creation of an organisation culture.

## 2.11 Innovation Leadership

New leadership strategies like innovation leadership explain the importance of human capital and leader's role in managing innovation. Weberg (2013) suggests that there are nine innovation leadership competencies that fosters a culture of innovation as seen in Figure 10: self-knowledge and competence, synthesis, formulation, collaboration, managing knowledge, coaching, essence of innovation and innovation knowledge.

**Figure 10: Innovation Leadership Competencies**



Source: (Weberg, 2013)

The problem-solving intelligence category represents four competencies: self-knowledge and competence, synthesis, and formulation. Idea generation is the first stage of the innovation process and it would be fitting that a leader's ability to use his/her own self-knowledge, synthesising information, and formulating a solution would be activities of this idea generation process (Kirby, 2012).

Problem-solving techniques are based on Sternberg's Triarchic theory of intelligence; a theory of that differentiates three aspects of intelligence: analytic skills; creativity; and practical skills (Clinkenbeard, Ferrari, Grigorenko & Sternberg, 1996). The triarchic theory of intelligence plays a supporting role within a culture of innovation leadership.

The second category of innovation leadership competencies is innovation management and this includes collaboration, managing knowledge, and coaching. The Leader-Member Exchange Theory is crucial in the equation of innovation leadership as it reasons the relationship between leaders and employees. Innovation development enhances these relationships and connectedness (Kirby, 2012).



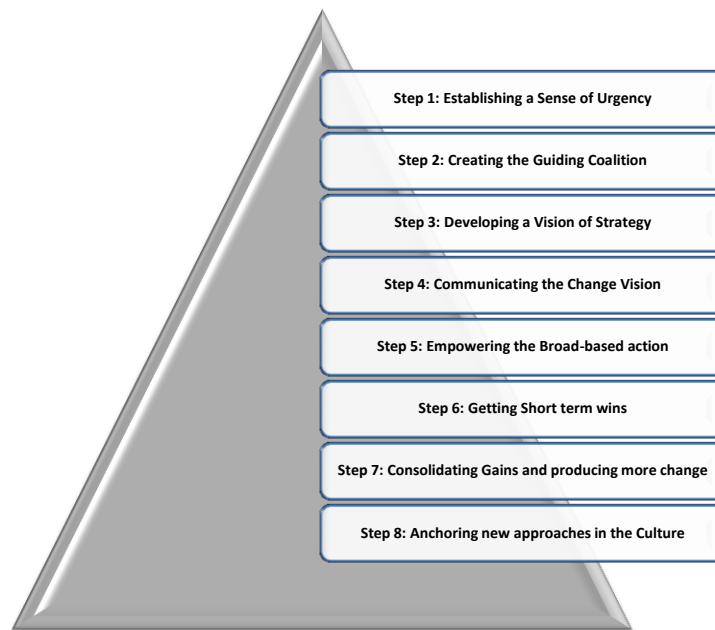
The last category of innovation leadership competencies is the organisational framework which includes essence of innovation and innovation knowledge. Employees need to be motivated to focus energy on ideas, processes, products or procedures, new to the relevant unit of adoption, designed to significantly benefit the individual, the group, or wider society (Kirby, 2012) i.e. innovation.

Employee motivation can be explained by Intrinsic Motivation Theory. Incentivising individuals with rewards from an individual's intrinsic motivation has been proven to engage employees within an organisation (Robbins, 2013).

A multitude of leadership theories aim at examining leadership capabilities required in healthcare organisations. Complex Leadership Theory (CLT) challenges traditional leadership theories regarding behaviours of command and control where the unit of analysis is leader and follower. CLT is based on the concept of complex adaptive system, or CAS (Bruce J. Avolio, Fred O.Walumbwa and Todd J.Weber, 2009). Successful implementation of innovation is highly dependent on a leadership style that facilitates information flow, openness and value driven relationships.

Successful change requires committed leadership and buy-in at all levels of the organisation. Traditional management approaches would not suffice to cascade the influx of innovation. Kotter's 8 steps of change management in Figure 11 provide management and leaders with a tool to efficiently manage change in an organisation.

**Figure 11: Kotter's 8 steps of Change Management**



Source: (Webster, 2012)

## **2.12 Innovation reduces the cost of Healthcare and improves service delivery**

Innovation has the potential to create a differentiated system. The differentiation would lie in the changing Customer Value Proposition of healthcare, one that entails lower costs, higher quality, and greater convenience (Chikotie & Owei, 2008).

Service delivery in all industries has become very tricky. It is no longer just about the delivery of services, the creation of value to the customer has become imperative (Kotler & Keller, 2012). This is no difference in the healthcare industry and the delivery of quality healthcare is dependent upon innovative initiatives that focus on the patient experience (Corso & Gastaldi, 2012).

## **2.13 Summary of Literature Review**

“Healthcare is at the dawn of a new era, belatedly joining other sectors to undergo a major transformation, in order to serve all patients more efficiently. In the face of ageing populations and exploding new technologies, it may be impossible to cut overall healthcare spending, but it’s within our grasp to bend the cost curve to achieve faster, cheaper and better healthcare” (PWC Report, 2012).

“According to KPMG’s report, Expect the Unexpected: Building business value in a changing world, there are 10 sustainability ‘megaforces’ which will dramatically change how healthcare is conceived and delivered in the decades to come” (KPMG International, 2014). Organisational innovation is highly dependent on effective knowledge management and transfer (Myllärniemi et al., 2012).

Alavi and Leidner (2001) express the potential of utilising ICT to systematise, expedite and enable cross-border knowledge transfer. The paramount benefits of ICTs are its reach and its knowledge-sharing benefits and its ability to support innovation Karunakaran (2013).

In sectors such as healthcare where knowledge is extensive, effectively leveraging open innovation denotes adopting disruptive change in business process (Chesbrough, 2003). The locus of innovation is shifting to respond to external stimuli and this can be viewed as disruptive innovation.

Dissemination of innovation through traditional closed methods have yielded sub-optimal results Efficiency is constrained by many challenges. Open Innovation models mark the dawn of transition that could assist the healthcare industry to fully leverage the value and

potential of ICTs. Several theories seek to explain the challenges and success factors of innovation diffusion.

In order for organisations to overcome some of the barriers of innovation diffusion, it is necessary to prepare the eco-system appropriately with strategic direction. Ultimately an organisation should build innovation energy and an organisational design to support the use of knowledge and adoption of Innovation and technology (Tidd & Bessant, 2009). Change management is a crucial component to creating a culture that supports innovation.

Communication has been identified as a fundamental component to an effective innovation framework (MacVaugh & Schiavone, 2010). Although this point seems obvious, Barrett, Davidson, & Vargo (2015) indicates that communication solidifies new ways of working.

Based on the literature review above, the researcher seeks to amalgamate and extrapolate the insights from the existing body of knowledge to develop a tenable multi-dimensional framework that can be utilised by healthcare providers to yield optimal results from ICT implementation.

In the ensuing chapter, the researcher attempts to express clear, concise, and unambiguous research hypotheses that shall address the research study objectives.

## Chapter 3: Research Hypotheses

### 3.1 Introduction

In this chapter the researcher explains the objective of the research study in the form of hypotheses.

A hypothesis is a testable tentative statement of the expected relationships between variables (Field, 2013; Weiers, 2011). Specifying the research hypotheses is one of the most important steps in planning a scientific quantitative research study. The elected method in this research study is a mixed methodology that is dominated by a quantitative research approach.

The conceptual framework in Chapter 2 clearly illustrates the concepts and objective of this research study. The hypotheses have been formulated based on the literature review and the objective of the research study. Statistical tests are subject to erroneous outcomes and the researcher was aware of the potential errors. The errors in hypotheses testing are expressed as follows in Table 3.

**Table 3: Types of Error**

Type of Error	Definition
Type 1	<p>A type I error occurs when the null hypothesis is true, but is rejected.</p> <p>A type I error, or false positive, is asserting something as true when it is actually false. This false positive error is basically a “false alarm”. It is a result that indicates a given condition has been fulfilled when it actually has not been fulfilled.</p>
Type 2	<p>A type II error occurs when the null hypothesis is false, but erroneously fails to be rejected.</p> <p>A type II error, or false negative, is where a test result indicates that a condition failed, while it actually was successful. A Type II error is committed when we fail to believe a true condition.</p>

Source: (Saunders & Lewis, 2012)

In statistics, a null hypothesis is a method for testing whether the phenomenon being studied produces no effect or makes no difference (Field, 2013). Hypotheses are stated in the null form.

### 3.2 Hypotheses

Stated in declarative form the hypotheses in this research study are:

#### Hypothesis 1:

H0: Null Hypothesis	Information Communication Technology is not a key strategic driver of innovation
Ha: Alternate Hypothesis	Information Communication Technology is a key strategic driver of innovation

The hypothesis above seeks to explore the association between information communication technology and innovation.

#### Hypothesis 2:

H0: Null Hypothesis	Innovation is not key to reducing the cost of healthcare
Ha: Alternate Hypothesis	Innovation is key to reducing the cost of healthcare

#### Hypothesis 3:

H0: Null Hypothesis	Innovation is not key to improving the service delivery of healthcare
Ha: Alternate Hypothesis	Innovation is key to improving the service delivery of healthcare

The hypotheses (Hypotheses 2 and 3) above are aimed at investigating the association between innovation and the reduction in the cost of healthcare and the service delivery within healthcare.

### **3.3 Summary**

The primary objective of this research study is to ascertain whether communication within ICTs drives innovation and this Innovation in turn is significant to improving healthcare in South Africa.

The secondary objective is to contribute to develop a tenable multi-dimensional framework that can be utilised by healthcare providers to implement and align an innovation framework with the organisation's strategy.

The hypotheses described in this chapter support these objectives of the research study.

The imminent chapter describes a logical and systematic approach to test the hypotheses and to conclude on the acceptance or rejection of the claims made in these hypotheses.

## Chapter 4: Research Methodology

### 4.1 Introduction

This chapter outlines the systematic research strategy applied to this field of research study. To address the research problem, the structure of the research process followed encompasses:

- The study design including the paradigms, theoretical models and the method applied to this study;
- The research design including the population and sampling technique used and; the research instrument/s used;
- The data collection procedures and the data analysis tools and techniques in relation to this study have been provided, followed by a discussion of the ethical considerations, the validity and reliability of this study.

### 4.2 Research methodology / paradigm

This study comprises a concurrent mixed method triangulation where a quantitative strategy is dominant; supported by a limited qualitative approach. The researcher studied the differences in methodologies and the philosophical perspectives of each paradigm; and after much consideration elected to use a mixed methodology approach.

According to Kumar (2011), quantitative research is defined as explaining a phenomena by collecting numerical data that are analysed using mathematically based methods and qualitative research is a method used in many different disciplines to understand, explore and analyse data that is unstructured (Saunders and Lewis, 2012). Quantitative research is seen as structured, rigid, hard, fixed, hypothesis testing, whilst qualitative research is seen as soft, flexible and speculative (Babbie & Mouton, 2001; Kumar, 2011; Saunders and Lewis, 2012).

#### **Mixed Methodology:**

Many researchers view the difference between quantitative and qualitative research as quite fundamental, leading people to talk about 'paradigm wars' in which quantitative and qualitative research are seen as warring against each other. Many researchers view the paradigms as mutually exclusive (Creswell, 2003; Bergman, 2011). Mixed methods research has been established as a third methodology over the past twenty years (Teddlie & Tashakkori, 2009). A research philosophy contains important assumptions

regarding the way you view the world (Saunders and Lewis, 2012). Table 4 explains the key research philosophies.

**Table 4: Key Research Philosophies**

Research Philosophy:	Description / Characteristics of the Philosophy:
Positivism	A research philosophy that has highly structured methods and employed to facilitate replication, resulting in law-like generalisations. Studies observable and measurable variables in controlled conditions.
Realism	A research philosophy that stresses that objects exist independently of our knowledge of their existence.
Interpretivism	A research philosophy that advocates the necessity to understand differences between humans in their role as social actors.
Pragmatism	A research philosophy which argues that the most important determinant of the research philosophy adopted are the research question(s) and objectives.

Source: (Saunders and Lewis, 2012)

The legacy of disagreement that exists in the views of academic scholars for mixing paradigms which claim incompatibility have made it difficult for researchers to decide on the appropriate mix of qualitative and quantitative design methods.

According to Hall (2013), this leaves the researcher with three possible positions of mixed methods paradigms that may be adopted:

- the a-paradigmatic stance (completely side step the paradigm issue);
- the multiple paradigm stance and;
- the single paradigm stance.

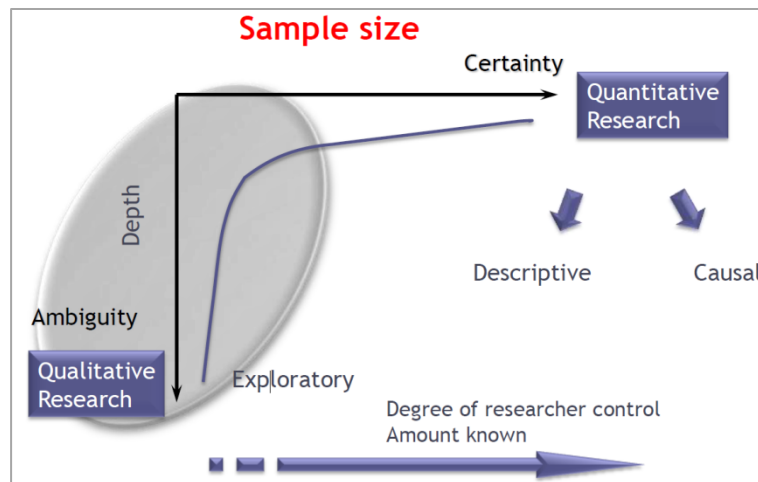
The researcher has decided to adopt a multiple paradigm approach to the study to ensure that no assumptions of philosophies are excluded.

The problem for mixed methods researchers is finding a rationale for combining qualitative and quantitative data. Figure 12 below by Chip (2014) explains the difference in methods with regard to the granularity and certainty that the designs provide. Should we wish to examine both the breadth and depth; it is best to use a mixed-methods design.



Mixed-methods research is a flexible approach, where the research design is determined by what we want to find out rather than by a predetermined outcome. The dominant method in a mixed-methods research can be either qualitative or quantitative in nature or both can have equal status (Creswell, 2003). As mentioned earlier in the chapter, this research is dominated by a quantitative method. The qualitative nature of the study allows for the discovery and exploration of concepts. The researcher did not choose only a qualitative study as a small sample size would not allow generalisability.

**Figure 12: Qualitative versus Quantitative Research: Breadth and Depth**



Source: (Chip, 2014)

In qualitative research, the researcher is not viewed as a neutral research instrument; however in quantitative research; the aim is for the researcher to remain detached from the study (Babbie & Mouton, 2001; Kumar, 2011). The researcher identified researcher bias as a limitation to the research based on the qualitative interviews chosen as one of the data collection methods. Even though qualitative studies advocate incorporating a researcher’s own perceptions, values and experiences in the study, there is much subjectivity attached to the research findings when the role of the researcher is considered. The findings may be skewed due to the influence by the researcher’s personal biases and idiosyncrasies. The quantitative surveys create the detachment factor that reduces the researcher bias.

In light of the above detailed investigation into the qualitative, quantitative or mixed methodologies, the researcher elected to adopt a mixed methodology as it was beneficial in attempting to triangulate the findings that supported the research problem.

## 4.3 Research Design

### a. Types of Studies

This research entails an exploratory study that takes descriptive research a stage further to gain insight into a new topic and to identify into relationships between variables (Saunders and Lewis, 2012). An exploratory research study can be both quantitative and qualitative and hence the researcher deemed this most appropriate to apply to a mixed methodology research design.

### b. Research Approach and Strategy

The research strategy was guided by the research questions and objectives as well as the resources available to the researcher.

When an inductive approach is adopted, the researcher uses particular facts from the study to form general rules and principles, however a deductive approach is more appropriate for research when an opinion needs to be deduced based on the information available and uses knowledge about things that are generally known to be true, in order to think about or understand particular situations or problems (Kumar, 2011).

Given that the researcher is attempting to form an opinion on whether communication within (ICTs) is a driver of innovation within the South African healthcare sector in the research study, an inductive approach is followed.

Major types of research strategies include: experimental, survey, case study, action research, grounded theory and ethnography. The researcher had the option to adopt or combine any of these strategies in this research study. Although some of these strategies are more clearly associated with either inductive or deductive approach, Saunders and Lewis (2012) suggest that it is not necessary to limit the allocation of a strategy to a specific approach. For this research study, it can be concluded that an experimental, action research and ethnographic study will not be suitable as the research centres primarily around one particular organisation and the researcher does not engage in field study or experimental activities to study the change in variables.

### **c. Time Dimension**

This research study entails a cross-sectional study that involves a single contact session with the selected sample. This is the most suitable study for the desired test of the variables. A before/ after study is not appropriate as a phenomenon is not being tested and the impact of variables is not being measured. A longitudinal study is also not appropriate as we are not testing a pattern of change over a period of time (Kumar, 2011).

### **d. Unit of Analysis, Population and Sample**

#### Unit of Analysis

The unit of analysis for this study consisted of individuals currently employed as expert professional healthcare senior executives and hospital managers within South Africa's private healthcare sector.

The unit of analysis in this study was further distilled to comprise of individual experts from the Large Hospital Group as this was used as the sample population.

#### Population

The population in this study consisted of all Hospital Managers and Senior Executives from large private hospital groups within South Africa and specifically those located and working in South Africa and not abroad. As no sampling frame could be obtained for this population a non-probability sample method was used as described below.

#### Sample and sampling method

35 Hospital Managers and 15 Senior Executive Managers at Large Hospital Group were selected for participation in this study as a deliberate consequence of their knowledge and experience of the business and their interaction between business processes and the organisational strategy.

Judgemental purposeful sampling design was chosen to identify the respondents that were best suited to provide the researcher with the information to achieve the objectives of the research study. Expert sampling was identified as the most appropriate method in this case as the contribution of management to the study would be invaluable (Saunders and Lewis, 2012).

## 4.4 Data Collection Tools/ Research Instrument

The research was supported by the Large Hospital Group Research Committee and the relevant Executive Management team which can be evidenced in Appendix 5. The introductory letter in Appendix 1 was prepared comprising of the following key information that provided contextual background to the research study:

- An introduction of the researcher and the representative academic institution;
- The main objective and relevance of the study;
- The Large Hospital Group Executive Management support and the Research Committee approval;
- General instructions including deadlines;
- An indication of the voluntary nature of the participation in the study as well as the anonymity of information provided by respondents;
- Contact details of the researcher and;
- A note of appreciation for participation in the survey.

The data collection tools used in the research study took the form of:

- Survey questionnaires and
- Interviews

### a. Survey Questionnaire

Survey questionnaires were administered online using an electronic survey tool called Survey Monkey. This survey was a click through process, making the process user-friendly and less time consuming. The questions were rated on an attitudinal Likert scale of 1 to 5 (1 being Strongly Agree and 5 being Strongly Disagree). The Likert scale assumes that each question has equal attitudinal value in terms of the issue in the question (Kumar, 2011). The questions were ordered logically to follow the objective of the study and were themed according to categories. The surveys were subject to a pilot test to ensure that the electronic survey worked, the respondents would not experience any problems in understanding the meaning of the questions and the instructions that were to be followed.

The questions in the survey and interviews were closed questions. Closed questions produce information that lacks variety and depth and there is a greater possibility of researcher bias as the researcher lists the theme he/ she is interested in. In light of this, the respondents were given the option to comment where they deemed necessary. This provided the researcher with qualitative data to explore based on the respondent's feelings, perceptions, attitudes, values and experiences. Closed questions also provided

“ready- made” categories and this made it easy for the researcher to analyse the data (Kumar, 2011). The questionnaire and interview template is included in Appendix 2.

All surveys were distributed to the Hospital Managers and collected as per the specified deadline date. The mandatory requirements field was set up during the design of the survey to ensure all questions were answered. These answers were then compiled into one document giving a clear indication and scoring per question. The scores were then transposed into a data workbook in preparation for statistical testing.

There are various advantages and disadvantages of surveys including those mentioned below:

#### **Advantages (Kumar, 2011; Saunders and Lewis, 2012)**

- It is relatively easy to manage and administer remotely via online, mail, email, or telephone. This convenience can reduce or prevent geographical dependence.
- It offers anonymity as there is no face to face interaction and this could remove any form of intimidation to the participant resulting in a higher likelihood of more accurate data.
- It can be developed in less time (compared to other data-collection methods).
- It is cost-effective as you save resources that you would expend to conduct interviews. This enhances the researcher’s ability to collect data from a large number of respondents.
- It is convenient as it can be administered.

#### **Disadvantages: (Kumar, 2011; Saunders and Lewis, 2012)**

The reliability of survey data may depend on the following factors:

- Response rates are generally low. The researcher should cater for this in the research. The researcher needs to consider that this could result in a self-selecting bias and this in turn may not be an accurate representation of the total population.
- Respondents may not feel encouraged to provide accurate, honest answers and it will not always be possible to conduct follow ups to validate the data.
- Respondents may not feel comfortable providing answers that present themselves in an unfavourable manner or could be perceived to have negative repercussions.
- Respondents may not be fully aware of their reasons for any given answer because of lack of memory on the subject, or even boredom and a response cannot be supplemented with other information. This could impede the validity of the data.

## **b. Interviews**

Obtaining information from Senior Executive Management via interviews was deemed a suitable and deliberate method as the researcher had an opportunity to ask the respondent complex questions and gain first hand insight. The respondents were key individuals in the organisation's strategy development and execution process. Interviews with 15 Senior Executive Management were scheduled and concluded during the months of June and July 2015. Interview requests were sent to the Senior Executive Management participants containing the introductory letter as well as the detailed proposal submitted to the academic institution and all relevant Ethical Clearance and Approval Documents as per Appendix 4.

The researcher utilised the same questions as that in the survey questionnaire with emphasis on comments from the interviewees. The structured interviews with the interview schedule provided uniform information that assured comparability of the data and was used in statistical tests conducted (Saunders and Lewis, 2012).

### **The drawbacks of interviews as a data collection method are:**

- Interviews are time consuming and securing interviews with Senior Executive Management is challenging.
- The researcher may introduce his/ her own personal bias in framing the questions. The analysis and interpretation of the responses are subjective.

Each interview was conducted by the researcher and the duration was approximately one hour. The researcher introduced herself and the topic of study including the methodology chosen to ensure the formulation of context and to captivate the interviewer's attention. Prior to the commencement of the interview, the interviewer was given the consent form in Appendix 3 to sign.

The option of a recorded interview was presented to the interviewees but given the sensitive information exchanged in respect of hospital information and the overarching legislative framework governing healthcare and privacy it was deemed not appropriate to record the interviews.

## **c. Questionnaire Design**

The survey questionnaire has been formulated based on the literature review in Chapter 2 and the hypotheses in Chapter 3. The interview questionnaire contained questions that were clear, unambiguous, not based on presumptions and that were non-leading. The questionnaire is structured into themes that assist in proving the Hypotheses. Table 5 below illustrates the themes in the questionnaire.

**Table 5: Themes in the Questionnaire**

Question Number	Theme	Purpose
1-8	The Communication of Information utilising Information Communication Technology (ICT's)	To explore the use and value of ICT within the organisation to drive decision making, knowledge management and ultimately Innovation.
9-22	Information Communication Technology as a key Strategic Driver of Innovation	To determine whether ICT is a key driver of Innovation and if this in turn will reduce cost and improve service delivery
23-38	Innovation in our Organisation	To ascertain the culture of Innovation in the organisation

#### **d. Data Coding**

The survey questionnaire data was extracted from Survey Monkey. The response data was in a Likert Scale, therefore minimal coding was required. The grouping of questions that formed themes was necessary. The coded data was captured on Microsoft Excel as required by the statistical analysis software. The interview commentary was not coded, but rather grouped into themes which assisted in analysing trends and commonalities.

## **4.5 Data analysis and interpretation**

### **Quantitative Analysis:**

The data collected from the online surveys completed by Hospital Managers and the interviews with Senior Executive Management was subjected to quantitative analysis.

Statistical analysis software called IBM SPSS Statistics was used to analyse the data collected. According to Field (2013) the data collected in this research study can be classified as categorical ordinal data.

#### **a. Missing Value Analysis**

The Missing Value Analysis procedure was performed as part of the data clean-up exercise to verify and validate the data by identifying any trends of missing data and as an estimation of summary statistics (Weiers, 2011).

**b. Descriptive tests**

Descriptive tests were used to construct simple portrayals of the characteristics of the data and to summarise the data. Descriptive tests include measures of central tendency and measures of dispersion (Field A, 2013).

i. Measures of Dispersion:

Measures of Dispersion describe how the data is spread around the central tendency. The most common measure of dispersion is standard deviation (Field, 2013). The researcher calculated the standard deviation and variance of the responses per question for the two data sets to show the distribution of points around the mean.

ii. Measures of Central Tendency:

Measures of central tendency measure the mean, median and mode of a data set. The Table 6 below describes the Measures of Central Tendency conducted by the researcher.

**Table 6: Measures of Central Tendency**

Description	
Mean	Given that the data on the Likert scale is interval data, the researcher calculated the mean of the responses per question in both the data sets to illustrate the average value of the responses.
Median	The median per question (Middle score) was calculated for all responses in the two data sets to compare with the mean value to ascertain skewness of the responses.
Mode	<p>The researcher illustrated the mode by conducting a frequency analysis of the various responses to express the incidents of occurrences of the various responses within the data sets.</p> <p>The frequency distribution was exhibited graphically using bar graphs.</p>

Source: (Field, 2013)



## **c. Validity**

### **External validity**

Validity can be defined as “the extent to which an empirical measure adequately reflects what humans agree on as the real meaning of a concept (Neuendorf, 2002). In asking the question “are we really measuring what we want to measure?” this study meets the condition for validity. External validity relates to the “generalisability” of learnings to groups other than the population researched (Neuendorf, 2002). The study will be relevant for healthcare providers globally. Students focusing research on quality of healthcare in the public sector will also find the results insightful. The learnings from the study can also be applied to other industries.

### **Internal validity**

Internal validity ensures the data collection process is uniform throughout. This study ensured internal validity by replicating the same questions for each respondent identified both in the executive interviews and the hospital manager questionnaires. The survey was tested on a test population prior to dissemination to ensure that there was no ambiguity in the interpretation of questions and to test the operations of the survey tool used (accessibility, ability to save and return to survey). To promote validity of the interviewee’s comments, these were transcribed immediately after the interview to limit the extent of recall error or inaccuracies in description.

### **Reliability**

Reliability is the extent to which results are consistent and yield the same results on repeated trials (Neuendorf, 2002). In order to understand and ascertain whether the questions formulated in the questionnaire all reliably measure the same underlying variable to support the constructs that are being researched in this study, statistical validity measures were performed.

These measures of Validity included:

- Cronbach’s Alpha
- Principle Component Analysis (PCA)

### a. Cronbach's alpha

A Cronbach's alpha was run on the data sets. Cronbach's alpha is a measure of validity and reliability of the set of questions to the construct (Field, 2013). The internal consistency is key to ensuring replicability of the research study, independent of the researcher.

The acceptable internal consistency measures are illustrated in the Table 7 below.

**Table 7: Internal Consistency Measures**

$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 < \alpha$	Unacceptable

Source: (Field, 2013; Weiers, 2011).

### b. Principal Components Analysis (PCA)

A principal components analysis (PCA) was run for the two sets of questionnaires to reduce the dimension of variables by eliminating redundant variables and to eliminate multi co-linearity (when two independent variables have a high correlation and they influence each other to avoid interference) (Weiers, 2011).

Conditions necessary for PCA (Weiers, 2011):

- 1) There needs to be relationships among the variables.
- 2) Further, the larger the sample size, especially in relation to the number of variables, the more reliable the resulting factors.

These two conditions can be tested using the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) and the Bartlett's Test of Sphericity (Field, 2013; Weiers, 2011).

The KMO value varies between 0 and 1, and values closer to 1 are better. A value of 0.6 is an accepted minimum. The KMO test tells us whether or not enough items are predicted by each factor. Table 8 below provides the KMO measure meaning (Field, 2013; Weiers, 2011).

**Table 8: KMO Measure Meaning**

<b>KMO Measure</b>	<b>Meaning</b>
$KMO \geq 0.9$	Marvelous
$0.8 \leq KMO < 0.9$	Meritorious
$0.7 \leq KMO < 0.8$	Middling
$0.6 \leq KMO < 0.7$	Mediocre
$0.5 \leq KMO < 0.6$	Miserable
$KMO < 0.5$	Unacceptable

Source: (Field, 2013; Weiers, 2011).

Bartlett's Test of Sphericity tests the null hypothesis by assessing significance value (sig. value less than .05) means that the variables are correlated highly enough to provide a reasonable basis for PCA analysis (Field, 2013; Weiers, 2011).

A Scree Plot shows the point of inflection. The researcher used scree plots in PCA to visually assess which components explain most of the variability in the data (Field, 2013; Weiers, 2011).

#### **d. Inferential Statistics**

Inferential statistics were applied to the data. These techniques allow the researcher to use these samples to make generalisations about the populations from which the samples were drawn (Field, 2013).

The researcher has formulated the following hypotheses based on the literature review and the purpose of this research study as articulated in Chapter 3:

H1: Information Communication Technology is not a key strategic driver of innovation.

H2: Innovation is not key to reducing the cost of healthcare.

H3: Innovation is not key to improving the service delivery of healthcare.

The selection of statistical tests was based on four major factors, namely:

- The type of data i.e. categorical ordinal in nature;
- The number of groups/samples in the research study. There are two samples in this research that formulates two data sets i.e. Senior Executive Management and Hospital Management;
- Independence of the groups/samples. The research study was conducted on two independent groups and;
- The characteristics of the data (i.e. the distribution of the data).

### **Level of Confidence:**

In order to test a hypothesis it is necessary to ascertain a confidence level. A confidence level tells us how confident you are that the results have not arisen by chance (Field, 2013). The desired level of confidence was set by the researcher at 95%.

- If this probability (p-value) is less than 0.05 this would be interpreted as a statistically significant finding as this would mean that there is a greater probability that the results have would not be achieved by chance i.e. greater than 95% certainty.
- If we have a certainty greater than 95% we reject the null claim. The null claim is the assumption that the researcher began with. This is the opposite of what is being tested.

### **Test for Normality**

A prerequisite for many statistical tests is an assessment of the normality of data (Field, 2013; Weiers, 2011). The researcher conducted a test for normality called the Kolmogorov test. This test is a non-parametric test that is used to test for normality for one or more groups in a dataset (Field, 2013; Weiers, 2011).

For a dataset smaller than 2000 elements, we use the Shapiro-Wilk test, otherwise, the Kolmogorov-Smirnov test is used (Field, 2013; Weiers, 2011). Since our data is a sample of 50 responses, we shall use the Shapiro-Wilk test. Where the p-value is less than 0.05 this would be interpreted as a statistically significant finding as this would mean that there is a greater probability that the results have would not be achieved by chance i.e. greater than 95% certainty, therefore reject the null hypothesis (Field, 2013; Weiers, 2011).

## Hypotheses Testing

As described in Chapter 2, the hypotheses in the research study seek to explore the influence of the variables ICT on innovation and innovation on reduced cost of healthcare and improved service delivery of healthcare.

The Pearson's Chi -squared test was conducted on each of the remaining variables from the PCA that related to ICT and Innovation respectively to discover if there is a relationship between the two categorical variables. Pearson's Chi -squared test was used because the data sets met the assumptions of independence of variables and the variables were categorical (Field, 2013; Weiers, 2011). Where the p- value was less than 0.05 this would be interpreted as a statistically significant finding as this would mean that there is a greater probability that the results have would not be achieved by chance i.e. greater than 95% certainty, therefore the researcher would reject the null hypothesis (Field, 2013; Weiers, 2011).

Chi -squared statistic does not give any information about the strength of the relationship. It only conveys the existence or non-existence of the relationships between the variables investigated (Field, 2013; Weiers, 2011). Phi and Cramer's V provide information about the strength of association between two variables. They can be used as measures of effect size. Phi is an appropriate statistic if the cross tabulation is a representation of 2x2 variables and Cramer's V is appropriate if the cross tabulation of variables is 2x1 (Field, 2013; Weiers, 2011). Phi and Cramer's V, the strength of association measures belong to the "r" family. The correlation measurement, called a correlation coefficient, expressed as "r" will always take on a value between 1 and – 1. If the correlation coefficient is one (1) the variables have a perfect positive correlation. If correlation coefficient is zero (0), no relationship exists between the variables. If correlation coefficient is –1, the variables are perfectly negatively correlated (or inversely correlated) and move in opposition to each other (Field, 2013). The strength of a relationship is termed as effect size. Cohen's D in Table 9 below is the index that is used to indicate effect size (Field, 2013).

**Table 9: Cohen's D Index Guidelines**

Co-efficient Value	Strength of Association
$0.1 < r < 0.3$	Small/ Weak correlation
$0.3 < r < 0.5$	Medium/ Moderate correlation
$r > 0.5$	Large/ Strong correlation

Source: (Field, 2013)

A strong Phi or Cramer's V could be close to 1.00 or -1.00, whereas close to zero would indicate no relationship (Field, 2013; Weiers, 2011).

### **Mann-Whitney U Test**

The researcher was interested in investigating the differences between the two groups of people and their view on ICTs and innovation i.e. Senior Executive Management and Hospital Management.

The Mann-Whitney U Test is a rank-based non-parametric test that can be used to determine if there are differences between two groups (Field, 2013). A Mann-Whitney U Test was run to determine if there were differences in the responses of executive and non-executive respondents. The Mann-Whitney U Test is the non-parametric alternative to the independent-samples t-test, which can be used when the dependent variable is not continuous i.e. categorical in this research study. The advantage of the Mann-Whitney U Test over the T/ test is that there are no onerous assumptions that need to be met (Field, 2013).

The Mann-Whitney U Test clearly indicates the null hypothesis and where the p-value is less than 0.05 this would be interpreted as a statistically significant finding as this would mean that there is a greater probability that the results have would not be achieved by chance i.e. greater than 95% certainty, therefore the researcher would reject the null hypothesis.

### **Qualitative Analysis:**

The qualitative analysis was performed on the commentary data collected from interviews with Executive Management. Documenting text comments from the interviews allowed the researcher the opportunity to immerse herself in the data and better understand the context.

The researcher chose not to utilise specialised computer aided qualitative data analysis software as the volume and the degree of complexity of the data was limited and did not warrant such. In addition, the researcher conducted structured closed questions interviews.

Since the researcher has adopted an inductive approach, the categories that the data was sorted into were based on the literature reviewed and the constructs that were formulated in the hypotheses.

Subsequent to the interviews, responses (commentary) were manually captured onto a data workbook. The researcher identified the main broad themes that emerged from the comments and narrated these using direct quotations from the respondents.

The qualitative data collected from interviews with Senior Executive Management were not coded and analysed, however used as supporting evidence in comparison to the responses by Hospital Management. The data was also used to highlight new themes.

These themes were then studied in detail to understand the meaning of the data. Conclusion and drawing meaning from the data involved compare/contrast analysis, as well as integration, noting patterns and trends that shall be discussed in Chapter 6.

## **4.6 Ethical Considerations**

All ethical issues were taken into consideration including the sensitive information and regulatory requirements in the Healthcare industry that govern this. The research ethical process was followed by the researcher. This included ethical clearance by the academic institution's Ethical Clearance Committee as well as Medical Ethics Approval Committee (Appendix 4). The research was carried out in a manner that ensured confidentiality without compromising the organisation and individual participants. The ethical considerations included:

- Approval from Large Hospital Group Research Committee;
- Consent to collect data from participants;
- Seeking sensitive information and maintaining confidentiality;
- Avoiding researcher bias and;
- Incorrect reporting of findings and inappropriate use of information.

## **4.7 Limitations of the study**

- The study is limited to the South African environment and therefore excludes the evolving global trends;
- The data acquired was predominantly from a single organisation in a single industry; therefore the results of the research study might not be relevant to other organisations or industries;
- The study will focus on the private healthcare sector with the universe being one of the leading healthcare providers (Large Hospital Group) and therefore the findings may not apply to public sector;
- The study shall include a collection of data from Hospital Management staff at the various other levels. The perceptions of management may vary to that of others;

- The recording of interviews was not allowed by the organisation and this increases the researchers recall bias and;
- The research is subject to researcher bias due to the researcher's role in the environment as well as pre-existing views.

## **4.8 Role of the Researcher**

The researcher held a position of employ at the Large Hospital Group. As mentioned earlier in this chapter, the researcher's role of influence would create bias and for this reason a mixed methodology was a suitable method. The researcher had the advantage of access to management and to other insights in the healthcare sector. This researcher's had the ability to highlight certain macroeconomic healthcare issues to management in an attempt initiate activities to create better solutions. Key stakeholder relationships were created through the research process and this will be beneficial to both the researcher and the Large Hospital Group.

## **4.9 Summary**

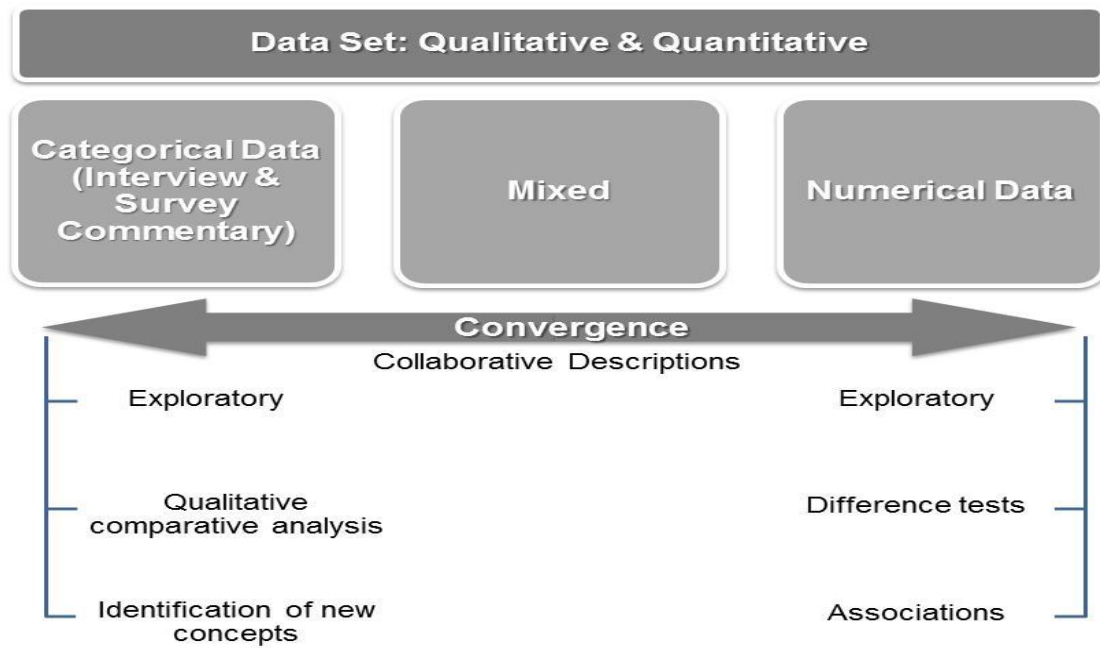
In this chapter the researcher discussed the adoption of a mixed methodology that was utilised to triangulate and interpret the subject matter more accurately.

The data collection methods appropriate to the research were reviewed and identified as surveys and interviews. The researcher discussed the justifications that support internal validity and reliability which are paramount to ensuring a consistent accurate representation in the research study.

The data analysis tools and techniques that support the hypotheses were explained in detail. Figure 13 below seeks to explain the data analysis conducted in this research study.



**Figure 13: Data Analysis Summary**



Source: (Adapted from Creswell, 2003)

The researcher expressed the ethical considerations and limitations in the research study.

Chapter 5 provides a detailed account of the research results collected by the researcher during the interviews and surveys both qualitative and quantitative in nature.

## Chapter 5: Presentation of Results

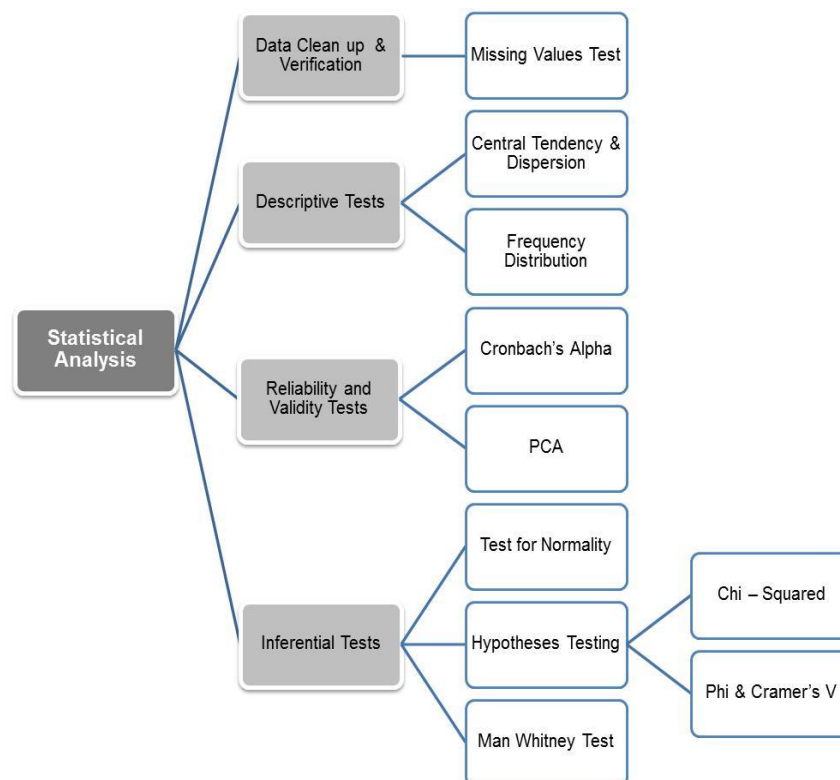
### 5.1 Introduction

This objective of the research study is to ascertain whether communication within ICTs drives innovation that in turn is crucial to improving healthcare in South Africa through reduced cost and improved service delivery. This chapter provides a detailed account of results and summary of the empirical data to prove the hypotheses. The researcher used a mixed methodology and shall therefore present results from both the quantitative and qualitative analysis.

#### Quantitative Analysis:

The statistical analysis that was conducted is illustrated in Figure 14 below.

**Figure 14: Quantitative Analysis**



#### Qualitative Analysis:

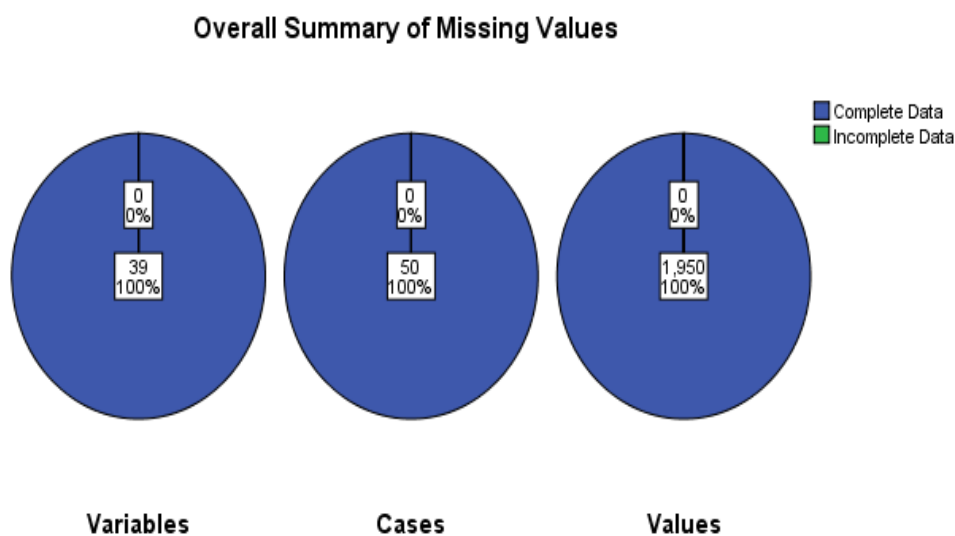
The qualitative data collected from interviews with Executive Management were not coded and analysed, however used as supporting evidence in comparison to the responses by Hospital Management. The data was also used to highlight new themes.

## 5.2 Quantitative Analysis:

### a. Missing Value Analysis

The questionnaire was sent electronically to 35 Hospital Managers and 15 interviews were held with Senior Executive Managers. The overall summary of Missing Values displays panelled pie charts that show the number and percentage of respondents that have one or more missing values. As can be viewed by the pie charts below, there were no missing values and the data is complete.

**Figure 15: Overall Summary of Missing Values**



### b. Descriptive test

Descriptive tests were conducted to provide the reader with information regarding the construct of the data and to determine the inferential statistical tests to be conducted.

These tests included:

- Measures of Central Tendency and Dispersion
- Frequency Distribution

i. Measures of Central Tendency and Dispersion:

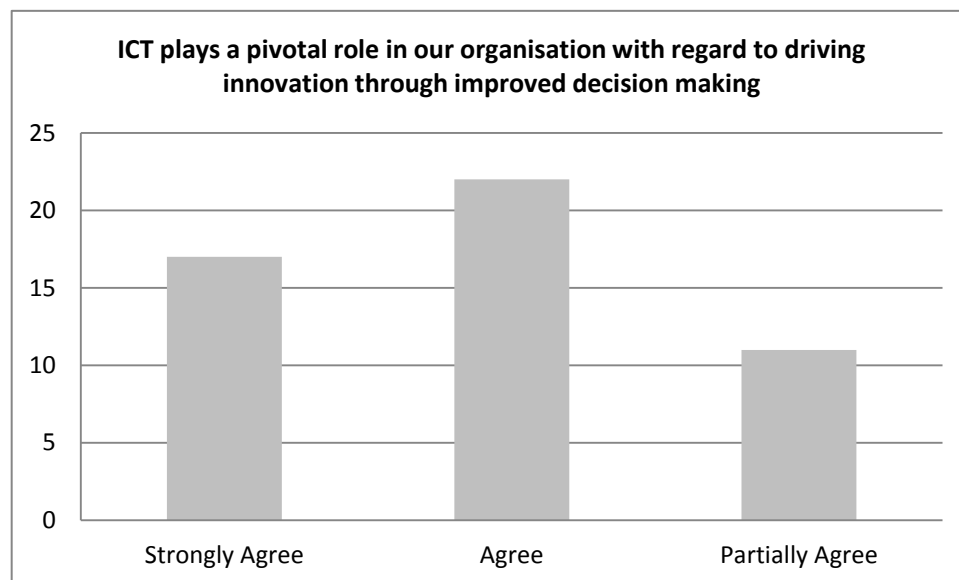
The measure of central tendency revealed no abnormality with the data. The results can be reviewed in Appendix 6.

ii. Frequency Distribution:

A total of 50 respondents (15 Senior Executive Management and 35 Hospital Management) have participated in the research study. The researcher has presented a graphical representation of the three most pertinent questions that shall be used to test the hypotheses.

**Question 1: ICT plays a pivotal role in our organisation with regards to driving innovation through improved decision making.**

**Figure 16: Frequency Distribution**

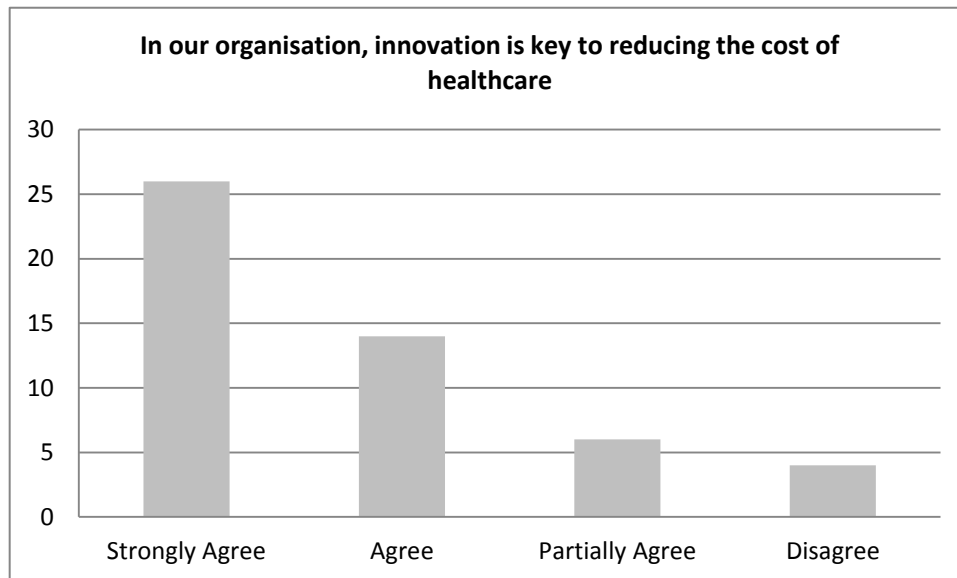


From the bar chart above in Figure 16, it can be seen that most of the respondents agreed with the concept. None of the respondents disagreed. The frequency percentages are as follows: 34% of respondents Strongly Agreed, 44% Agreed and 22% Partially Agreed.

**Question 2: In our organisation, innovation is key to reducing the cost of healthcare.**

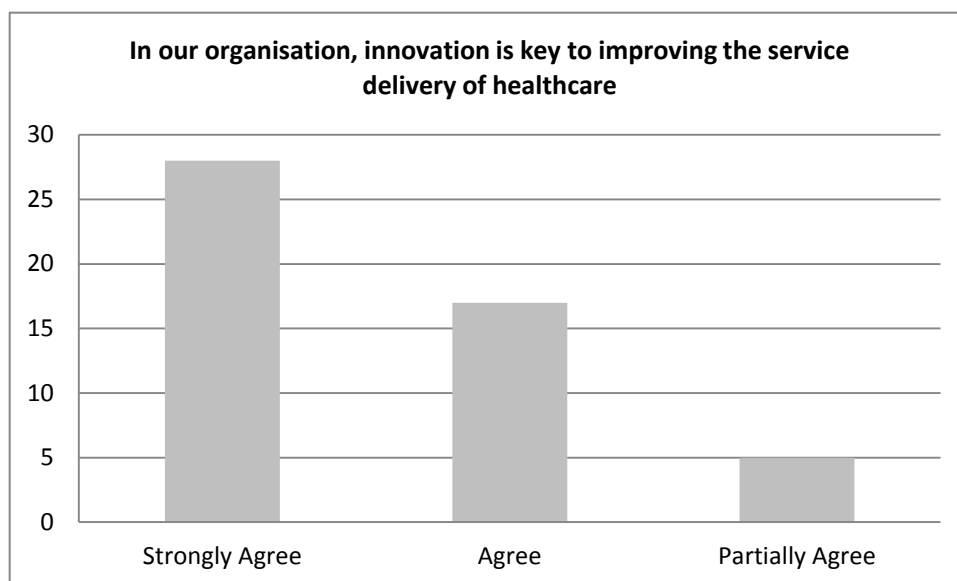
From the bar chart below in Figure 17, it can be seen that the responses were varied, however the instances of strongly agreed were highest. The frequency percentages are as follows: 52% of respondents Strongly Agreed, 28% Agreed and 12% Partially Agreed and 8% Disagreed.

**Figure 17: Frequency Distribution**



**Question 3: In our organisation, innovation is key to improving the service delivery of healthcare.**

**Figure 18: Frequency Distribution**



From the bar chart above, it can be seen that most of the respondents agreed with the concept. A marginal number of respondents partially agreed. None of the respondents disagreed. The Frequency percentages are as follows: 56% of respondents Strongly Agreed, 34% Agreed and 10% Partially Agreed.

### c. Reliability Analysis:

#### Cronbach's Alpha

##### Information Communication Technology:

Table 10 below illustrates the internal validity and reliability of the questions that relate to Information Communication Technology. The Cronbach's Alpha based on standardised items for N=22 (being the number of questions related to ICT). A Cronbach's Alpha Based on Standardized Items 0.806 indicates a good internal consistency of the data.

**Table 10: Cronbach's Alpha for Internal Consistency: ICT**

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.787	.806	22

##### Innovation:

Table 11 below illustrates the internal validity and reliability of the 16 questions that relate to innovation. A Cronbach's Alpha Based on Standardized Items 0.666 indicates a good internal consistency of the data.

**Table 11: Cronbach's Alpha for Internal Consistency: Innovation**

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.664	.666	16

## Principal Component Analysis

A principal components analysis (PCA) was run on two sets of questions under the topics ICT and Innovation. The suitability of the method was assessed before the analysis. Analysis of the correlation matrix showed that all variables had at least one correlation coefficient greater than 0.3 for both sets of data.

The overall Kaiser-Meyer-Olkin (KMO) measure was 0.547 for ICT and 0.587 for Innovation as illustrated in Table 12 below. All variables have at least one correlation above  $r = 0.3$ , so the process can continue to the next step. Bartlett's Test of Sphericity was statistically significant ( $p < .005$ ), indicating that the data was mostly appropriate.

**Table 12: KMO and Bartlett's Tests: ICT and Innovation**

KMO and Bartlett's Tests			
		ICT	Innovation
<b>Kaiser- Meyer- Olkin Measure of Sampling Adequacy</b>		0.547	0.587
<b>Bartlett's Test of Sphericity</b>	df	231	120
	Sig.	0	0

There are 6 steps in performing a PCA (Weiers, 2011). These steps were performed on the two sets of data and the results are presented below.

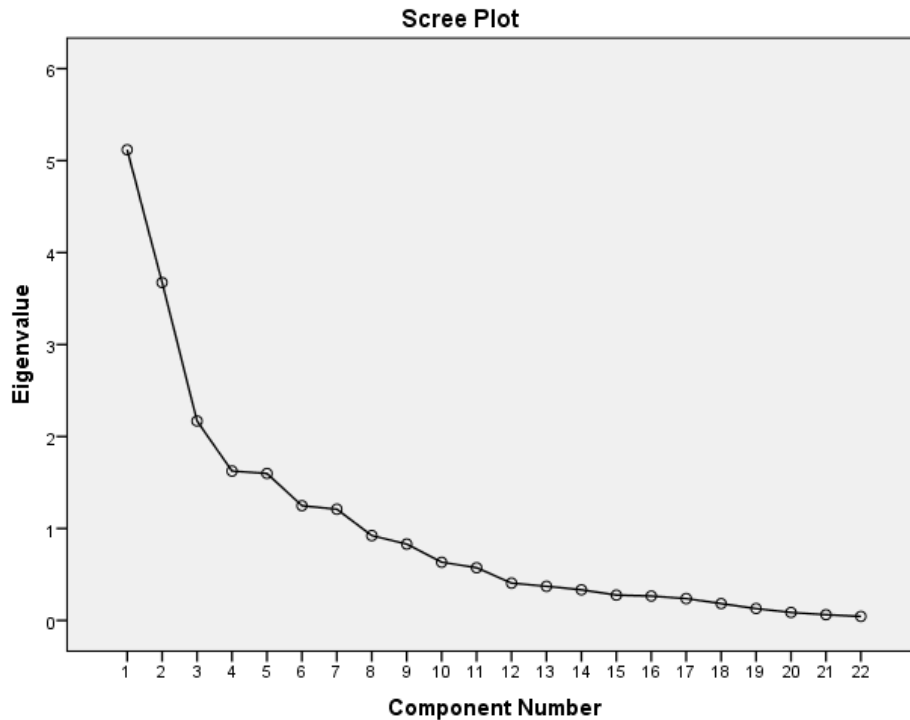
Extraction of the aggregated variables

- 1) Determining the number of meaningful components that can be retained
- 2) Rotation to a final solution
- 3) Interpreting the rotated solution
- 4) Computing component scores or component based scores
- 5) Reporting the results the number of variables that remain

## PCA ICT:

Principal components analysis with varimax rotation was conducted to assess how 22 “ICT” variables clustered. Seven components were rotated, based on the eigenvalues over 1 criterion and the Scree Plot in Figure 19 below reflects an inflection point at 6. After rotation, the seven components cumulatively accounted for 75% of the variance. Appendix 8 displays the items and component loadings for the rotated components, with loadings less than .50 omitted to improve clarity.

**Figure 19: Scree Plot: ICT**



The remaining variables that relate to ICT are:

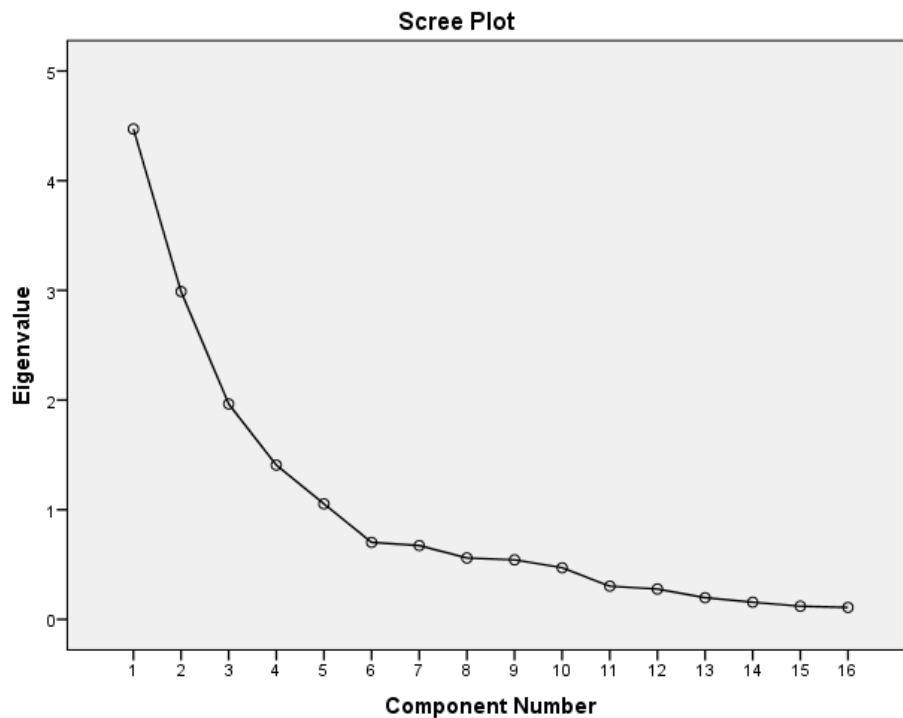
1. Our organisation uses current and historical information to support the decision making process.
2. In our organisation, information is viewed as the key enabler of innovation.
3. In our organisation, technology is viewed as the key enabler of innovation.
4. In our organisation, communication is viewed as the key enabler of innovation.
5. Communication through ICT systems is essential for innovation collaboration.
6. Communication through ICT systems is essential for the quality of innovation.



PCA Innovation:

Principal components analysis with varimax rotation was conducted to assess how 16 “Innovation” variables clustered. Five components were rotated, based on the eigenvalues over 1 criterion and the Scree Plot in Figure 20 reflects an inflection point at 5. After rotation, the five components cumulatively accounted for 74% of the variance. Appendix 8 displays the items and component loadings for the rotated components, with loadings less than .50 omitted to improve clarity.

**Figure 20: Scree Plot: Innovation**



The remaining variables that relate to Innovation are:

1. In our organisation, innovation is viewed as a strategic imperative.
2. In our organisation, innovation is key to remaining competitive.
3. Our lack of communication makes it hard for people to put forward innovative ideas.
4. In our organisation, innovation is key to reducing the cost of healthcare.
5. In our organisation, innovation is key to improving the service delivery of healthcare.

## d. Inferential Statistics

### Test for Normality

The Kolmogorov test was conducted to ascertain normality. The Shapiro-Wilk test in Table 13 and 14 below indicates that some of the levels in the question were statistically significant and others were not. We were not guaranteed of normality thus we opted for the association type of hypotheses testing which is not reliant on normality.

**Table 13: Kolmogrov Test for Normality: ICT**

The lack of information within organisation's contributes to decision makers being unable to make strategic decisions optimally		Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
		Statistic	Df	Sig.	Statistic	df	Sig.
ICT plays a pivotal role in our organisation with regard to driving innovation through improved decision making	1	.254	30	.000	.794	30	.000
	2	.300	11	.007	.793	11	.008
	3	.307	4	.	.729	4	.024
	4	.441	4	.	.630	4	.001

**Table 14: Kolmogrov Test for Normality: Innovation**

In our organisation, innovation is viewed as a strategic imperative		Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
		Statistic	Df	Sig.	Statistic	df	Sig.
In our organisation, innovation is key to reducing the cost of healthcare	1	.260	15	.007	.774	15	.002
	2	.336	30	.000	.736	30	.000
	3	.273	5	.200*	.852	5	.201
In our organisation, innovation is key to improving the service delivery of healthcare	1	.367	15	.000	.713	15	.000
	2	.371	30	.000	.701	30	.000
	3	.231	5	.200*	.881	5	.314

## Hypothesis testing

The Pearson's Chi -squared test was conducted on each of the remaining variables from the PCA that related to ICT and Innovation respectively to discover if there is a relationship between the two categorical variables.

### Hypothesis 1: Information Communication Technology is not key Strategic Driver of Innovation

Table 15 below illustrates the results from the Chi -squared test used to determine the relationship between the following variables: ICT and Innovation. In order to test the hypothesis, the response that was utilised as a measure of Innovation was: ICT plays a pivotal role in our organisation with regard to driving innovation through improved decision making.

**Table 15: Chi - Squared Results Hypothesis 1**

Questions that relate to ICT:		Statistical Significance		Strength of Relationship		
		Sig Value	Yes/ No	Phi	Cramer	Association
1	Our organisation uses current and historical information to support the decision making process	0.000	Yes	0.699	0.494	Moderately Strong
2	In our organisation, information is viewed as the key enabler of innovation	0.016	Yes	0.558	0.395	Moderately Strong to Weak
3	In our organisation, technology is viewed as the key enabler of innovation	0.085	No	0.471	0.333	Moderately Strong to Weak
4	In our organisation, communication is viewed as the key enabler of innovation	0.072	No	0.481	0.34	Moderately Strong to Weak
5	Communication through ICT systems is essential for innovation collaboration	0.00	Yes	0.712	0.503	Strong to Moderately Strong
6	Communication through ICT systems is essential for the quality of innovation	0.031	Yes	0.526	0.372	Moderately Strong to Weak

The results in the table above indicate that 4 of the 6 variables have a relationship with the construct. A moderately strong relationship exists between the use of current and

historical information to support decision making and that this drives innovation and there is a strong relationship that infers that communication through ICT is essential for innovation collaboration.

## Hypothesis 2: Innovation and Reducing the Cost of Healthcare

Table 16 below illustrates the results from the Chi - squared test used to determine the relationship between the following variables: ICT and Innovation. In order to test the hypothesis, the response that was be utilised as a measure of Cost Reduction is: In our organisation, innovation is key to reducing the cost of healthcare.

**Table 16: Chi - Squared Results Hypothesis 2**

Questions that relate to Innovation:		Statistical Significance		Strength of Relationship		
		Sig Value	Yes/ No	Phi	Cramer	Association
1	In our organisation, innovation is viewed as a strategic imperative In our organisation	0.25	No	0.398	0.281	Weak
2	In our organisation, innovation is key to remaining competitive	0.00	Yes	0.866	0.500	Strong to Moderately Strong
3	Our lack of communication makes it hard for people to put forward innovative ideas	0.26	No	0.680	0.393	Moderately Strong to Weak
4	In our organisation, innovation is key to improving the service delivery of healthcare	0.00	Yes	1.043	0.738	Strong

The results in the table above indicate that 2 of the 4 variables have a relationship with the construct. A strong to moderately strong relationship exists between the innovation as key to remaining competitive and the reduction in costs. Improving service delivery in healthcare is strongly correlated to the reduction in cost.

### Hypothesis 3: Innovation & Service Delivery of HealthCare

Table 17 below illustrates the results from the Chi - squared test used to determine the relationship between the following variables: ICT and Innovation. In order to test the hypothesis, the response that was be utilised as a measure of Innovation is: In our organisation, innovation is key to improving the service delivery of healthcare.

**Table 17: Chi - Squared Results Hypothesis 3**

Questions that relate to Innovation:		Statistical Significance		Strength of Relationship		
		Sig Value	Yes/ No	Phi	Cramer	Association
1	In our organisation, innovation is viewed as a strategic imperative In our organisation	0.175	No	0.356	0.252	Weak
2	In our organisation, innovation is key to remaining competitive	0.00	Yes	0.767	0.543	Strong to Moderately Strong
3	Our lack of communication makes it hard for people to put forward innovative ideas	0.049	Yes	0.558	0.395	Moderately Strong to Weak
4	In our organisation, innovation is key to reducing the cost of healthcare	0.00	Yes	1.043	0.738	Strong

The results in the table above indicate that 3 of the 4 variables have a relationship with the construct. A strong relationship exists between innovation as a key competitive factor and service delivery. A moderately strong association exists between the lack of communication that affects employee's idea generation and service delivery. There is a strong association between the cost of healthcare reduced by innovation and service delivery.

## Mann-Whitney U Test

A Mann-Whitney U test was run to determine if there were differences in responses between the independent samples of Senior Executive Management and Hospital Management.

Figure 21 indicates that when the Mann-Whitney u Test was run on each question in the questionnaire, Executive and Hospital Management were in agreement on 39% of the questions and had contradictory views on 61% of the questions.

### Figure 21: Mann-Whitney U Test Results

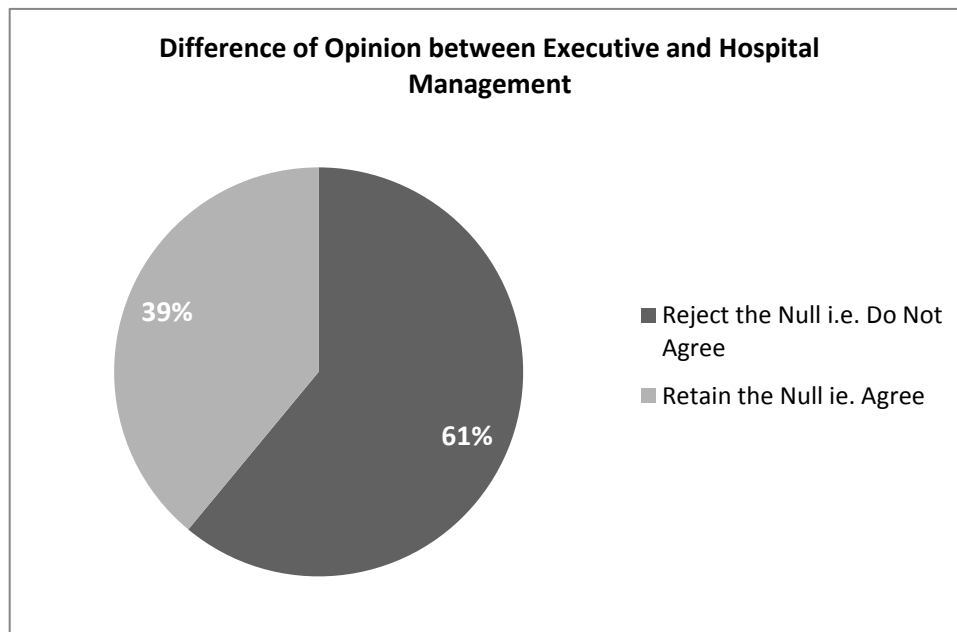


Table 18 below provides the questions that made up the 39% that Executive and Hospital Management were not in agreement i.e. where the Sig Value was less than 0.05. See Appendix 10 for a complete set of SPSS tests.

**Table 18: Mann- Whitney U Test Results**

Questions that resulted in a Rejection of the Null Hypotheses	Sig Value
1. The lack of information within organisation's contributes to decision makers being unable to make strategic decisions optimally	0.000
2. Organisations that do not communicate information effectively through ICT systems limits their ability to make key strategic decision	0.007
3. In our organisation, current and historical information is easily accessible and available and transferrable across all decision making units	0.000
4. In our organisation, effective communication is an imperative to enable key decisions, albeit the abundance of information and technology	0.000
5. In our organisation, information is viewed as the key enabler of innovation	0.001
6. In our organisation, technology is viewed as the key enabler of innovation	0.001
7. Integrated communication through ICT systems must be embedded by formal and informal change management processes	0.000
8. Improving communication through ICT systems creates the potential for internal collaboration and co-creation of innovation	0.000
9. Our organisation has a mature communication mechanism within our ICT system that promotes collaboration which drives innovation	0.001
10. Our organisation effectively promotes the importance of communication in driving innovation	0.006
11. Our organisation provides clearly communicates an innovative process for idea generation	0.000
12. Our culture makes it hard for people to put forward innovative ideas	0.000
13. Our processes makes it hard for people to put forward innovative ideas	0.036
14. Our lack of communication makes it hard for people to put forward innovative ideas	0.013
15. Our organisation is slow to roll out innovative products and services	0.004

### 5.3 Qualitative Analysis:

Interviews with 15 Senior Executive Management were conducted. The researcher utilised the same questions as that in the survey questionnaire with emphasis on comments from the interviewees. The commentary that was provided during the interviews was essential to gaining first hand insight as well allowing the researcher to understand the context of the environment better. As discussed in Chapter 4, the qualitative analysis of the interview commentary provided advantages of triangulation and interpretation of the subject matter more accurately. It also allowed for new themes to emerge and for the researcher to explore this in order to contribute to developing a tenable multidimensional framework that can be utilised by Healthcare providers to implement and align an innovation framework with the organisation's strategy.

The Interview Schedule in Table 19 below indicates the Senior Executive Managers that were selected for participation in this study as a deliberate consequence of their knowledge and experience of the business and their interaction between business processes and the organisational strategy.

**Table 19: Interview Schedule**

Designations of Executives Interviewed			
1	Executive Management: Quality Leadership	9	Emergency Services Chief Operations Officer
2	Executive Management: Hospital Director	10	Group Financial Director
3	Executive Management: Clinical Leadership	11	Executive Management: Strategy Development
4	Head of Pharmacy Division	12	Primary Care Managing Director/ Financial Director (Subsidiary)
5	Head of Project Office	13	Executive Management: Quality Leadership
6	Executive Management: Chief Information Officer	14	Group Company Secretariat
7	Renal Care Managing Director (Subsidiary)	15	Executive Management: HR Director
8	Emergency Services Managing Director (Subsidiary)		



**An extract of some of the verbatim responses from respondents per theme were as follows:**

Theme 1: The Communication of Information utilising Information Communication Technology (ICT's)

- “Centralised communication systems shall improve electronic patient records and reduce wasteful expenditure. By working in an agile environment, solutions would be faster and more accurate; however we have not reached a stage where we completely trust our data and our ability to integrate such to provide us with such advantages.”
- “The lack of Management Information makes it extremely difficult to make decisions and to plan scenarios to execute an effective strategy.”
- “Communication within the organisation is archaic- we do not use the most efficient technology. If we did, we would save time and money.”
- “The use of current and historical information has improved significantly, however communication is not always efficient.”
- “ICT affordability plays a role in these economic times.”
- “It is important to make sense of the information we have. Too much information flying around is not always good.”
- “Integration and Interoperability of systems are necessary for us to be innovative. This will reduce effort and cost, however in difficult economic times innovation would not take key priority.”

Theme 2: Information Communication Technology as a key Strategic Driver of Innovation

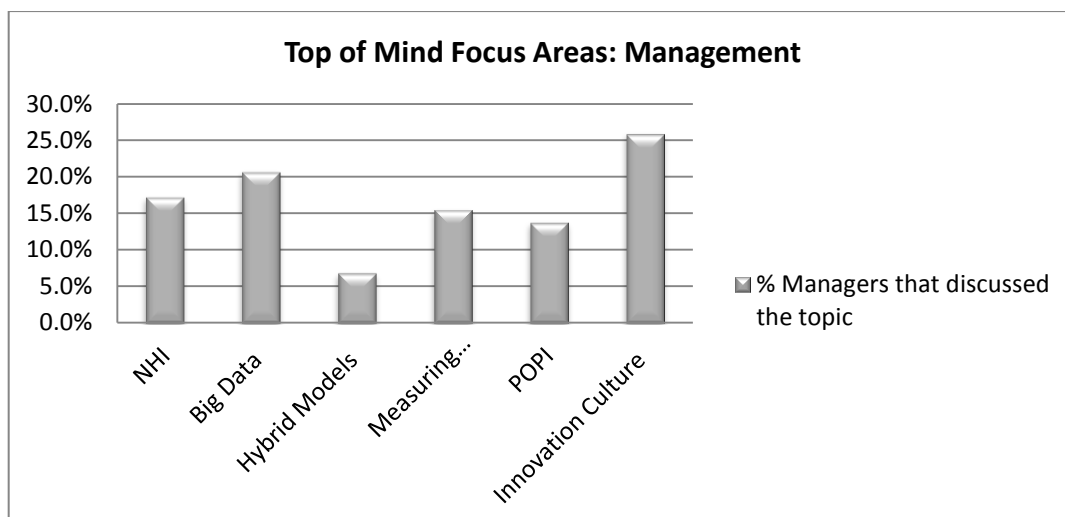
- “ICT's support achieving continuity of care, however this requires behavioural change.”
- “The creation and diffusion of innovation is key to find the correct technology and to implement this with training. Training and change management is important.”
- “I can almost taste the positives of communication technology if we used it effectively in this industry.”

### Theme 3: Innovation in our Organisation

- “Historically the healthcare sector was very conservative; we are now becoming more risk averse to innovation. The maturity of innovation in the industry is not great.”
- “There are not many high barriers to entry for competitors to copy innovation; therefore our culture is slow to innovate”.
- “Unlike financial institutions, we have not got onto the Big Data band wagon.”
- “Technology acceptance at operational level is an issue- staff does not embrace change rapidly.”
- “The culture of our environment and the sector is sluggish and innovation initiatives are reactive and from external sources.”
- “We focus on driving shareholder value and this market logic can sometimes be at the expense of innovation.”
- “Traditional management approaches are not going to bring the industry to the much needed innovation”
- “There are many innovation initiatives on the go, however, to appropriately explore/exploit these opportunities, we should formally develop our corporate culture in order to allow it to focus on continuous improvement”.

### New Concepts/ Phenomena and Themes that emerged during the Interviews:

**Figure 22: Top of Mind Focus Areas for Management**



As can be seen in the figure above, certain new themes were identified from the interviews with Executives. The most topical theme that was discussed during interviews was Innovation culture. Along with innovation culture the measurement of innovation investments (cost vs benefit) was a divisive matter. 8 Executive managers shared their concerns regarding the POPI Act. Big data was top of mind for 12 interviewees. Although

a small number of Executives engaged in conversation regarding hybrid models, the theme sparked many key interesting potential solutions that can be considered to address some of South Africa's healthcare challenges.

- National Health Insurance

The promulgation of National Health Insurance Regulation in South Africa shall necessitate the utilisation of ICTs as Healthcare providers will need to find innovate ways to engage more with the data to meet targets, demonstrate quality and enable financial integrity.

- Big Data

Healthcare is a data intensive industry that generates large volumes of information. Manual processing of information will no longer suffice.

- Hybrid models

In order for the private sector to contribute to the macroeconomic problems of healthcare in South Africa, it is necessary to start thinking about other target segments and hybrid models that can accommodate such.

- Measuring innovation performance

Measuring the return on investment from innovation is key to the sustainability of any innovation model. The innovation measurement component should be incorporated into the design of a model/ framework.

- Patient Privacy and POPI

The Act was partially enacted on 11 April 2014. We are awaiting the commencement date of the other sections of the Act. POPI promotes transparency with regard to what information is collected and how it is to be processed. This openness is likely to increase customer confidence in the organisation. The Act has a huge impact on the utilisation of ICTs especially in the Healthcare Sector.

- Culture

Organisational design and culture and attitude are the most important construct in influencing decisions regarding innovation adoption in an organisation.

## 5.4 Summary

This chapter presented the results of both the quantitative and qualitative data analysis that were used with the objective of proving the hypotheses being tested in this research study.

The empirical evidence demonstrated in quantitative analysis supports the researcher's hypotheses that were formulated in Chapter 3.

The first hypothesis sought to explore the association of Information Communication Technology on innovation. This hypothesis is supported.

The second and third hypotheses aimed at investigating the association of innovation on the reducing the cost of healthcare and on service delivery of healthcare. These hypotheses are supported.

The comments from the qualitative analysis varied between descriptions of the benefits of ICTs in driving innovation and the implementation issues. The discussions included culture and organisation design factors. Although the comments highlighted current inefficiencies in utilisation of ICTs, moreover, the outlook on future possibilities was more positive than the view of ICT in today's healthcare. The analysis provided supportive information to coincide with the quantitative results.

As mentioned in earlier chapters, the primary objective of this research study is to ascertain whether Communication within ICTs drives Innovation and this Innovation in turn is essential to improving healthcare in South Africa.

The results presented in this chapter will be discussed in detail in the following chapter in order to draw inferences and make deductions that shall inform the objective of this research study. The researcher shall relate the results in this chapter back to the theory and literature in Chapter 2.

## **Chapter 6: Interpretation of the Results**

### **6.1 Introduction**

The primary objective of this research study is to ascertain whether communication within ICTs drives innovation and this innovation in turn is significant to improving healthcare in South Africa.

This chapter is an interpretation of the results of the data presented in Chapter 5. The findings of the data analysis are linked to the research problem and the literature review in earlier chapters in order to draw inferences and to achieve the secondary objective of this research study i.e. to contribute to develop a tenable multidimensional framework that can be utilised by healthcare providers to implement and align an innovation framework with the organisation's strategy. The researcher shall triangulate findings using a combination of the empirical findings of the quantitative and qualitative data and supported by existing theory to prove the hypotheses of the research study.

### **6.2 Review of the Research Objectives**

In Chapter 1, the research problem was articulated as: To assess whether effective communication within an Information Communication Technology (ICT) system contributes to an effective strategic innovation framework and how this improves the quality of healthcare in South Africa.

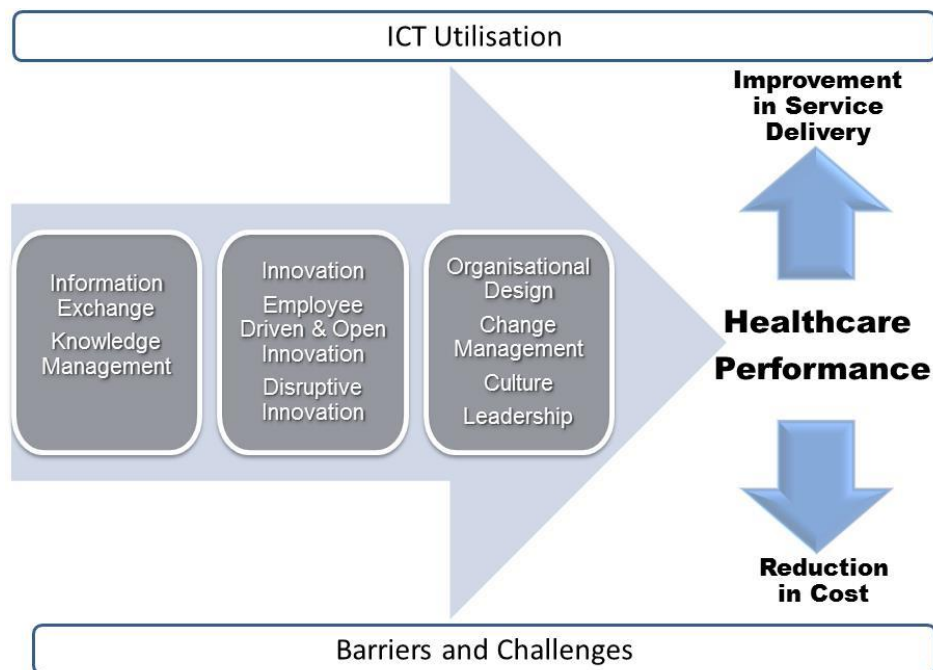
In Chapter 2 the researcher conducted a critical evaluation of the literature reviewed. This revealed the various arguments from scholars with regard to the themes constructed in the conceptual model in Figure 22. The role of ICT as a driver of innovation in organisations and the challenges of dissemination through traditional closed methods were discussed. The researcher investigated several theories to explain the adoption of ICT and innovation in healthcare and this is used to coagulate the results of the findings in Chapter 5 that support the hypotheses per Chapter 3.

H1: Information Communication Technology is not a key strategic driver of innovation.

H2: Innovation is not key to reducing the cost of healthcare.

H3: Innovation is not key to improving the service delivery of healthcare.

**Figure 22: Conceptual Framework of the Research Study**



## 6.3 Discussion of Results

### 6.3.1 Hypothesis 1: Information Communication Technology is not a key Strategic Driver of Innovation

Hypothesis 1 sought to explore the association of Information Communication Technology and innovation.

#### **Quantitative Empirical Evidence:**

Six variables were tested in a Pearson's Chi - squared test used to determine the association between ICT and innovation. The results in the table below indicate that 4 of the 6 variables have a relationship with the construct and the researcher has inferred that this sufficiently indicates an association between ICT and innovation. The researcher noted the strength of the relationship of the significant variables and investigated this further by referring to other statistical tests and evidence, qualitative analysis and the literature reviewed.

**Table 20: Chi - Squared Results Hypothesis 1**

Questions that relate to ICT:		Statistical Significance		Strength of Relationship		
		Sig Value	Yes/ No	Phi	Cramer	Association
1	Our organisation uses current and historical information to support the decision making process	0.000	Yes	0.699	0.494	Moderately Strong
2	In our organisation, information is viewed as the key enabler of innovation	0.016	Yes	0.558	0.395	Moderately Strong to Weak
3	In our organisation, technology is viewed as the key enabler of innovation	0.085	No	0.471	0.333	Moderately Strong to Weak
4	In our organisation, communication is viewed as the key enabler of innovation	0.072	No	0.481	0.34	Moderately Strong to Weak
5	Communication through ICT systems is essential for innovation collaboration	0.00	Yes	0.712	0.503	Strong to Moderately Strong
6	Communication through ICT systems is essential for the quality of innovation	0.031	Yes	0.526	0.372	Moderately Strong to Weak

Two key themes that the researcher identified from the Pearson's Chi-squared test from further investigation and analysis was:

- 1) The use of information to support the decision making process and
- 2) Communication through ICT systems being essential for innovation collaboration.

1) The use of information to support the decision making process:

From the Mann Whitney U Test, Appendix 10, the researcher was able to extrapolate that Executive and Hospital Managers share the same views on the utilisation of current and historical information to support the decision making process in the organisation. While in agreement with the utilisation of the information, the groups had differing views on the accessibility, availability and transferability of current and historical information across all decision making units.

The frequency distributions in Appendix 7 further corroborate the favourable views of both Executive and Hospital Management regarding utilising information to support decision

making was favourably in agreement. However, while in agreement with the conceptual philosophy, both groups of individuals evaluated their own organisation's efficiency and effectiveness in the utilisation of information and ICTs to support strategic and operational decisions and communicate these across functions was poor.

## 2) Communication through ICT systems being essential for innovation collaboration.

The researcher found by review of the Mann Whitney U test results that both Executive and Hospital Management perceived Communication through ICT systems as essential for innovation collaboration.

Evidence from the frequency distribution in Appendix 7 indicates that the responses were favourable to support the necessity for communication through ICTs for innovation collaboration.

### **Qualitative Evidence:**

#### 1) The use of information to support the decision making process:

- “The lack of Management Information makes it extremely difficult to make decisions and to plan scenarios to execute an effective strategy.”
- “Communication within the organisation is archaic- we do not use the most efficient technology. If we did, we would save time and money”.
- “The use of current and historical information has improved significantly, however communication is not always efficient.”
- “It is important to make sense of the information we have. Too much information flying around is not always good.”

#### 2) Communication through ICT systems being essential for innovation collaboration.

- “The lack of Management Information makes it extremely difficult to make decisions and to plan scenarios to execute an effective strategy.”
- “Communication within the organisation is archaic- we do not use the most efficient technology. If we did, we would save time and money”.
- “Integration and Interoperability of systems are necessary for us to be innovative. This will reduce effort and cost, however in difficult economic times innovation would not take key priority”.
- “I can almost taste the positives of communication technology if we used it effectively in this industry”.



## **Literature Review:**

### **1) The use of information to support the decision making process:**

Myllärniemi, Laihonen, Karppinen, & Seppänen (2012) advocate the importance of inter-organisation knowledge resources.

Effective communication and information exchange can be challenging, however an innovation framework is built upon the foundation of a strong organisation culture that supports effective information exchange among stakeholders in an organisation (Bessant, 2009) emphasises the role of the information as a key dimension of quality management in healthcare organisations.

Alavi and Leidner (2001); Sargeant (2009); Paswan and Wittmann (2009) established that ICT in healthcare organisations has the effect of accelerating knowledge transfer; enabling rapid access to information and creating the potential for internal and cross organisation collaboration.

The paramount benefits of ICTs are its reach and its knowledge-sharing benefits and its ability to support innovation Karunakaran (2013).

### **2) Communication through ICT systems being essential for innovation collaboration.**

A review of literature by MacDonald, Bath, & Booth (2011) reveals the contrast between information overload vs. information poverty and supports that the Information infrastructure and communication mechanisms are required to support good decision making practices.

Alavi and Leidner (2001) express the potential of utilising ICT to systematize, expedite and enable cross-border knowledge transfer. The paramount benefits of ICTs are its reach and its knowledge-sharing benefits and its ability to support innovation Karunakaran (2013).

Communication has been identified as a fundamental component to an effective innovation framework (MacVaugh & Schiavone, 2010).

## **Summary of Hypothesis 1:**

The evidence from the data analysis provides sufficient strength in argument to support the hypothesis that there is an association between ICT and innovation, the researcher makes inference that ICT is a key driver of innovation.

The researcher does note that the key factor influencing the success of an innovation system in an organisation is the element of Information – Exchange and a component of this relationship is knowledge management and transfer and from the discussion above it

is clear that there is room for improvement in Large Hospital Group prior to the reliance on the relationship between ICT and innovation. These are the foundational aspects of ICT that need to be embedded within the organisation.

Management at Large Hospital Group acknowledge the role Communication through ICT systems as essential for innovation collaboration. The interviews with management revealed interesting views on ineffective communication mechanisms within the organisations and the unintended consequences of wastage and increased costs and information overflow. Integration and interoperability of systems were echoed as critical for innovation.

The researcher has utilised the various data elements available to conclude that hypothesis 1 is supported in this research study.

### **6.3.2 Hypothesis 2: Innovation is not key to reducing the cost of healthcare**

Hypothesis 2 sought to explore the association of innovation and the reduction of healthcare costs.

#### **Quantitative Empirical Evidence**

Four variables were tested in a Pearson's Chi - squared test used to determine the association between innovation and the reduction in healthcare costs. The results in the table below indicate that 2 of the 4 variables have a relationship with the construct and the researcher has inferred that this indicates an association between Innovation and the reduction in healthcare costs. The researcher shall further corroborate the findings of this statistical test by referring to other statistical tests and evidence, qualitative analysis and the literature reviewed to prove the hypothesis.

**Table 21: Chi - Squared Results Hypothesis 2**

Questions that relate to Innovation:		Statistical Significance		Strength of Relationship		
		Sig Value	Yes/ No	Phi	Cramer	Association
1	In our organisation, innovation is viewed as a strategic imperative In our organisation	0.25	No	0.398	0.281	Weak
2	In our organisation, innovation is key to remaining competitive	0.00	Yes	0.866	0.500	Strong to Moderately Strong
3	Our lack of communication makes it hard for people to put forward innovative ideas	0.26	No	0.680	0.393	Moderately Strong to Weak
4	In our organisation, innovation is key to improving the service delivery of healthcare	0.00	Yes	1.043	0.738	Strong

The researcher shall discuss the following significant variable:

- 1) Innovation is key to remaining competitive

Innovation and service delivery shall be discussed in hypothesis 3. The researcher shall also discuss at a later stage the association between service delivery and cost reduction in healthcare as a spin-off from innovation.

Innovation has been associated with competitive advantage in many industries and the healthcare industry is no different.

From the Mann Whitney U Test, Appendix 10, the researcher was able to extrapolate that Executive and Hospital Managers share the same views on the competitive advantage of innovation in the healthcare organisation. From the frequency distribution in Appendix 7, the researcher identified that 92% of the managers were in agreement.

### **Qualitative Evidence:**

- “There are not many high barriers to entry for competitors to copy innovation; therefore our culture is slow to innovate”.
- Discussions with management revealed that they view the industry as one that is not highly competitive; however they do agree that innovation would be a disruptor that would spur competition.

### **Literature Review:**

Innovation has the potential to create a differentiated system. The differentiation would lie in the changing Customer value Proposition of healthcare, one that is lower costs, higher quality, and greater convenience (Chikotie & Owei, 2008).

The researcher found that certain divisions viewed Technology as a competitive advantage and one such example includes Emergency Services the manager described technology and innovation as a key differentiator in the healthcare industry. The systems and technology implemented in that business have led to key improvements and advantages. Advanced mapping and telematics had enabled faster response time to patients the control room to see who the closest most appropriate respondent is. This is a competitive advantage and assists in managing the costs associated with emergency service vehicle accidents.

An exploratory study PWC Report, (2013) has revealed that CEOs of Healthcare providers are aware of the transition and disruptions that the industry faces and that they are expectant of technology investments to gear up for the change. (Omachonu, 2010) define disruptive innovations as innovation that transforms old systems into new systems, creating new market segments and adding value to the business.

### **Summary of Hypothesis 2:**

The evidence from the data analysis provides sufficient strength in argument to support the hypothesis that there is an association between innovation and the reduction in cost of healthcare. Although more studies need to be conducted to accurately measure the reduction in costs after innovation interventions, the researcher can deduce from the use the various data elements available to conclude that hypothesis 2 is supported in this research study

The researcher does note that the discussions with Large Hospital Group Management where there was not a consistent view on the competitiveness of the industry. The traditional business model of the industry would not warrant as much competition as the disrupted model.

### 6.3.3 Hypothesis 3: Innovation is not key to improving the service delivery of healthcare

Hypothesis 3 sought to explore the association of innovation and improving service delivery of healthcare.

#### Quantitative Empirical Evidence

Four variables were tested in a Pearson's Chi - squared test used to determine the association between innovation and improving service delivery of healthcare. The results in the table below indicate that 3 of the 4 variables have a relationship with the construct and the researcher has inferred that this sufficiently indicates an association between innovation and improving service delivery of healthcare. The researcher shall further corroborate the findings of this statistical test by referring to other statistical tests and evidence, qualitative analysis and the literature reviewed to prove the hypothesis.

**Table 22: Chi - Squared Results Hypothesis 3**

Questions that relate to Innovation:		Statistical Significance		Strength of Relationship		
		Sig Value	Yes/ No	Phi	Cramer	Association
1	In our organisation, innovation is viewed as a strategic imperative In our organisation	0.175	No	0.356	0.252	Weak
2	In our organisation, innovation is key to remaining competitive	0.00	Yes	0.767	0.543	Strong to Moderately Strong
3	Our lack of communication makes it hard for people to put forward innovative ideas	0.049	Yes	0.558	0.395	Moderately Strong to Weak
4	In our organisation, innovation is key to reducing the cost of healthcare	0.00	Yes	1.043	0.738	Strong

The researcher shall discuss the following significant variable:

- 1) Our lack of communication makes it hard for people to put forward innovative ideas.

### **Qualitative Evidence:**

- “Communication within the organisation is archaic- we do not use the most efficient technology. If we did, we would save time and money”.
- “Traditional management approaches are not going to bring the industry to the much needed innovation”
- “There are many innovation initiatives on the go, however, to appropriately explore/exploit these opportunities, we should formally develop our corporate culture in order to allow it to focus on continuous improvement.
- A resounding theme that was identified during interviews with Executive management was that of the importance of communication and the close link to driving innovation. Both levels of management share the view that communication is a fundamental requirement and cornerstone of innovation diffusion.

### **Literature Review:**

Hannola & Ovaska (2011) represents a conceptual model of the problems in Front End Innovation in Figure 7. Communication channel challenges and inefficiencies have been recognised as an impediment to communication in this innovation process. Poor communication could be as a result of linguistic problems, inadequate communication channels and user participation issues.

Healthcare providers have the opportunity to influence more effective service delivery through the healthcare value chain. In order to do this, it is important to foster the right culture. Ultimately an organisation should build innovation energy and an organisational design to support the use of knowledge and intellectual property of the organisation (Tidd & Bessant, 2009). This research study shall endeavour to explore and recommend an optimal organisation design to foster an innovation culture. (Tidd & Bessant, 2009) describes an organisational structure as visible artefacts of innovation culture.

Leadership plays a key role in the creation of an organisation culture. New leadership strategies like innovation leadership explain the importance of human capital and leaders’s role in managing innovation. Weberg (2013) suggest that there are nine innovation leadership competencies that fosters a culture of innovation as seen in Figure 10: self-knowledge and competence, synthesis, formulation, collaboration, managing knowledge, coaching, essence of innovation and innovation knowledge.

Cevahir, Uzokurt, Rachna, Kumar, Halil, Semih, Kimzan, Gozde (2013) provided validation of a positive correlation between organisation culture, innovation and firm performance in the banking sector. The researcher was decided to gain insight on the role of culture on an organisation’s innovation adoption. Birkinshaw’s Innovation Chain model was utilised

to design questions within the instruments to ascertain the views of management on the mediating role of culture on innovation adoption.

### **Summary of Hypothesis 3:**

The evidence from the data analysis provides sufficient strength in argument to support the hypothesis that there is an association between innovation and improved service delivery of healthcare. One of the key elements that facilitate this relationship is communication through the organisation. Communication is driven through channels and facilitated by the culture of the organisation. Culture is discussed in detail in this research study as it was found to be imperative as a driver of innovation and adoption of ICT.

The researcher found through the statistical tests and through interviews that the culture at Large Hospital Group could improve to support optimal communication especially regarding innovation. The researcher shall provide recommendations to management in Chapter 7.

### **Summary of all Hypotheses Findings:**

While the hypotheses have been proven, this research study has brought to the fore key elements that contribute to the success of ICTs.

A topical discussion in the healthcare sector currently is the institutionalisation of the National Health Insurance (NHI). As at the end of November 2015 the Government has not yet published the anticipated NHI white paper. In light of the need for private sector solutions, the introduction of the National Health Insurance in South Africa shall bring about changes in the Healthcare sector and this will force the service providers to consider alternative opportunities within innovative ideas to sustain their business models and to achieve the objective of equity in service delivery.

Anderson & King (1991) criticises organisations that adopt a “top- down” innovation approach as this leads to organisational oversight. The open source model described in Chapter 2 discusses the ubiquitous healthcare community (Frey et al., 2011).

Albeit the encouragement of technology, healthcare companies are weary of data security and regulatory impositions that go hand in hand. Senior executive managers were particularly concerned regarding the impact of Protection of Personal Information Act (POPI) and the utilisation of ICTs. This would increase the cost and in difficult economic times, management would need to weigh priorities for innovation and healthcare service delivery. Management’s view is that innovation would always be secondary to regulatory compliance required. Interview responses brought in issues of a need to satisfy diverse stakeholders. Regulatory and policy requirements dictate a significant amount of compliance by healthcare providers. The other driver of decisions is “market logic”.

Respondents described this as driving shareholder value and this is sometimes at the expense of innovation and continuous improvement.

The interviews with Senior Executive Management disclose the conservatism of the healthcare industry culture with regard to innovation adoption. Although there are some parts of the sector that are innovative, in comparison to other sectors like financial institutions, the healthcare industry is risk averse toward cost and the possible structural or organisational changes resulting from innovation. Both levels of management share these views (See the results of the Mann Whitney U test). In order for organisations to overcome some of the barriers of innovation diffusion and to create a supportive culture, an ecosystem with an innovation framework is necessary.

Although ICTs drive innovation, the organisational design dictates the facilitation of innovation (Avey, Rennan, & Eenan 2010). The researcher utilised the organisation design of Cummings and Worley (2013) along with the theory from the various theories that explain innovation adoption and resistance to attempt to add to the existing body of knowledge by proposing a framework that can be utilised by Healthcare providers to implement and align an innovation framework with the organisation's strategy. The theories utilised as described in detail in chapter 2 include: The Diffusion of Innovation (DOI) (Rogers, 1995); the technology acceptance model (TAM) (Davis F, 1989); the conceptual model of the problems in Front End Innovation (Hannola & Ovaska, 2011); the adoption categories (Rogers, 2003) and Berwick's (2003) diffusion influential factors.

## **6.4 ICT Innovation Maturity Matrix: Researcher Developed Model**

The researcher developed a model by synthesizing the research findings with many existing approaches and future thinking. This model is not designed to replace any former concepts/ models that are familiar in the innovation fraternity but rather to be used as in conjunction with existing models. The model can be applied in private and public sectors and does not need to be limited to healthcare. Organisations can use this model to plot assess their maturity with regard to ICT and innovation and map these to interventions to elevate ICT and innovation to an optimal structure. Utilising this model on an interactive basis could assist the organisation to drive innovation as a performance measure if linked to specific key performance indicators.

The concept of innovation maturity is used by the researcher to explain the desire to be innovative in an organisation. The researcher used the key factors from existing research on organisational design, individual factors, culture and leadership as shown below that contribute to innovation success to assist in formulating the significant influencers of the concept of Innovation Maturity:

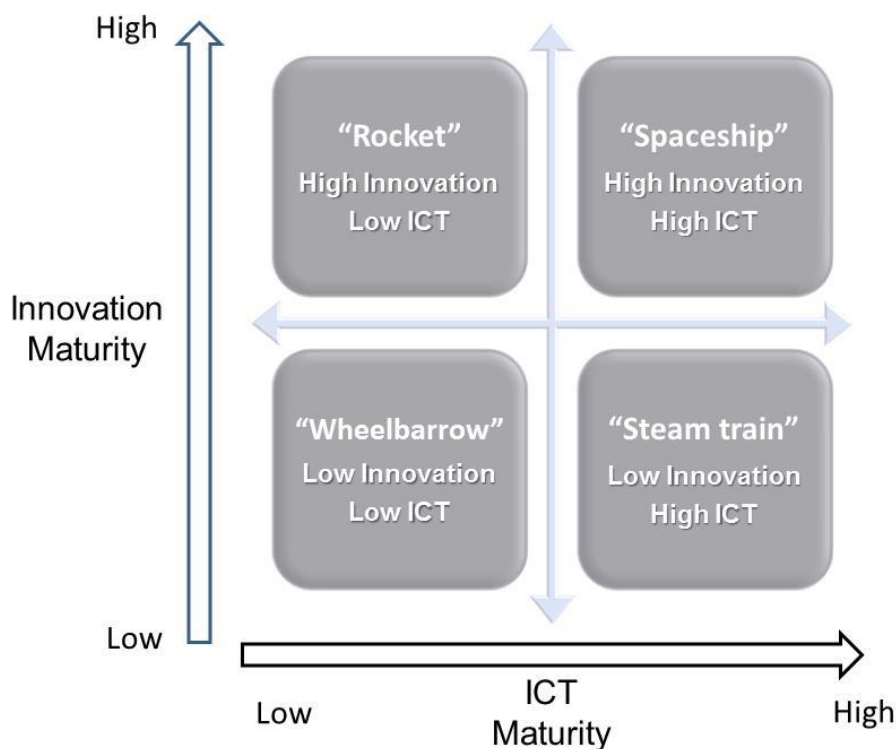


- 1) Organisational design (Cummings & Worley, 2013) describes how the factors of structure and size of an organisation, the Human Resource Systems, Technology and Business Processes;
- 2) Individual factors include both intrinsic and extrinsic components, end user perceptions and attitudes, stakeholder relationships;
- 3) Organisational culture and leadership constitutes the competencies of an Innovation Leader and this impacts an innovation culture.

The ICT Innovation Maturity Matrix would best be supported by standardised assessment tools that could be used to assess and measure the Innovation and ICT maturity of an organisation so that these maturity levels can be plotted against the ICT Innovation Maturity Matrix. Future researchers could investigate and develop a standardised assessment tool.

The **ICT Innovation Maturity Matrix (IMM)** in Figure 23 is a chart created by the researcher to assist corporations to analyse their business unit’s propensity for innovation and their ICT utilisation to ascertain their performance level. This assists the organisation to identify strategies that can be executed and resources that can be allocated to optimise the business. The model provides a basis for the testing of principles within other organisations and other industries.

**Figure 23: ICT Innovation Maturity Matrix – Researcher Developed Model**



To use the chart, an organisation should rank their organisation on the basis of their relative innovation maturity and ICT utilisation. It is worth noting that this measure is subjective and relative to specific industries and organisational size.

Leadership can plot their organisation against the ICT Innovation Maturity Matrix using any existing data on their organisation innovation and ICT maturity or consider obtaining such maturity measures through internal or external means and then plotting against the ICT Innovation matrix and align the interventions to elevate their maturity status with the organisations strategic imperative.

An organisation can internally measure their innovation maturity based on many existing mechanisms and models. Models that can be utilised to measure organisational innovation culture include, but are not limited to: The Diamond Model, The OSLO Model, The Innovation Value Chain (Gamal, Salah, & Elrayyes, 2011). The researcher used The Birkanshaw model (Gamal et al., 2011) to measure the innovativeness of Large Hospital Group.

- **Wheelbarrow** is where an organisation has low innovation maturity and low ICT utilisation. These organisations shall typically be described as wheelbarrows. The concept of the wheelbarrow dates back to the 1<sup>st</sup> century. The wheelbarrow would represent organisations that portray characteristics of low creativity, high administrative or labour intensive and where there is no need or desire for innovation to improve performance. The competitiveness of the Customer Value Proposition is low.
- **Steam Train** signifies organisations that find change difficult. Due to the legacy culture, it is difficult to develop an innovation maturity; however the nature of the industry demands ICT utilisation to ensure efficiency. This space is not sustainable, unless the organisation is in a highly regulated monopolistic market.
- **Spaceship** is an organisation that is highly driven to be successful in terms of the organisational strategy and has a vision to compete to be the best. These are organisations that innovate constantly and invest in ICTs in abundance. These organisations are risk averse in terms of innovation success. These organisations constantly reappear with new advancements.
- **Rocket** refers to organisations that have a high innovation energy drive, but lack the ability to utilise ICTs appropriately. These organisations can be termed “one hit wonders”. The organisation shows room for improvement and this is highly probable due to the organisational culture.

The model may be used by organisations to analyse their degree of integration of the various factors that promote innovation maturity. To be successful, an organisation should balance their innovation maturity and their investments in ICT to generate the optimal performance. Innovation is paradoxical and constantly evolving, therefore an organisation would not maintain a linear innovation maturity position.

The researcher plotted the Large Hospital Group on the matrix and concluded that it was a “steam train”. The organisation was performing at an average pace with regard to cost reduction and quality improvements. The study provided evidence of moderate innovation energy and culture. The organisation did not view innovation as a competitive advantage and albeit the abundance in technology, the adoption of ICT is slow.

## 6.5 Summary

This chapter provides a detailed account for interpretation of the results from the data analysis in order to draw inferences and make deductions that shall inform the objective of this research study. The findings of the research study have proven hypotheses 1, 2 and 3 as outlined in Chapter 3.

From a combination of the empirical findings of the quantitative and qualitative data and supported by existing theory, the researcher was able to achieve the research objectives set out for this study. The association between communication within ICTs and its role as a strategic driver of innovation was explored and it can be deduced that a strong relationship does exist and this in turn is significant to improving healthcare in South Africa.

The researcher has conceptualised a model that may act as tool for organisations to utilise to assess their innovation and ICT maturity. Strategic initiatives may be executed to drive innovation as a performance measure and organisations can strive from their current ICT and innovation position toward “spaceship” or toward the optimal structure that meets their organisational strategy, given their regulatory and market environment.

The researcher identified from the interviews with Senior Executive Managers that Large Hospital Group is aware that the nature of the healthcare environment is evolving and that traditional approaches, reactive in nature, will be a resistance to the change required to adopt innovative solutions. The Large Hospital Group was assessed on the ICT Innovation Matrix as a “steamtrain” performing at an average pace with regard to cost reduction and quality improvements and in order for advancements to be made to exploit future opportunities, the culture should evolve into an innovative one.

In Chapter 7, the researcher shall conclude the research study objectives and findings to address the adoption of ICT and innovation in South African healthcare. The researcher provides specific recommendations to:

- management of Large Hospital Group as insight to assist with their organisational performance through ICT and innovation adoption and;
- future researchers summarising the salient issues and areas that need further examination.

## **Chapter 7: Conclusion and Recommendations**

### **7.1 Introduction**

This chapter highlights the cohesive set of findings in this research study in line with both the primary and secondary research objectives:

The primary objective of this research study is to ascertain whether communication within ICTs drives innovation and this innovation in turn is significant to improving healthcare in South Africa.

The secondary objective is to develop a tenable multi-dimensional framework that can be utilised by healthcare providers to implement and align an innovation framework with the organisation's strategy.

This chapter also includes recommendations to stakeholders based directly on the findings from the research and it provides specific recommendations to future researchers summarising the salient issues and areas that need further examination.

### **7.2 Review of the Objectives and Purpose of the Research**

In the introductory chapter, the researcher clearly indicates the purpose and relevance of the study of ICTs and innovation in healthcare in relation to hospital performance, in terms of reduction in cost and improvements in service delivery. The business need for the study as well as the theoretical need was articulated. The relationship between the research problem and the research objectives was explained and the scope of the research defined. To contextualise the key concepts discussed in the research study, the researcher defines Information Communication Technology and innovation with reference to literature.

In Chapter 2, the researcher formulated a conceptual model to frame the literature review. The model synthesised the components of the study and revealed the various arguments from scholars on the role of ICTs as a key strategic driver of innovation and the impact on healthcare performance.

The literature review formed the basis of clear, unambiguous hypotheses formulated in Chapter 3:

H1: Information Communication Technology is not a key strategic driver of innovation.

H2: Innovation is not key to reducing the cost of healthcare.

H3: Innovation is not key to improving the service delivery of healthcare.

Chapter 4 outlines the research method, study design and strategy applied by the researcher. The data collection procedures and the data analysis tools and techniques in relation to this study were discussed in detail to provide a clear view of the researcher's approach to proving the hypotheses.

Chapter 5 and 6 provides a detailed account for interpretation of the results from the data analysis in order to draw inferences and make deductions that shall inform the objective of this research study.

### **7.3 Research Findings and Conclusion**

From a combination of the empirical findings of the quantitative and qualitative data and supported by existing theory, the researcher concludes that communication within ICTs drives innovation and this innovation in turn is significant to improving healthcare in South Africa.

If well executed, innovation allows healthcare organisations to maximise their opportunities for improving the quality of care and to rationalise healthcare costs. The performance of healthcare organisations is dependent on leadership competencies and a culture of innovation that has the ability to overcome the barriers of adoption and the ability to deal with change. Open innovation and a learning culture is positively correlated and act as enablers for successful innovation execution.

Healthcare in South Africa remains a highly political domain and the interoperability between the government public and private sector is key to improving healthcare performance. Improving communication through ICT systems across organisations creates the potential for collaboration and co-creation of innovation, however given the political tension and the adoption of such innovation has no guarantee at this juncture to improve the healthcare eco-system.

Clear government policies and strategies in the promotion of innovation and the use of ICTs in healthcare service delivery are imperative as a key strategic item on the agenda of the National Health Commission.

From a theoretical perspective, this paper contributes to a model that may be tested in future research against other organisations and industries to establish the degree of integration of innovation maturity and ICT maturity to drive performance. The model contributes to the existing body of knowledge regarding innovation challenges and success factors. In addition, the model adds a new dimension to the academic studies that constitute organisational performance including the assessment of innovation maturity of an organisation.

## 7.4 Recommendations to Management

From a business perspective, the researcher has contributed through inter alia, the development of a model that that can be utilised by Healthcare providers to implement and align an innovation framework with the organisation's strategy. This study provided insight into innovation in Large Hospital Group by engaging experts in their own field. The recommendations put forth by the researcher draw from a combination of quantitative tests, qualitative extractions and literature review and research.

The researcher contextualised/ plotted the Large Hospital Group on the **ICT Innovation Maturity Matrix** and concluded that it was a "steam train". The organisation was performing at an average pace with regard to cost reduction and quality improvements. The study provided evidence of moderate innovation energy and culture. The organisation did not view innovation as a competitive advantage and therefore the adoption of ICT is slow.

In order for the organisation to move to a "spaceship" or rocket, the organisation's innovation maturity needs to be improved. Currently the organisation utilises ICT in abundance, however this is not sustainable due to the innovation factors that act as constraints.

A "systems thinking" approach is necessary for the successful adoption of Information Communication Technology. Systems thinking analyses the relationships of components of a situation and aims to understand the process based on this. There is interconnectedness between technology and humans and this impacts the implementation of ICTs.

The following pragmatic solutions were identified through the research to improve innovation maturity within Large Hospital Group:

- Leadership can plot their organisation against the ICT Innovation Maturity Matrix using any existing data on their organisation innovation and ICT maturity or consider obtaining such maturity measures through internal or external means

and then plotting against the ICT Innovation matrix and align the interventions to elevate their maturity status with the organisations strategic imperative;

- Develop new curriculum to train staff to be innovative- training and embodiment of end user training is key to ensure that this is not a barrier to ICT adoption;
- Create clear communication channels that inform the process of idea generation,
- Train leaders to be innovation leaders- Innovation leaders have the competencies of self-knowledge and competence, synthesis, formulation, collaboration, managing knowledge, coaching, essence of innovation and innovation knowledge.
- Create an innovation hub that is a meeting place for a community of the innovation leaders. The organisation can dabble with entrepreneurial freedom and translate their innovation energy and the ideas of other employees into diffusible innovations.
- Create and espouse an environment that is conducive to innovation, considering issues such as culture, reward, collaboration, technology forums, and mechanisms to promote and capture employee ideas.
- Monitor the implementation and use of innovation during integration, adoption and for the full economic life cycle to ensure that the promised benefits are realised and to identify lessons learned. Measurement of innovation benefits provides management with confidence for future innovation investment.
- Incorporate innovation as a performance indicator on Balance Scorecards and Key Performance Indicators .

The promulgation of National Health Insurance Regulation in South Africa shall challenge organisations to reduce costs and improve service delivery and this shall necessitate a transformation agenda that enables healthcare providers to deal with the demand for healthcare with resource constraints. Healthcare providers, including Large Hospital Group should restructure models to accommodate such and this can be achieved with the utilisation of ICTs that drive innovation.



## 7.5 Recommendations for Future Research

- The ICT Innovation Maturity Matrix would best be supported by standardised assessment tools that could be used to assess and measure the Innovation and ICT maturity of an organisation so that these maturity levels can be plotted against the ICT Innovation Maturity Matrix. Future researchers could investigate and develop a standardised assessment tool.
- This research study was conducted in the South African environment and therefore excludes the evolving global trends; future researchers may consider directing a similar study in other markets. Although existent, there is limited literature available in this environment.
- The data acquired was predominantly from a single large private sector organisation. Research studies suggest that South Africa is the leading Information Communication Technology developer in healthcare in the African continent yet it is poorly adopted in underprivileged communities. It would also be beneficial to extend the universe of the study to other private sector healthcare providers to investigate and generalise a private sector perspective.
- In order to understand end user ICT innovation adoption, future research would need to be conducted to incorporate end user perceptions.
- An interesting observation of findings from interviews with Executive Management related to the correlation of an existence of an innovation attitude and the functional roles. Interesting research going forward would encompass leadership functional roles and their attitude to ICT innovation adoption.
- Explore gender particularities of end users of technology- In the context of the study
- In the context of measuring an innovation culture future researchers could explore the impact of Employee Driven Innovation and open source innovation on healthcare performance.
- Future research should include the creation of innovation hubs.
- ICT Doctor patient- why would doctors not implement ICT's? The digitalization process is well underway within many healthcare providers and the South African practitioners view on ICT adoption as an end user would be invaluable to this field of study.
- Strategic implication of ICT and innovation in product design and customer service/ needs.

## 7.6 Summary

The researcher commenced this exploratory research journey to ascertain whether communication within ICTs offer possibilities of advancements that drives innovation and improves the quality of healthcare provided to South African citizens at an affordable level.

Experts from a large private hospital group were used as the sample population for this research study and by triangulation of the results the researcher was able to extract key findings.

The researcher finds that communication, if well executed, shall drive innovation which shall allow healthcare organisations the ability to maximise opportunities by improving their value propositions with an enhanced quality of care while rationalising cost. The performance of healthcare organisations is dependent on leadership competencies and a culture of innovation. The ICT Innovation Maturity Matrix (IMM) developed by the researcher proposes a degree of integration between ICT utilisation, innovation maturity and an organisation's performance. This model may act as a guide to navigate organisations from their current position of performance based on Innovation and ICT maturity toward the optimal structure that meets their organisational strategy, given their regulatory and market environment.

The overall status of healthcare and the economic pressure faced by the country contributes to increased complexity in the service delivery of healthcare in South Africa. Budget and resource constraints add to the difficulties in providing affordable solutions. These dire constraints have propelled the sector to scrutinise alternative solutions and technology innovation and the utilisation of Information Communication Technology has become key to supporting enhanced service delivery in the healthcare value chain

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# APPENDICES

## Appendix 1: Questionnaire and Interview Guide

UNIVERSITY OF PRETORIA (GIBS)

Masters of Business Administration

Interview Guide

*Leveraging Communication within Information Communication Technology (ICT) Systems as a Driver of Innovation within the South African Health Sector.*

**Researcher:** Nazeera Khan  
**Supervisors:** Dr Irfaan Khota  
**Discipline:** Innovation  
**Application Field:** Healthcare  
**Institution:** University of Pretoria

Thank you for participating in this study of Information Communication Technology and Innovation, conducted by Miss N Khan (Senior Risk Advisor, Large Hospital Group).

### **The Objective of my Research:**

To assess the effect of Communication within an Information Communication Technology (ICT) system and how it may contribute to an effective Strategic Innovation framework and the possible improvement of the quality of Healthcare in South Africa.

### **Significance of the study**

The status of healthcare in South Africa desperately needs assistance and there are opportunities to alleviate the issues through innovation initiatives within organisations. The contribution of this study will be in terms of an academic framework and business guidance.

**Confidentiality:**

The nature of this research and interview is both of a conversational and exploratory nature. Kindly speak freely and be reassured in the fact that any information shared in this interview will be treated as confidential and your comments will remain without identifiers.

Your participation in this study is voluntary and you may withdraw at any time without penalty. Confidentiality is maintained throughout the process. All data will be kept confidential and any quotations used will be anonymised. Prior to commencing the interview, may I ask you to please sign the consent form and can you in addition please confirm that you have no objections for me to record the interview utilising an audio recording device?

If you have any concerns, please contact my supervisor or myself directly. Our respective details are listed herein.

Please indicate your availability to be interviewed during the months of July and August 2015.

**Researcher:** Nazeera Khan

Direct Contact: 083 568 2664

Email: [nazeerakhan716@gmail.com](mailto:nazeerakhan716@gmail.com) or [Nazeera.khan@Large Hospital Group.co.za](mailto:Nazeera.khan@Large Hospital Group.co.za)

**Supervisor:** Dr. Irfaan Khota

Email: [irfaan.khota@gmail.com](mailto:irfaan.khota@gmail.com)

## Appendix 2: Questionnaire (Surveys and Interviews)

Question:	Strongly Agree	Agree	Partially Agree	Disagree	Strongly Disagree	Comments:  (Please elaborate on answers where you deem necessary)
<b>The Communication of Information utilising Information Communication Technology (ICT's)</b>						
1. The lack of information within organisation's contributes to decision makers being unable to make strategic decisions optimally						
2. Organisations that do not communicate information effectively through ICT systems limits their ability to make key strategic decision						
3. Our organisation utilises technology, in the form of Information Communication Systems (ICT's), effectively to communicate information for decision making						
4. Our organisation communicates information effectively across functions and divisions to support the decision making process						
5. Our organisation uses information effectively at all levels to make strategic and operational decisions						
6. Our organisation uses current and historical information to support the decision making process						
7. In our organisation, current and historical information is easily accessible and available and transferrable across all decision making units						

8. In our organisation, effective communication is an imperative to enable key decisions, albeit the abundance of information and technology						
<b>Information Communication Technology as a key Strategic Driver of Innovation:</b>						
9. ICT plays a pivotal role in our organisation with regard to driving innovation through improved decision making						
10. In our organisation, information is viewed as the key enabler of innovation						
11. In our organisation, communication is viewed as the key enabler of innovation						
12. In our organisation, technology is viewed as the key enabler of innovation						
13. In our organisation, business processes are viewed as the key enablers of innovation						
14. Communication through ICT systems is essential for innovation collaboration						
15. Communication through ICT systems is essential for the quality of innovation						
16. Integrated communication through ICT system is pivotal to the innovation ideation						
17. Effective communication through ICT systems enables the diffusion of innovation						
18. Communication through ICT systems can support critical business functions through more effective provisioning of business and customer insight through information management						
19. Improving the uptake of ICT systems requires better awareness of what technologies are						

available, what these can offer and the affordability of such technologies						
20. Integrated communication through ICT systems must be embedded by formal and informal change management processes						
21. Improving communication through ICT systems creates the potential for internal collaboration and co-creation of innovation						
22. Improving communication through ICT systems across organisations creates the potential for collaboration and co-creation of innovation						
<b>Innovation in our Organisation:</b>						
23. In our organisation, innovation is viewed as a strategic imperative						
24. In our organisation, innovation is key to remaining competitive						
25. Our organisation has a mature communication mechanism within our ICT system that promotes collaboration which drives innovation						
26. Our organisation effectively promotes the importance of communication in driving innovation						
27. Our organisation provides clearly communicates an innovative process for idea generation						
28. Our culture makes it hard for people to put forward innovative ideas						
29. Our processes makes it hard for people to put forward innovative ideas						
30. Our lack of communication makes it hard for people to put forward innovative ideas						

31. Our organisation is slow to roll out innovative products and services						
32. Our organisation has a risk-averse attitude toward the possible structural or organisational changes resulting from innovation						
33. Our organisation has a risk-averse attitude toward the cost associated with innovation						
34. Competitors quickly copy our product introductions and often make pre-emptive launches locally and in other countries						
35. In our organisation, the benefits arising from innovation relate primarily to improvements in technology						
36. In our organisation, the benefits arising from innovation relate primarily to improvements in Customer Relationship Management						
37. In our organisation, innovation is key to reducing the cost of healthcare						
38. In our organisation, innovation is key to improving the service delivery of healthcare						



## Appendix 3: Interview Consent Form

***Leveraging Communication within Information Communication Technology (ICT) Systems as a Key Strategic Driver of Innovation and Improvements within the South African Healthcare Sector.***

**Researcher:** Nazeera Khan, MBA Student at the Gordon Institute of Business Science, University of Pretoria

---

I am conducting research on Communication within an Information Communication Technology (ICT) system and effective Strategic Innovation frameworks within the Healthcare industry in South Africa.

Through your participation I hope to assess and understand the effect of Communication within an Information Communication Technology (ICT) system and how it may contribute to an effective Strategic Innovation framework and the possible improvement of the quality of Healthcare in South Africa.

Your participation is voluntary and you can withdraw at any time without penalty. The audio recording of this interview is also voluntary and you may choose not to be recorded. All data will be kept confidential and any quotations used will be anonymised.

If you have any concerns, please contact my supervisor or I. Our details are provided below:

Nazeera Khan

Dr Irfaan Khota

[nazeerakhan716@gmail.com](mailto:nazeerakhan716@gmail.com)

[irfaan.khota@gmail.com](mailto:irfaan.khota@gmail.com)

083 568 2664

011 269 3621

Participant's Name: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Researcher's Name: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

## Appendix 4: GIBS Ethical Clearance Consent

**Gordon Institute  
of Business Science**  
University of Pretoria

Dear Miss Nazeera Khan

Protocol Number: **Temp2015-00989**

Title: **Leveraging Communication within Information Communication Technology (ICT) Systems as a Key Strategic Driver of Innovation and Improvements within RSA Health Sector.**

Please be advised that your application for Ethical Clearance has been APPROVED.

You are therefore allowed to continue collecting your data.

We wish you everything of the best for the rest of the project.

Kind Regards,

GIBS Ethics Administrator



MANOJ D. CHIBA

Chiba M @gibs.co.za

## Appendix 5: Large Hospital Group Research Approval

### RESEARCH OPERATIONS COMMITTEE FINAL APPROVAL OF RESEARCH

Approval number: UNIV-2015-0042

Ms Nazeera Khan

E mail: Nazeera.Khan@netcare.co.za

Dear Ms Khan

#### RE: LEVERAGING COMMUNICATION (INFORMATION COMMUNICATION TECHNOLOGY SYSTEMS - ICTS) AS A KEY STRATEGIC DRIVER OF INNOVATION AND IMPROVEMENTS WITHIN RSA HEALTH SECTOR

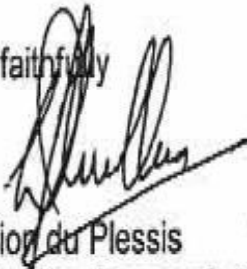
The above-mentioned research was reviewed by the Research Operations Committee's delegated members and it is with pleasure that we inform you that your application to conduct this research at Private Health Care Provider has been approved, subject to the following:

- i) Research may now commence with this FINAL APPROVAL from the Committee.
- ii) All information regarding the Company will be treated as legally privileged and confidential.
- iii) The Company's name will not be mentioned without written consent from the Committee.
- iv) All legal requirements with regards to participants' rights and confidentiality will be complied with.
- v) The Company must be furnished with a STATUS REPORT on the progress of the study at least annually on 30th September irrespective of the date of approval from the Committee as well as a FINAL REPORT with reference to intention to publish and probable journals for publication, on completion of the study.
- vi) A copy of the research report will be provided to the Committee once it is finally approved by the relevant primary party or tertiary institution, or once complete or if discontinued for any reason whatsoever prior to the expected completion date..
- vii) The Company has the right to implement any recommendations from the research.

- viii) The Company reserves the right to withdraw the approval for research at any time during the process, should the research prove to be detrimental to the subjects/ Company or should the researcher not comply with the conditions of approval.
- ix) APPROVAL IS VALID FOR A PERIOD OF 36 MONTHS FROM DATE OF THIS LETTER OR COMPLETION OR DISCONTINUATION OF THE STUDY, WHICHEVER IS THE FIRST.

We wish you success in your research.

Yours faithfully

  
Prof Dion du Plessis

11/7/2015  
Full member: Research Operations Committee & Medical Practitioner evaluating research applications as per Management and Governance Policy

  
Shannon Nell

Chairperson: Research Operations Committee

Date:

20/7/2015

This letter has been anonymised to ensure confidentiality in the research report. The original letter is available with author of research

## Appendix 6: Central Tendency

### Information Communication Technology:

The lack of information within organisation's contributes to decision makers being unable to make strategic decisions optimally		Statistic	Std. Error	
1	Mean	1.83	0.145	
	95% Confidence Interval for Mean	Lower Bound Upper Bound	1.54 2.13	
	5% Trimmed Mean	1.81		
	Median	2		
	Variance	0.626		
	Std. Deviation	0.791		
	Minimum	1		
	Maximum	3		
	Range	2		
	Interquartile Range	1		
	Skewness	0.315	0.427	
	Kurtosis	-1.309	0.833	
	2	Mean	2.27	0.195
		95% Confidence Interval for Mean	Lower Bound Upper Bound	1.84 2.71
5% Trimmed Mean		2.3		
Median		2		
Variance		0.418		
Std. Deviation		0.647		
Minimum		1		
Maximum		3		
Range		2		
Interquartile Range		1		
Skewness		-0.291	0.661	
Kurtosis		-0.208	1.279	
3		Mean	1.5	0.289
		95% Confidence Interval for Mean	Lower Bound Upper Bound	0.58 2.42
	5% Trimmed Mean	1.5		
	Median	1.5		
	Variance	0.333		
	Std. Deviation	0.577		
	Minimum	1		
	Maximum	2		
	Range	1		
	Interquartile Range	1		
	Skewness	0	1.014	
	Kurtosis	-6	2.619	
	4	Mean	1.75	0.25
		95% Confidence Interval for Mean	Lower Bound Upper Bound	0.95 2.55
5% Trimmed Mean		1.78		
Median		2		
Variance		0.25		
Std. Deviation		0.5		
Minimum		1		
Maximum		2		
Range		1		
Interquartile Range		1		
Skewness		-2	1.014	
Kurtosis		4	2.619	

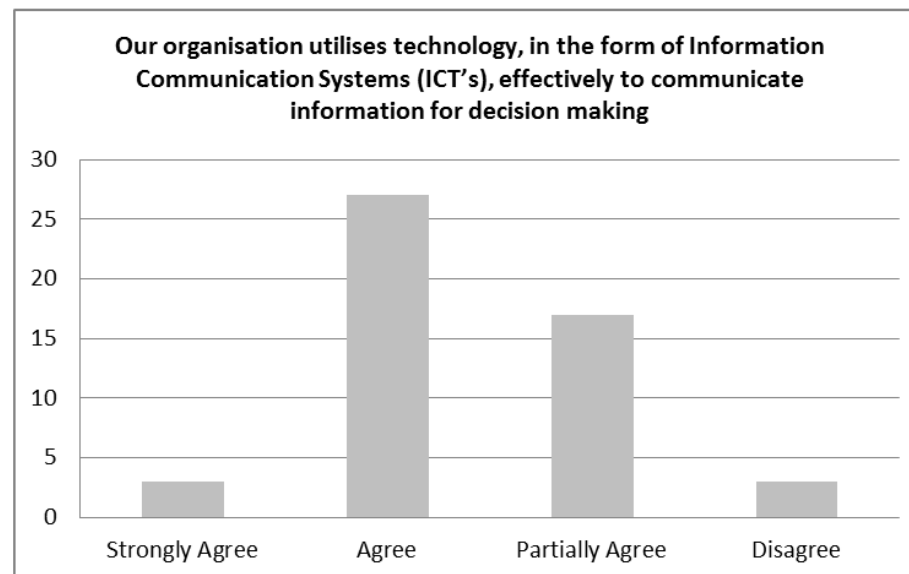
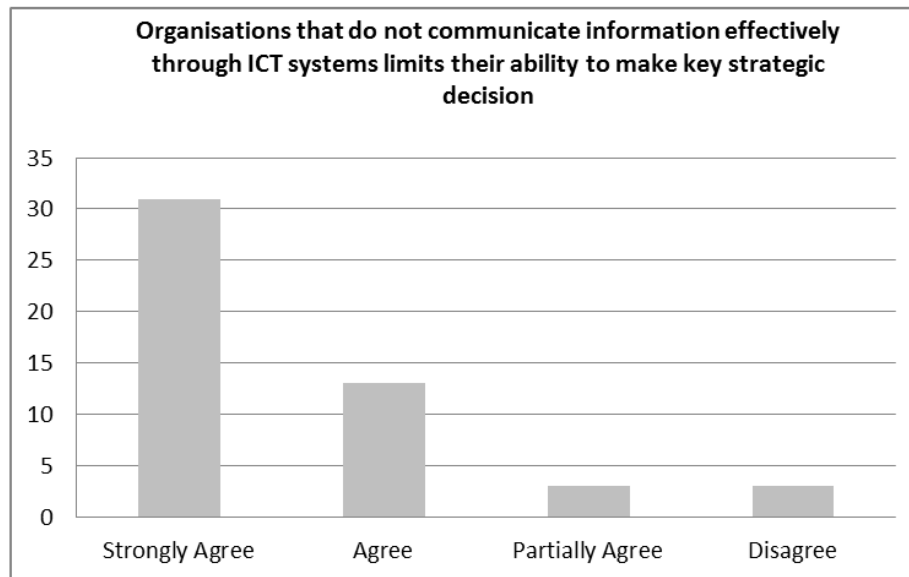
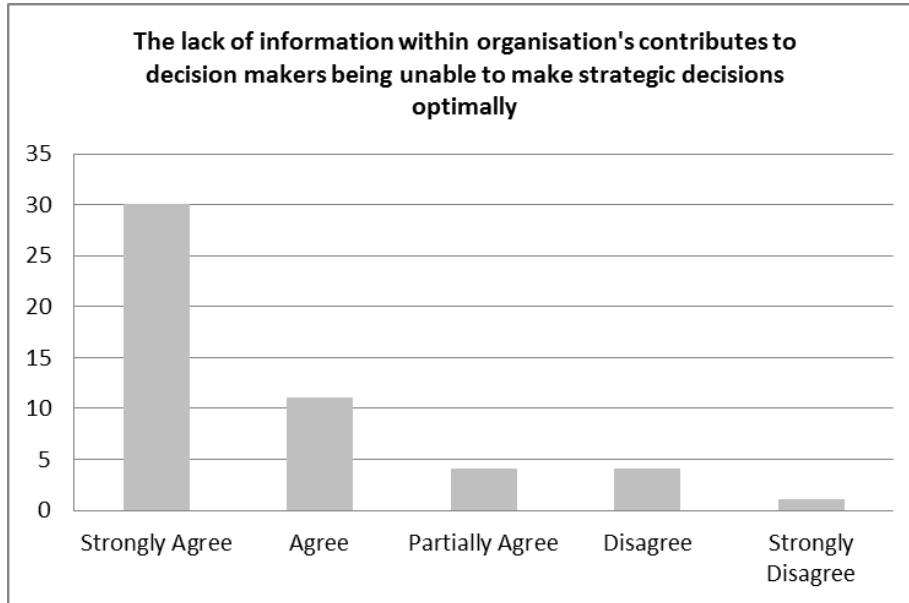
ICT plays a pivotal role in our organisation with regard to driving innovation through improved decision making

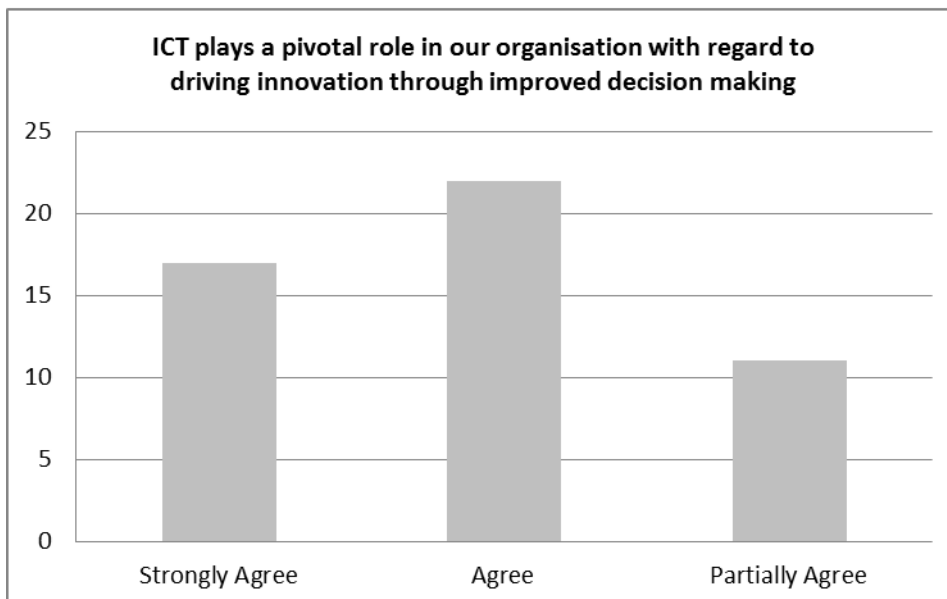
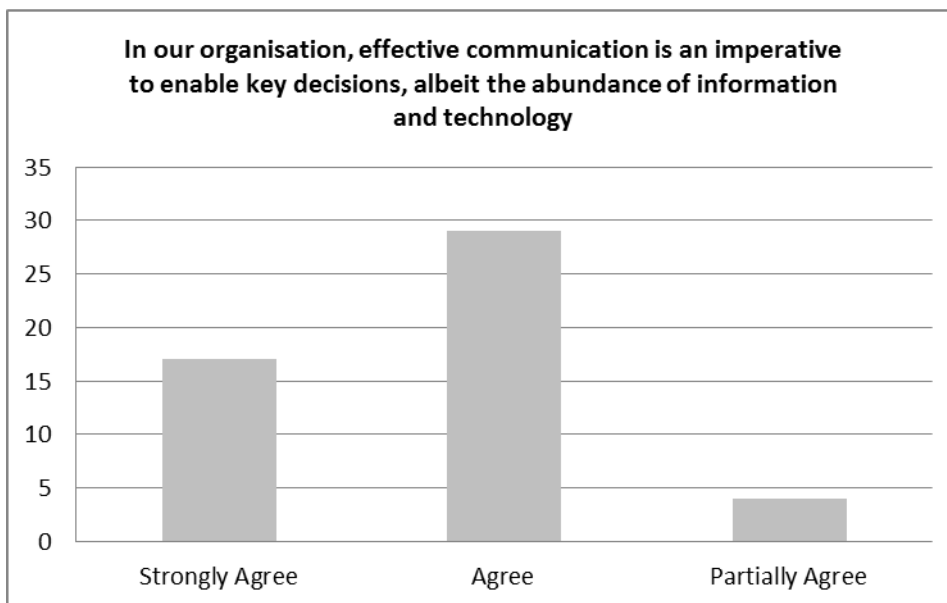
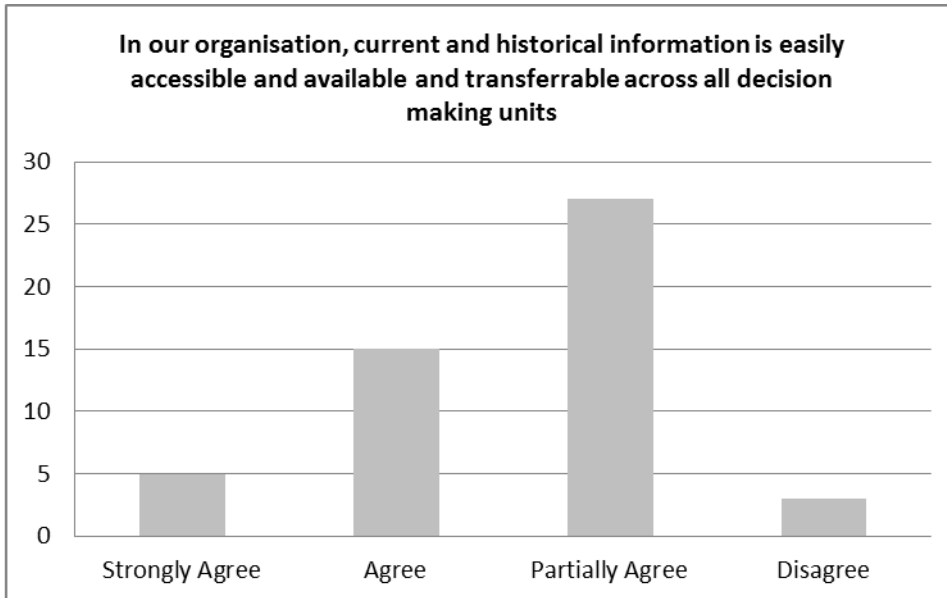
## Correlation Matrix: Innovation:

### Descriptives

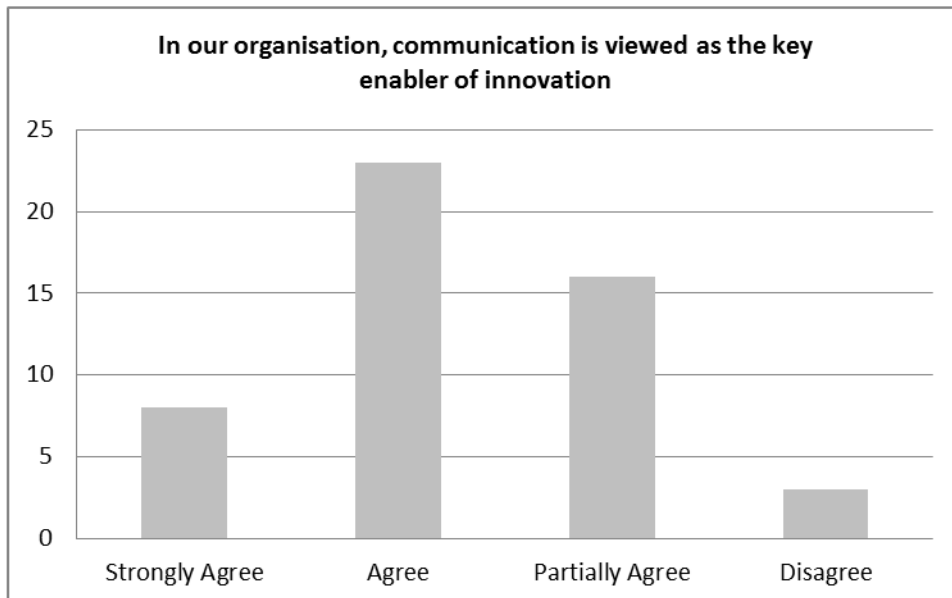
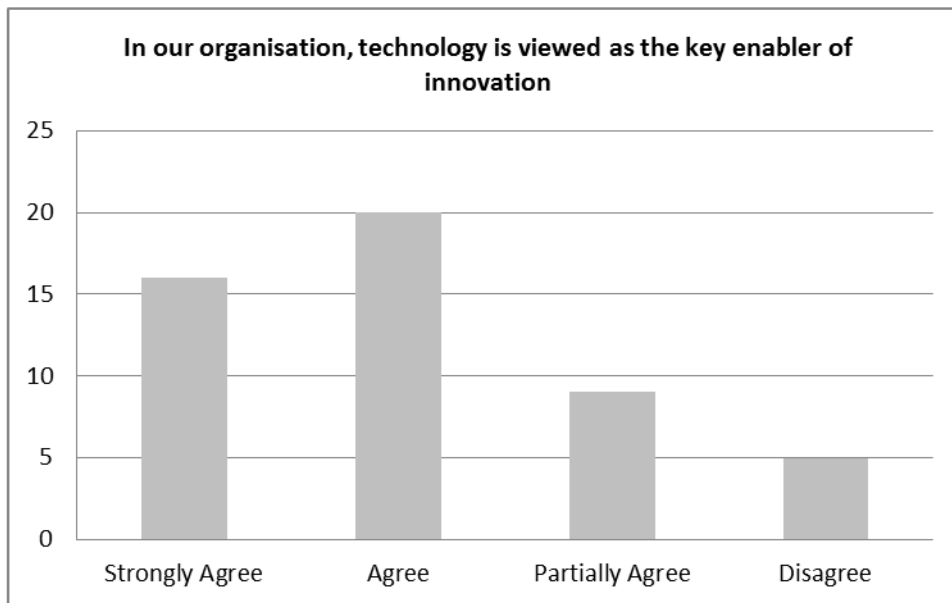
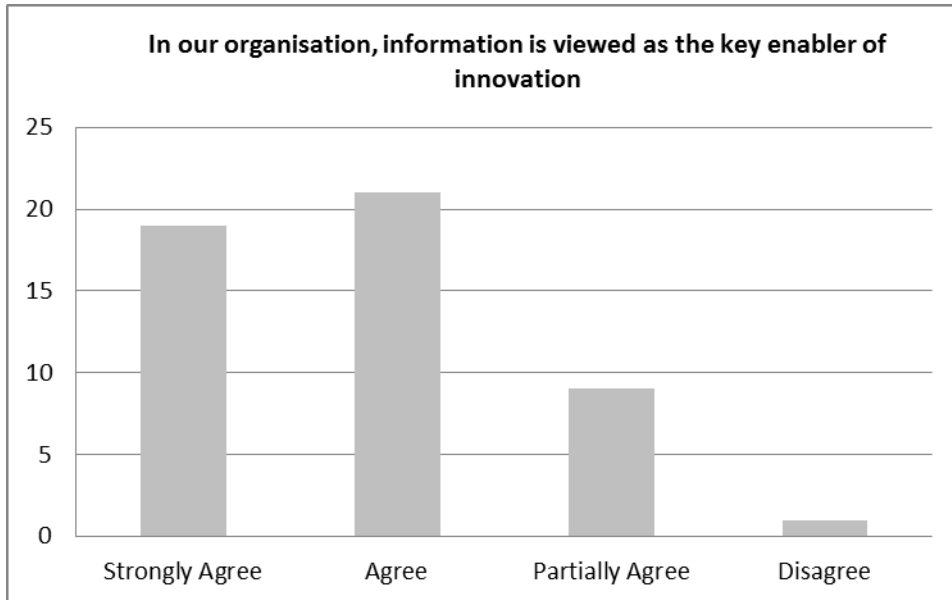
		Statistic	Std. Error	
In our organisation, innovation is viewed as a strategic imperative	Mean	1.87	0.274	
	95% Confidence Interval for Mean	Lower Bound	1.28	
		Upper Bound	2.45	
	5% Trimmed Mean	1.8		
	Median	2		
	Variance	1.124		
	Std. Deviation	1.06		
	Minimum	1		
	Maximum	4		
	Range	3		
	Interquartile Range	1		
	Skewness	1.13	0.58	
	Kurtosis	0.323	1.121	
	In our organisation, innovation is key to reducing the cost of healthcare	Mean	1.6	0.149
		95% Confidence Interval for Mean	Lower Bound	1.3
Upper Bound			1.9	
5% Trimmed Mean		1.52		
Median		1		
Variance		0.662		
Std. Deviation		0.814		
Minimum		1		
Maximum		4		
Range		3		
Interquartile Range		1		
Skewness		1.3	0.427	
Kurtosis		1.224	0.833	
In our organisation, innovation is key to improving the service delivery of healthcare		Mean	2.4	0.6
		95% Confidence Interval for Mean	Lower Bound	0.73
	Upper Bound		4.07	
	5% Trimmed Mean	2.39		
	Median	3		
	Variance	1.8		
	Std. Deviation	1.342		
	Minimum	1		
	Maximum	4		
	Range	3		
	Interquartile Range	3		
	Skewness	-0.166	0.913	
	Kurtosis	-2.407	2	
	In our organisation, innovation is key to improving the service delivery of healthcare	Mean	1.47	0.165
		95% Confidence Interval for Mean	Lower Bound	1.11
Upper Bound			1.82	
5% Trimmed Mean		1.41		
Median		1		
Variance		0.41		
Std. Deviation		0.64		
Minimum		1		
Maximum		3		
Range		2		
Interquartile Range		1		
Skewness		1.085	0.58	
Kurtosis		0.398	1.121	
In our organisation, innovation is key to improving the service delivery of healthcare		Mean	1.47	0.115
		95% Confidence Interval for Mean	Lower Bound	1.23
	Upper Bound		1.7	
	5% Trimmed Mean	1.41		
	Median	1		
	Variance	0.395		
	Std. Deviation	0.629		
	Minimum	1		
	Maximum	3		
	Range	2		
	Interquartile Range	1		
	Skewness	1.025	0.427	
	Kurtosis	0.113	0.833	
	In our organisation, innovation is key to improving the service delivery of healthcare	Mean	2.2	0.374
		95% Confidence Interval for Mean	Lower Bound	1.16
Upper Bound			3.24	
5% Trimmed Mean	2.22			

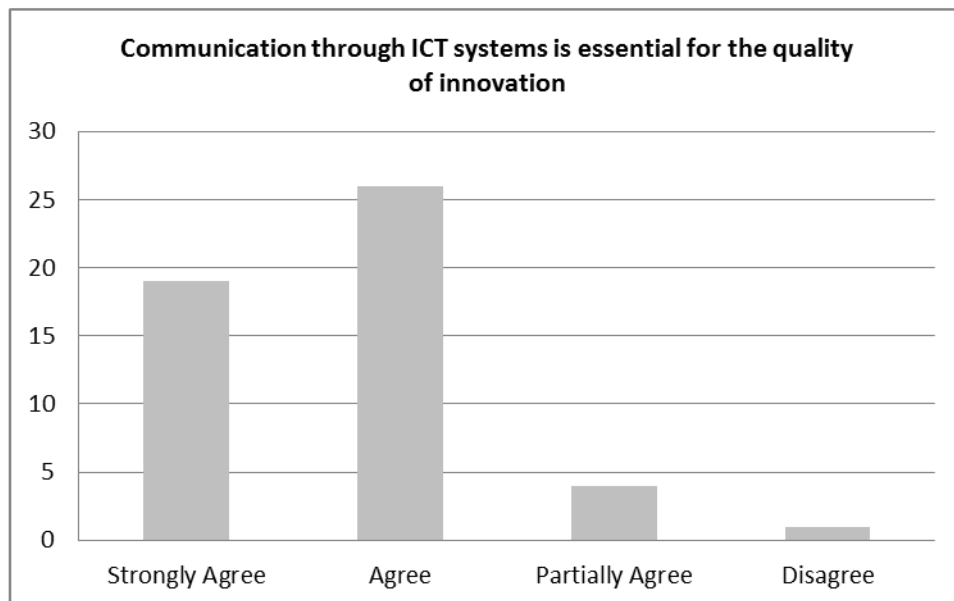
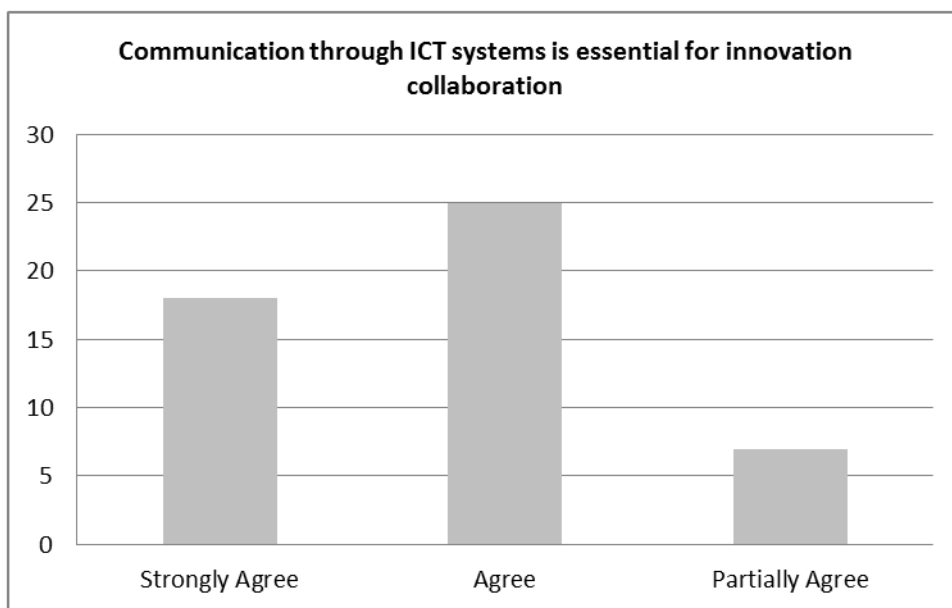
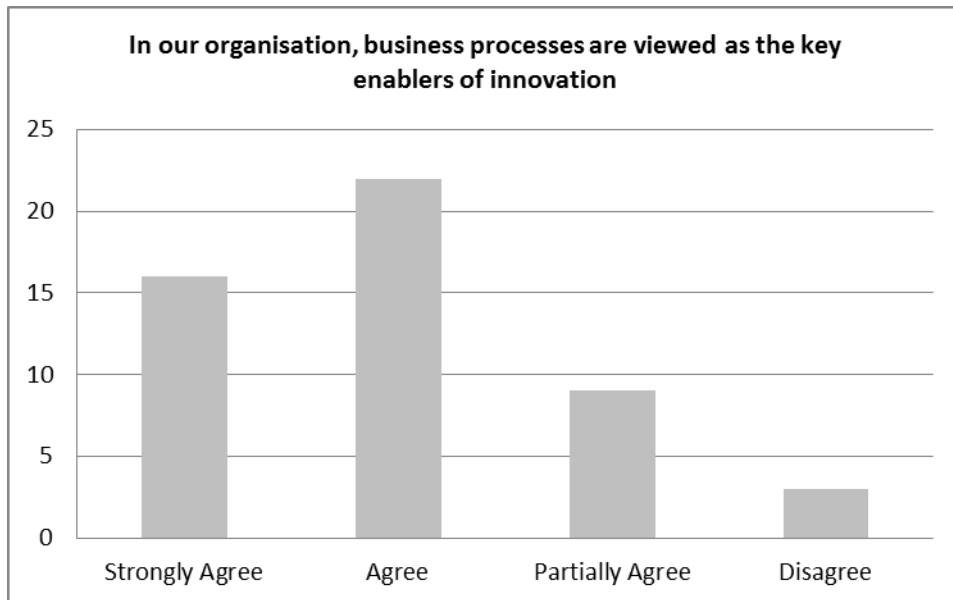
## Appendix 7: Frequency Distributions

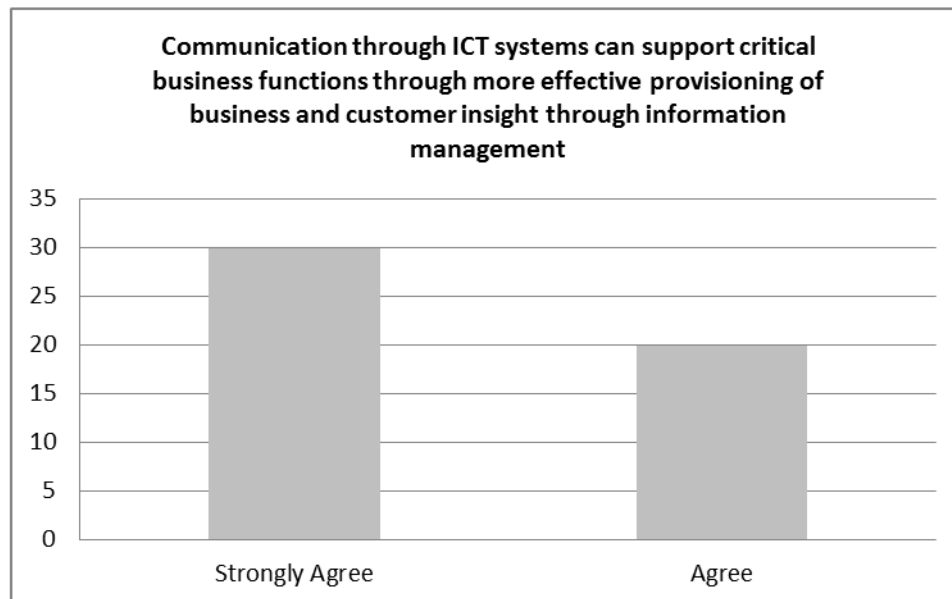
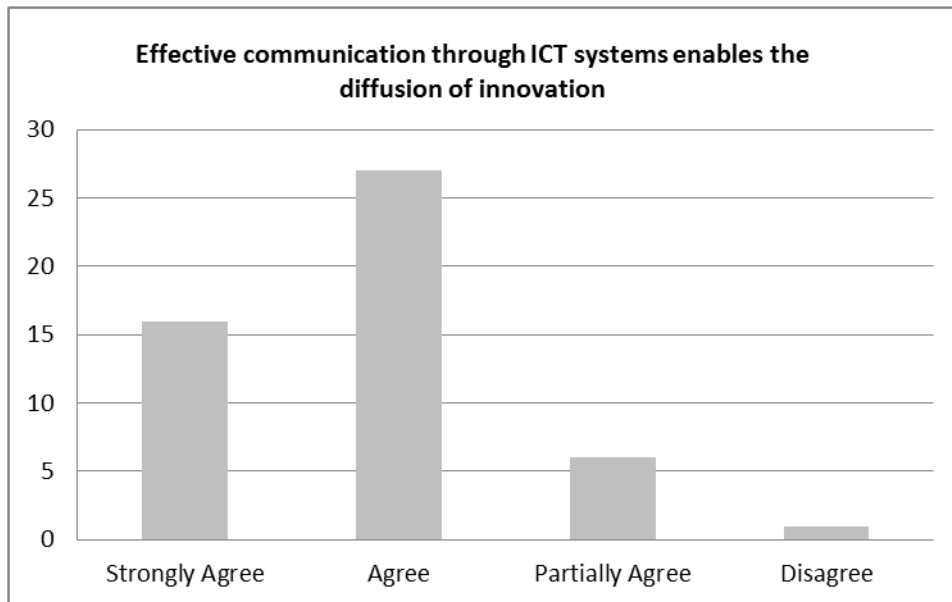
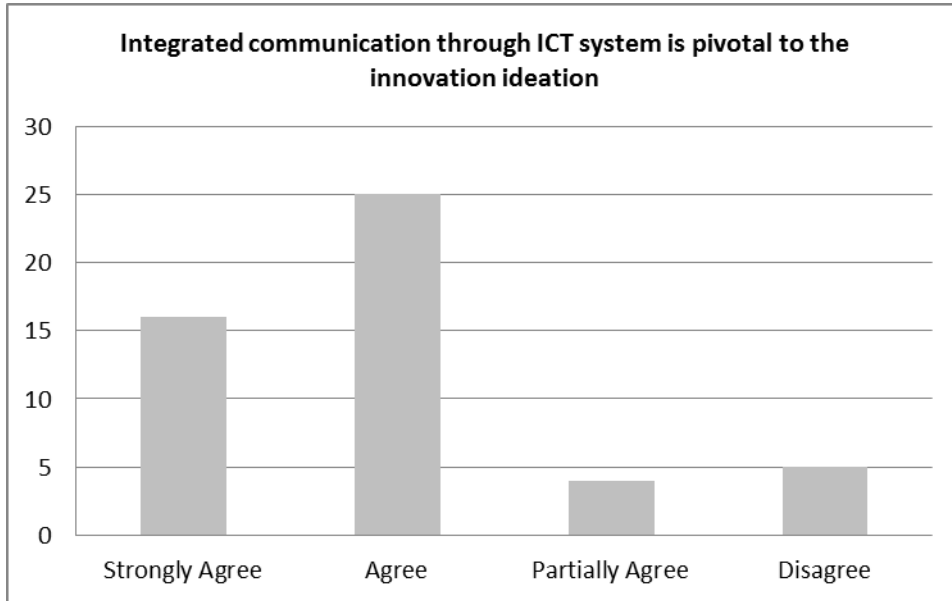


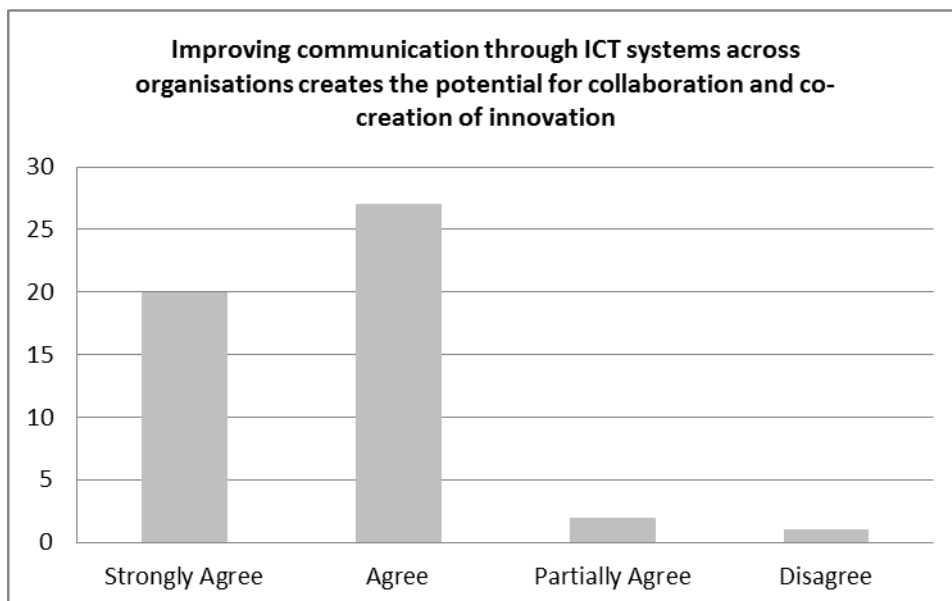
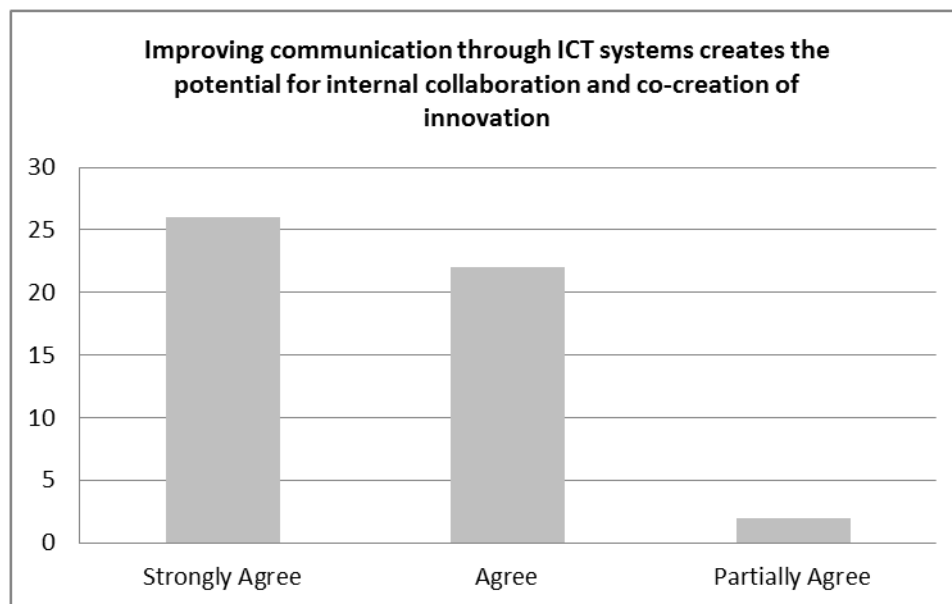
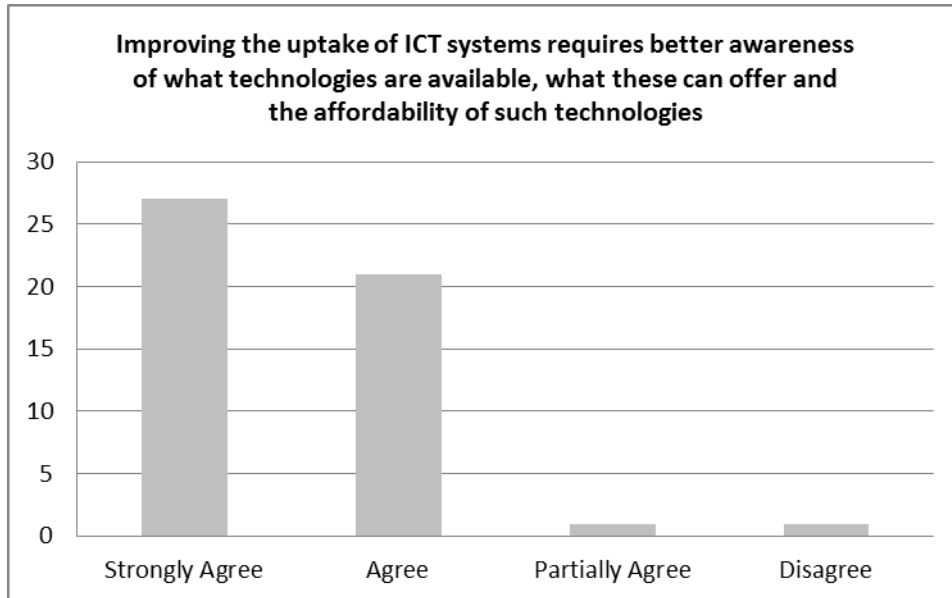


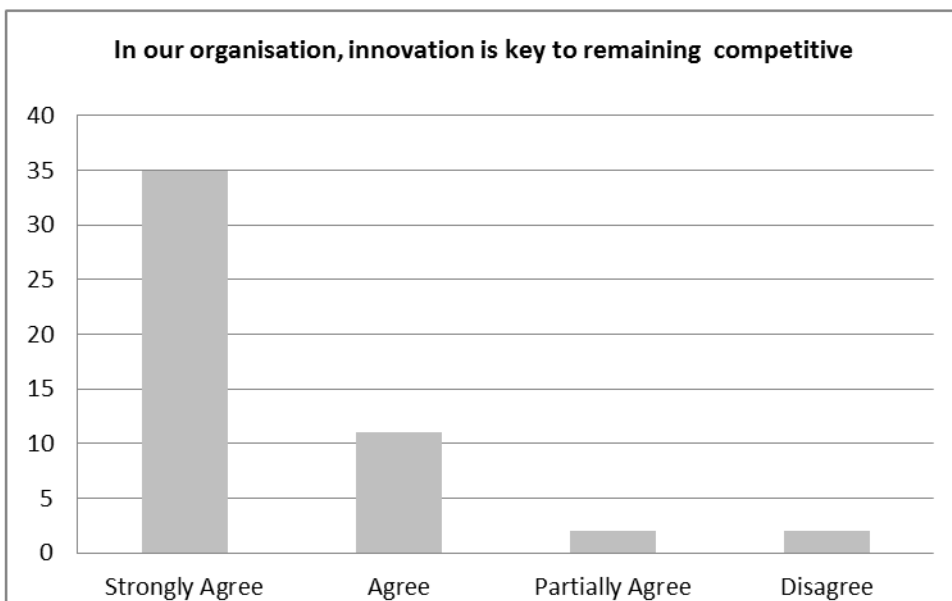
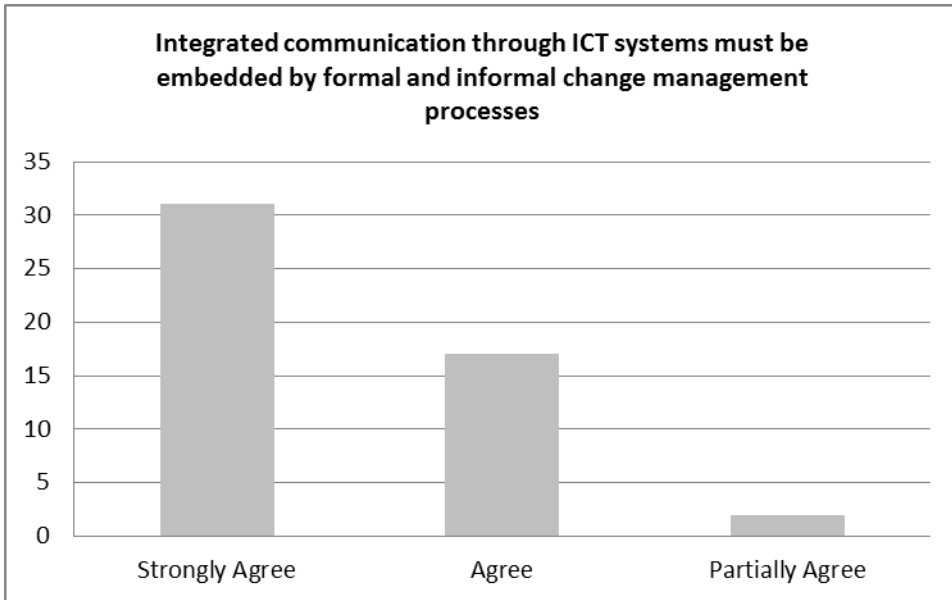


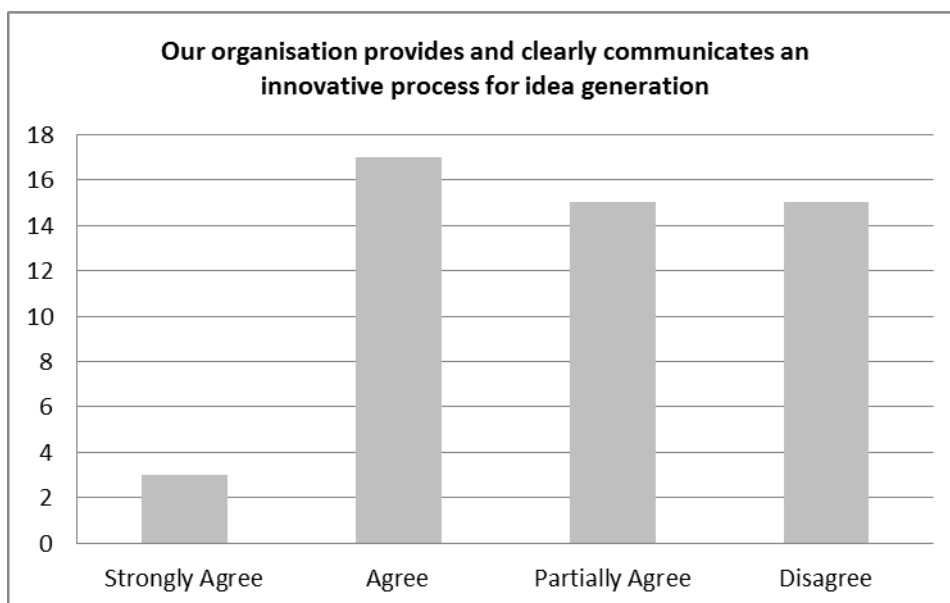
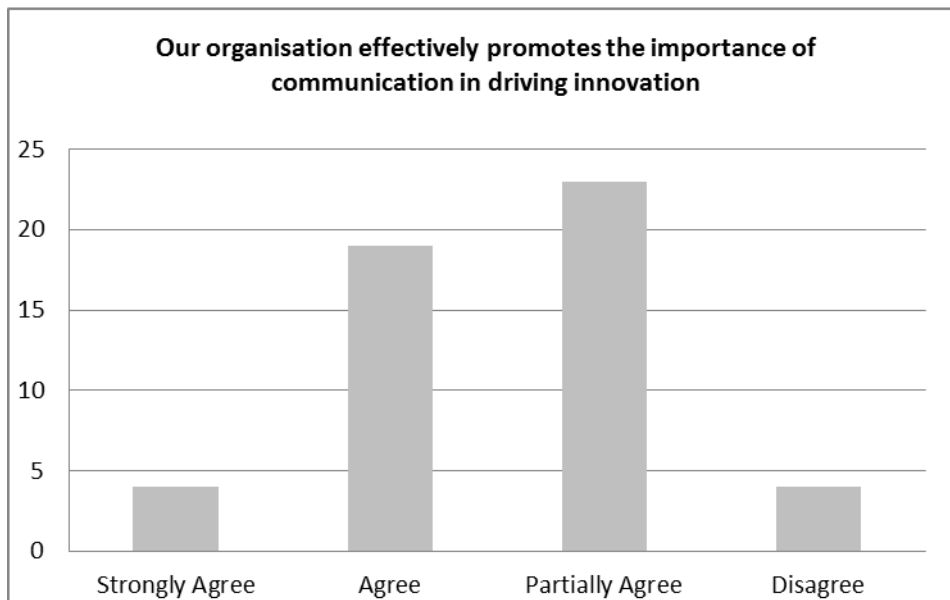
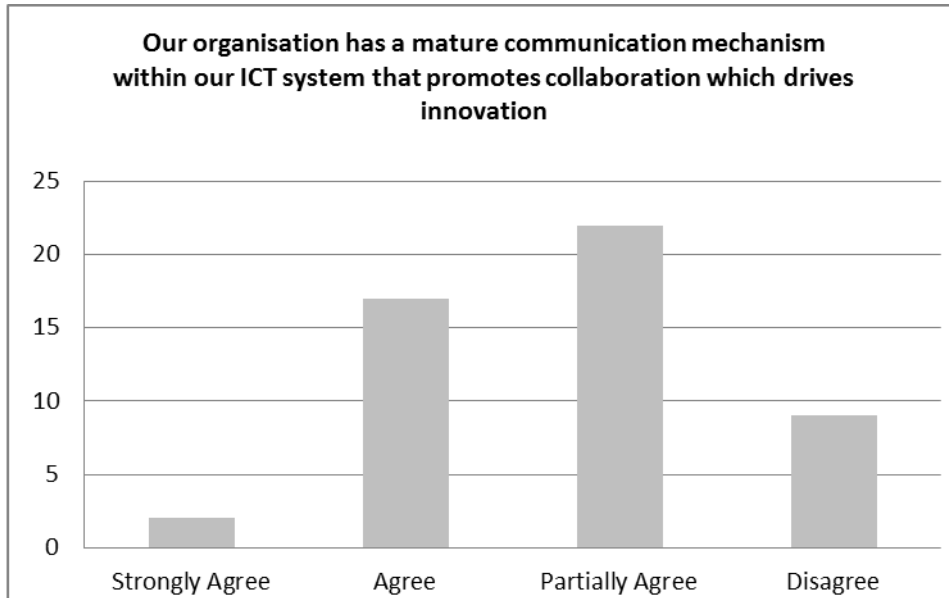


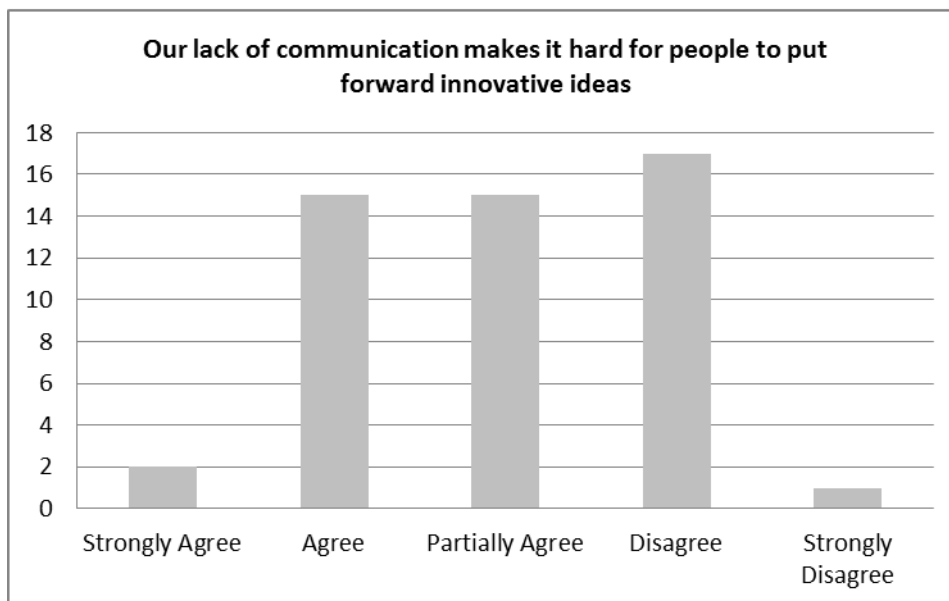
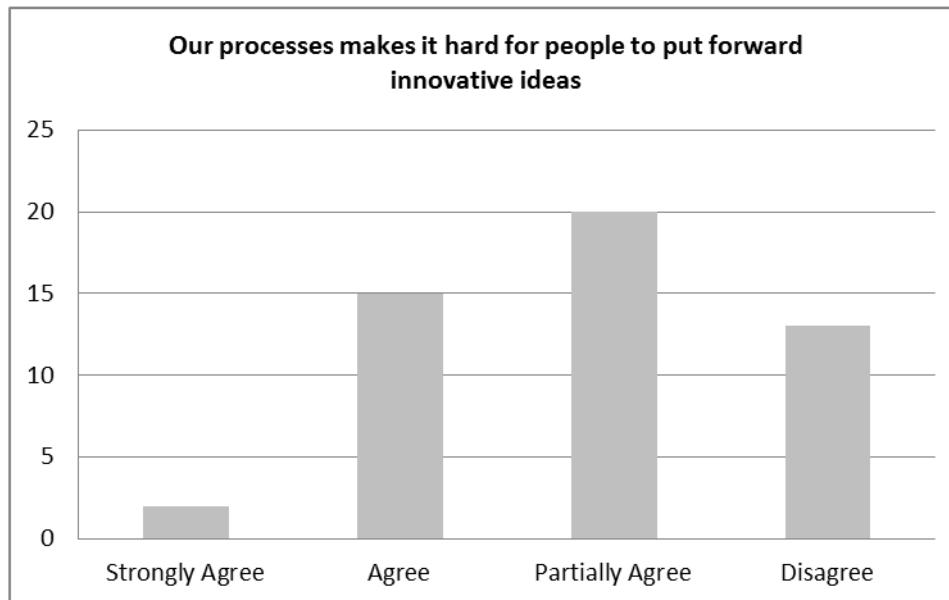
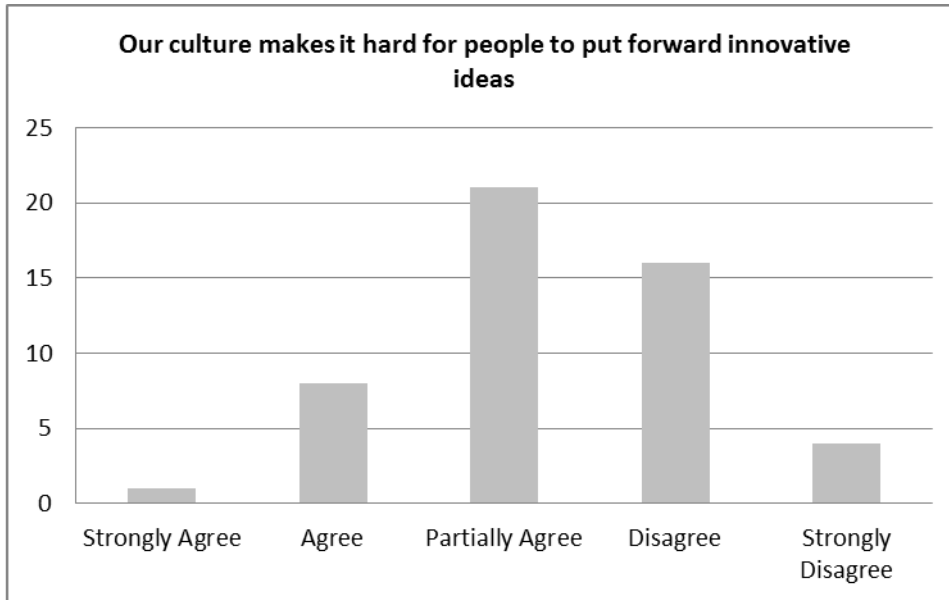


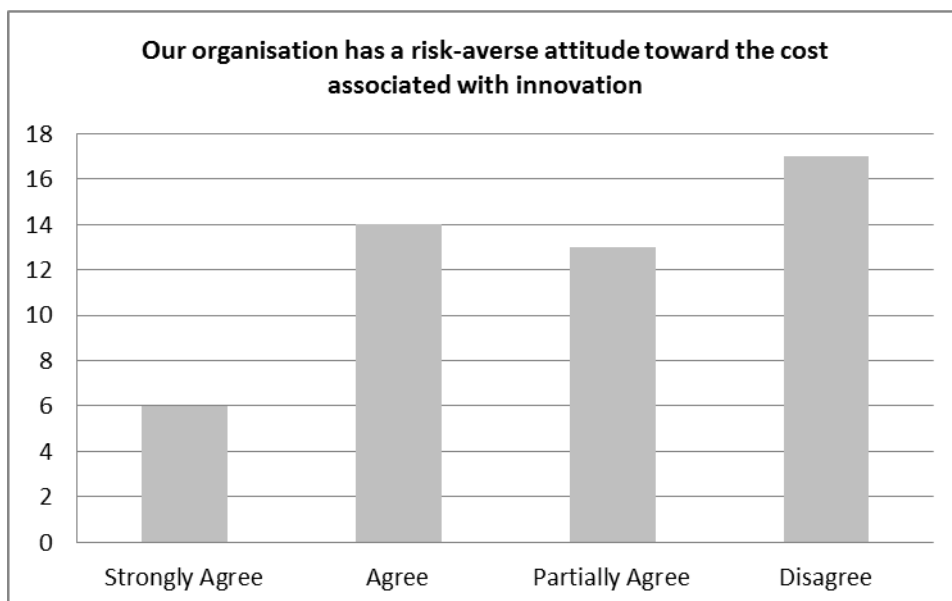
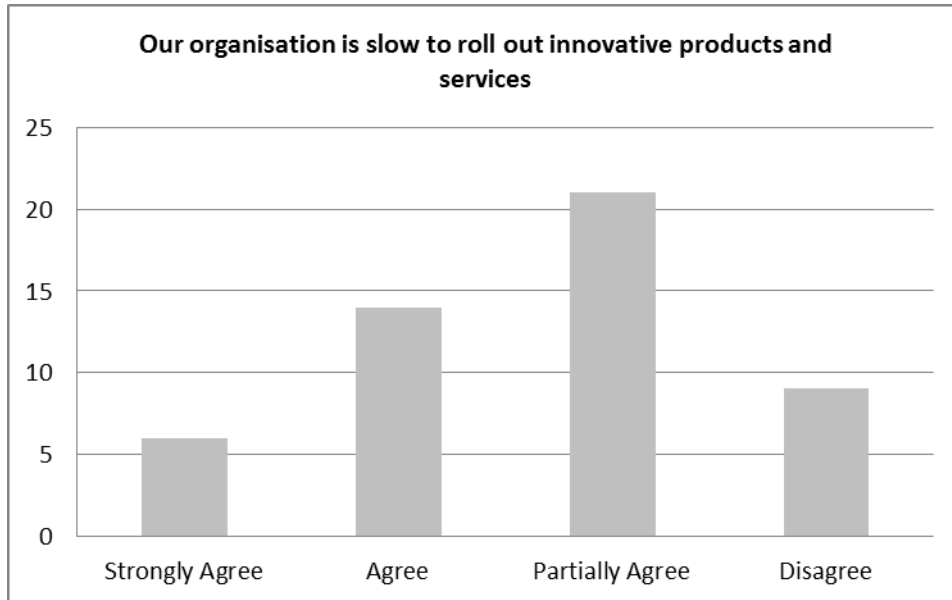




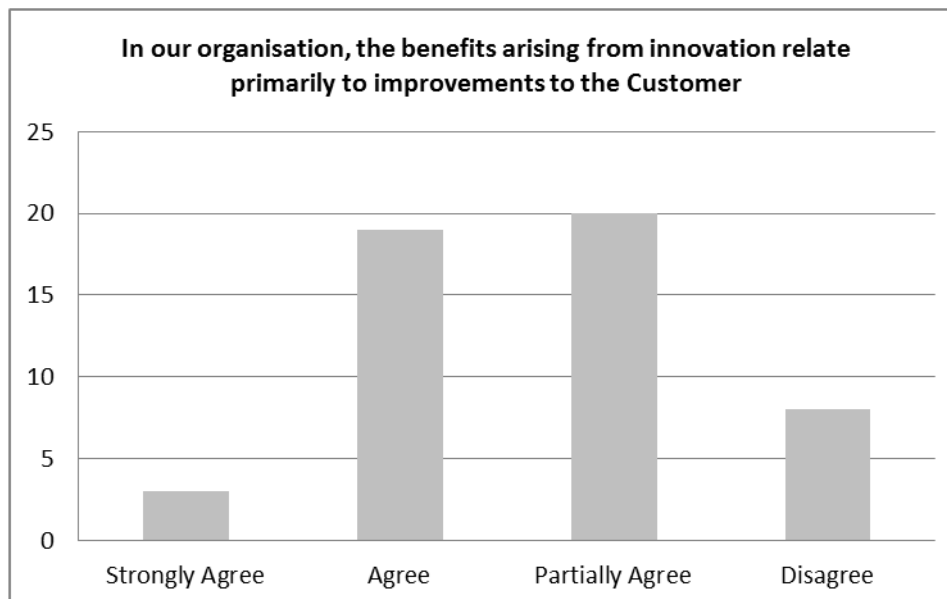
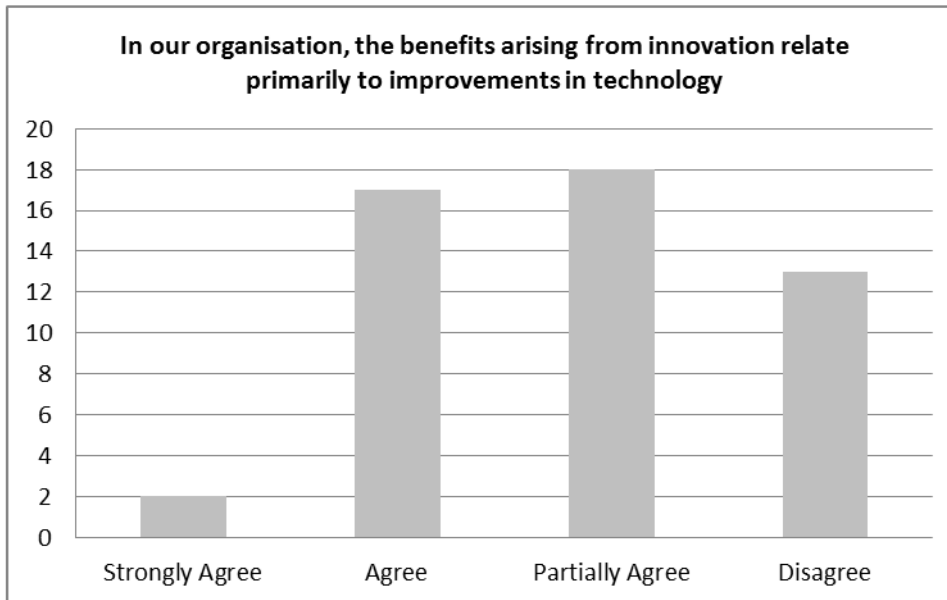
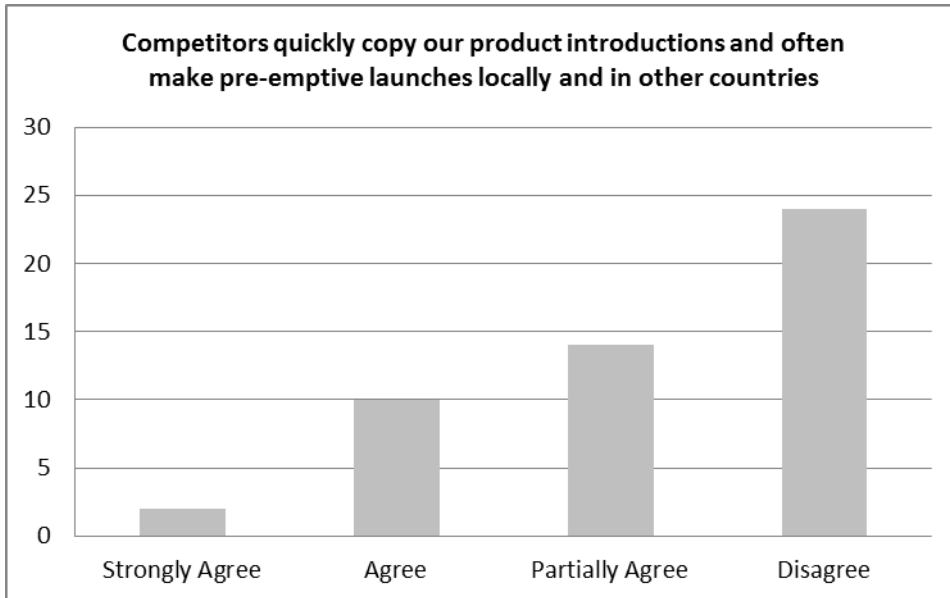


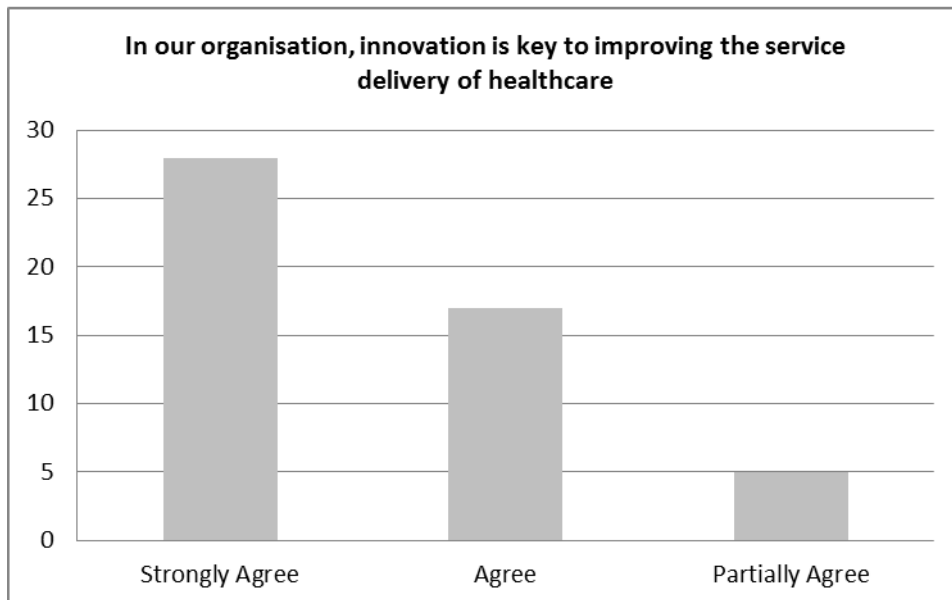
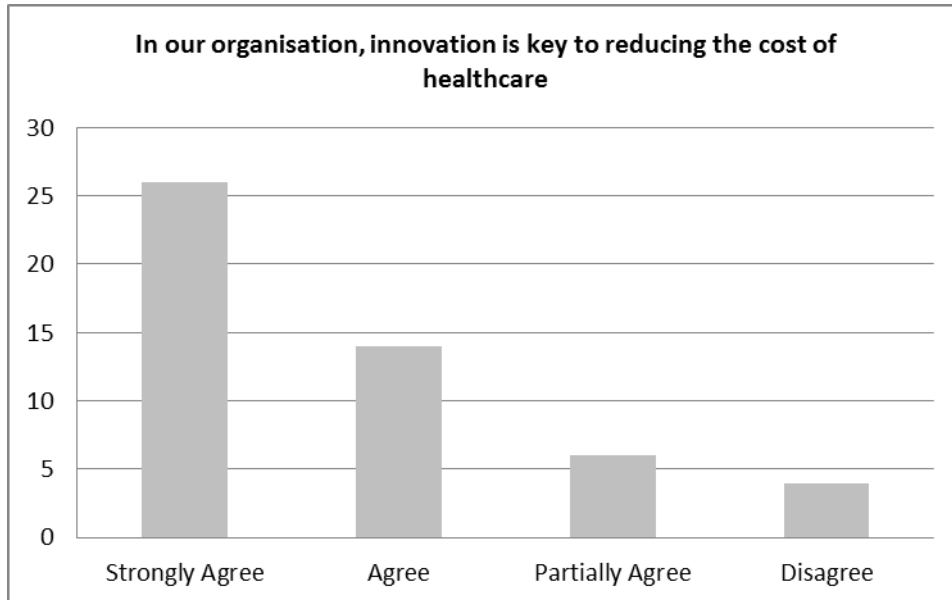












## Appendix 8: Principal Component Analysis

### *Information Communication Technology*

#### Communalities:

Communalities		
	Initial	Extraction
The lack of information within organisation's contributes to decision makers being unable to make strategic decisions optimally	1	0.713
Organisations that do not communicate information effectively through ICT systems limits their ability to make key strategic decision	1	0.663
Our organisation utilises technology, in the form of Information Communication Systems (ICT's), effectively to communicate information for decision making	1	0.828
Our organisation communicates information effectively across functions and divisions to support the decision making process	1	0.748
Our organisation uses information effectively at all levels to make strategic and operational decisions	1	0.705
Our organisation uses current and historical information to support the decision making process	1	0.689
In our organisation, current and historical information is easily accessible and available and transferrable across all decision making units	1	0.55
In our organisation, effective communication is an imperative to enable key decisions, albeit the abundance of information and technology	1	0.788
ICT plays a pivotal role in our organisation with regard to driving innovation through improved decision making	1	0.649
In our organisation, information is viewed as the key enabler of innovation	1	0.78
In our organisation, technology is viewed as the key enabler of innovation	1	0.808
In our organisation, communication is viewed as the key enabler of innovation	1	0.754
In our organisation, business processes are viewed as the key enablers of innovation	1	0.748
Communication through ICT systems is essential for innovation collaboration	1	0.814
Communication through ICT systems is essential for the quality of innovation	1	0.813
Integrated communication through ICT system is pivotal to the innovation ideation	1	0.862
Effective communication through ICT systems enables the diffusion of innovation	1	0.741
Communication through ICT systems can support critical business functions through more effective provisioning of business and customer insight through information management	1	0.772
Improving the uptake of ICT systems requires better awareness of what technologies are available, what these can offer and the affordability of such technologies	1	0.833
Improving communication through ICT systems creates the potential for internal collaboration and co-creation of innovation	1	0.76
Improving communication through ICT systems across organisations creates the potential for collaboration and co-creation of innovation	1	0.93
Integrated communication through ICT systems must be embedded by formal and informal change management processes	1	0.693

**Total Variance:**

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of	Cumulative %	Total	% of	Cumulative	Total	% of	Cumulative
1	5.119	23.266	23.266	5.119	23.266	23.266	3.538	16.08	16.08
2	3.675	16.704	39.97	3.675	16.704	39.97	3.134	14.244	30.325
3	2.168	9.856	49.826	2.168	9.856	49.826	2.356	10.708	41.033
4	1.624	7.383	57.209	1.624	7.383	57.209	2.278	10.355	51.388
5	1.599	7.267	64.476	1.599	7.267	64.476	2.135	9.707	61.095
6	1.248	5.673	70.149	1.248	5.673	70.149	1.751	7.957	69.053
7	1.21	5.499	75.648	1.21	5.499	75.648	1.451	6.595	75.648
8	0.923	4.195	79.843						
9	0.83	3.774	83.617						
10	0.633	2.879	86.495						
11	0.574	2.607	89.103						
12	0.406	1.847	90.949						
13	0.371	1.688	92.637						
14	0.334	1.517	94.154						
15	0.275	1.252	95.406						
16	0.266	1.209	96.615						
17	0.238	1.08	97.695						
18	0.183	0.834	98.529						
19	0.13	0.589	99.118						
20	0.087	0.393	99.511						
21	0.063	0.286	99.797						
22	0.045	0.203	100						

## Rotation Method: Varimax with Kaiser Normalization.

Rotated Component Matrix <sup>a</sup>							
	Component						
	1	2	3	4	5	6	7
Effective communication through ICT systems enables the diffusion of innovation	0.794						
Communication through ICT systems is essential for the quality of innovation	0.793						
Communication through ICT systems can support critical business functions through more effective provisioning of business and customer insight through information management	0.78						
Communication through ICT systems is essential for innovation collaboration	0.752				0.47		
ICT plays a pivotal role in our organisation with regard to driving innovation through improved decision making	0.609			0.46			
Our organisation uses current and historical information to support the decision making process	0.581			0.383		0.385	
Our organisation communicates information effectively across functions and divisions to support the decision making process		0.849					
Our organisation utilises technology, in the form of Information Communication Systems (ICT's), effectively to communicate information for decision making		0.848					
Our organisation uses information effectively at all levels to make strategic and operational decisions		0.717					-0.411
In our organisation, business processes are viewed as the key enablers of innovation		0.599		0.388			
In our organisation, current and historical information is easily accessible and available and transferrable across all decision making units		0.572					
The lack of information within organisation's contributes to decision makers being unable to make strategic decisions optimally			0.821				
Integrated communication through ICT systems must be embedded by formal and informal change management processes			0.801				
Improving communication through ICT systems creates the potential for internal collaboration and co-creation of innovation			0.535		0.446	0.487	
Organisations that do not communicate information effectively through ICT systems limits their ability to make key strategic decision			0.522			0.352	0.365
In our organisation, information is viewed as the key enabler of innovation				0.786			
In our organisation, communication is viewed as the key enabler of innovation				0.758			
In our organisation, technology is viewed as the key enabler of innovation		0.526		0.621			
Improving communication through ICT systems across organisations creates the potential for collaboration and co-creation of innovation					0.917		
Improving the uptake of ICT systems requires better awareness of what technologies are available, what these can offer and the affordability of such technologies					0.747		
In our organisation, effective communication is an imperative to enable key decisions, albeit the abundance of information and technology						0.8	
Integrated communication through ICT system is pivotal to the innovation ideation							0.911

## Component Transformation Matrix:

Component Transformation Matrix							
Component	1	2	3	4	5	6	7
1	0.731	0.059	0.329	0.3	0.437	0.265	0.055
2	0.02	0.839	-0.288	0.412	-0.149	-0.079	-0.122
3	-0.483	0.321	0.726	0.02	0.035	0.216	0.299
4	0.187	0.423	-0.013	-0.845	0.174	0.114	-0.169
5	-0.052	0.09	-0.087	-0.043	0.531	-0.691	0.469
6	-0.178	0	-0.521	0.002	0.252	0.615	0.504
7	0.404	0.052	0.05	-0.154	-0.64	-0.089	0.624

## ***Innovation***

### **Communalities**

<b>Communalities</b>		
	<b>Initial</b>	<b>Extraction</b>
In our organisation, innovation is viewed as a strategic imperative	1	0.697
In our organisation, innovation is key to remaining competitive	1	0.764
Our organisation has a mature communication mechanism within our ICT system that promotes collaboration which drives innovation	1	0.759
Our organisation effectively promotes the importance of communication in driving innovation	1	0.773
Our organisation provides and clearly communicates an innovative process for idea generation	1	0.69
Our culture makes it hard for people to put forward innovative ideas	1	0.67
Our processes makes it hard for people to put forward innovative ideas	1	0.735
Our lack of communication makes it hard for people to put forward innovative ideas	1	0.701
Our organisation is slow to roll out innovative products and services	1	0.75
Our organisation has a risk-averse attitude toward the possible structural or organisational changes resulting from innovation	1	0.648
Our organisation has a risk-averse attitude toward the cost associated with innovation	1	0.843
Competitors quickly copy our product introductions and often make pre-emptive launches locally and in other countries	1	0.612
In our organisation, the benefits arising from innovation relate primarily to improvements in technology	1	0.809
In our organisation, the benefits arising from innovation relate primarily to improvements to the Customer	1	0.794
In our organisation, innovation is key to reducing the cost of healthcare	1	0.835
In our organisation, innovation is key to improving the service delivery of healthcare	1	0.805

### Total Variance Explained:

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of	Cumulative %	Total	% of	Cumulative	Total	% of	Cumulativ
1	4.472	27.948	27.948	4.472	27.948	27.948	3.096	19.35	19.35
2	2.989	18.683	46.631	2.989	18.683	46.631	2.704	16.9	36.25
3	1.964	12.278	58.909	1.964	12.278	58.909	2.514	15.712	51.962
4	1.407	8.795	67.704	1.407	8.795	67.704	1.963	12.269	64.231
5	1.053	6.583	74.287	1.053	6.583	74.287	1.609	10.056	74.287
6	0.702	4.387	78.674						
7	0.673	4.209	82.884						
8	0.56	3.502	86.386						
9	0.543	3.393	89.779						
10	0.471	2.945	92.724						
11	0.303	1.894	94.617						
12	0.277	1.733	96.35						
13	0.198	1.237	97.587						
14	0.157	0.979	98.566						
15	0.12	0.751	99.317						
16	0.109	0.683	100						

## Rotated Component Matrix:

Rotated Component Matrix <sup>a</sup>					
	Component				
	1	2	3	4	5
Our processes makes it hard for people to put forward innovative ideas	0.803				
Our organisation has a risk-averse attitude toward the possible structural or organisational changes resulting from innovation	0.745				
Our lack of communication makes it hard for people to put forward innovative ideas	0.728		0.363		
Our culture makes it hard for people to put forward innovative ideas	0.664	-0.355			
Our organisation is slow to roll out innovative products and services	0.548	-0.481		0.449	
Our organisation has a mature communication mechanism within our ICT system that promotes collaboration which drives innovation		0.849			
Our organisation effectively promotes the importance of communication in driving innovation		0.805			
Our organisation provides and clearly communicates an innovative process for idea generation		0.748			
In our organisation, innovation is key to improving the service delivery of healthcare			0.886		
In our organisation, innovation is key to reducing the cost of healthcare			0.859		
In our organisation, innovation is key to remaining competitive			0.708		0.369
In our organisation, the benefits arising from innovation relate primarily to improvements in technology				0.868	
In our organisation, the benefits arising from innovation relate primarily to improvements to the Customer				0.847	
Competitors quickly copy our product introductions and often make pre-emptive launches locally and in other countries					0.687
In our organisation, innovation is viewed as a strategic imperative	-0.368				0.637
Our organisation has a risk-averse attitude toward the cost associated with innovation	0.408	-0.407			0.591

## Component Transformation Matrix:

Component Transformation Matrix					
Component	1	2	3	4	5
1	0.749	-0.637	0.177	0.041	-0.017
2	0.1	0.33	0.704	0.434	0.445
3	0.263	0.169	-0.643	0.679	0.17
4	0.343	0.285	-0.229	-0.581	0.641
5	0.492	0.613	0.09	-0.107	-0.602



## Appendix 9: Hypotheses

### ***Hypothesis 1: Information Communication Technology is not a key Strategic Driver of Innovation***

- Our organisation uses current and historical information to support the decision making process \* ICT plays a pivotal role in our organisation with regard to driving innovation through improved decision making*

	ICT plays a pivotal role in our organisation with regard to driving innovation through improved decision making			Total
	1	2	3	
In our organisation, information is viewed as the key enabler of innovation	12	4	3	19
1	4	12	5	21
2	1	6	2	9
3	0	0	1	1
4	17	22	11	50
Total				

### Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	24.427 <sup>a</sup>	6	.000
Likelihood Ratio	23.816	6	.001
Linear-by-Linear Association	13.443	1	.000
N of Valid Cases	50		

### Symmetric Measures

	Value	Approximate Significance
Nominal by Nominal Phi	.699	.000
Cramer's V	.494	.000
N of Valid Cases	50	

2. *In our organisation, information is viewed as the key enabler of innovation \* ICT plays a pivotal role in our organisation with regard to driving innovation through improved decision making*

	ICT plays a pivotal role in our organisation with regard to driving innovation through improved decision making			Total
	1	2	3	
In our organisation, information is viewed as the key enabler of innovation	12	4	3	19
1	4	12	5	21
2	1	6	2	9
3	0	0	1	1
4	17	22	11	50
Total				

### Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	15.578 <sup>a</sup>	6	.016
Likelihood Ratio	15.221	6	.019
Linear-by-Linear Association	7.126	1	.008
N of Valid Cases	50		

### Symmetric Measures

	Value	Approximate Significance
Nominal by Nominal Phi	.558	.016
Cramer's V	.395	.016
N of Valid Cases	50	

3. *In our organisation, technology is viewed as the key enabler of innovation \* ICT plays a pivotal role in our organisation with regard to driving innovation through improved decision making*

	ICT plays a pivotal role in our organisation with regard to driving innovation through improved decision making			Total
	1	2	3	
In our organisation, technology is viewed as the key enabler of innovation	9	3	4	16
1	3	11	6	20
2	4	5	0	9
3	1	3	1	5
4	17	22	11	50
Total				

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	11.099 <sup>a</sup>	6	.085
Likelihood Ratio	13.772	6	.032
Linear-by-Linear Association	.074	1	.785
N of Valid Cases	50		

Symmetric Measures

	Value	Approximate Significance
Nominal by Nominal		
Phi	.471	.085
Cramer's V	.333	.085
N of Valid Cases	50	

4. *In our organisation, communication is viewed as the key enabler of innovation \* ICT plays a pivotal role in our organisation with regard to driving innovation through improved decision making*

		ICT plays a pivotal role in our organisation with regard to driving innovation through improved decision making			Total
		1	2	3	
In our organisation, communication is viewed as the key enabler of innovation	1	6	2	0	8
	2	9	9	5	23
	3	2	9	5	16
	4	0	2	1	3
Total		17	22	11	50

#### Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	11.563 <sup>a</sup>	6	.072
Likelihood Ratio	13.953	6	.030
Linear-by-Linear Association	9.002	1	.003
N of Valid Cases	50		

#### Symmetric Measures

	Value	Approximate Significance
Nominal by Nominal Phi	.481	.072
Cramer's V	.340	.072
N of Valid Cases	50	

5. *Communication through ICT systems is essential for innovation collaboration \* ICT plays a pivotal role in our organisation with regard to driving innovation through improved decision making*

	ICT plays a pivotal role in our organisation with regard to driving innovation through improved decision making			Total
	1	2	3	
Communication through 1	12	3	3	18
ICT systems is essential 2	5	17	3	25
for innovation 3	0	2	5	7
collaboration				
Total	17	22	11	50

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	25.321 <sup>a</sup>	4	.000
Likelihood Ratio	24.577	4	.000
Linear-by-Linear Association	12.790	1	.000
N of Valid Cases	50		

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Phi	.712	.000
	Cramer's V	.503	.000
N of Valid Cases		50	

6. *Communication through ICT systems is essential for the quality of innovation \* ICT plays a pivotal role in our organisation with regard to driving innovation through improved decision making*

	ICT plays a pivotal role in our organisation with regard to driving innovation through improved decision making			Total
	1	2	3	
Communication through 1	11	5	3	19
ICT systems is essential				
for the quality of 2	5	16	5	26
innovation 3	1	1	2	4
4	0	0	1	1
Total	17	22	11	50

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	13.845 <sup>a</sup>	6	.031
Likelihood Ratio	12.837	6	.046
Linear-by-Linear Association	6.777	1	.009
N of Valid Cases	50		

Symmetric Measures

	Value	Approximate Significance
Nominal by Nominal Phi	.526	.031
Cramer's V	.372	.031
N of Valid Cases	50	

## Hypothesis 2: Innovation and Reducing the Cost of Healthcare

1. In our organisation, innovation is viewed as a strategic imperative \* In our organisation, innovation is key to reducing the cost of healthcare

	In our organisation, innovation is key to reducing the cost of healthcare				Total
	1	2	3	4	
In our organisation, 1 innovation is viewed as a strategic imperative	7	5	1	2	15
2	17	9	3	1	30
3	2	0	2	1	5
Total	26	14	6	4	50

### Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	7.914 <sup>a</sup>	6	.245
Likelihood Ratio	8.014	6	.237
Linear-by-Linear Association	.154	1	.694
N of Valid Cases	50		

### Symmetric Measures

	Value	Approximate Significance
Nominal by Nominal Phi	.398	.245
Cramer's V	.281	.245
N of Valid Cases	50	

2. *In our organisation, innovation is key to remaining competitive* \* *In our organisation, innovation is key to reducing the cost of healthcare*

	In our organisation, innovation is key to reducing the cost of healthcare				Total
	1	2	3	4	
In our organisation, innovation is key to remaining competitive	22	10	1	2	35
1	3	4	4	0	11
2	1	0	1	0	2
3	0	0	0	2	2
4	0	0	0	2	2
Total	26	14	6	4	50

### Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	37.482 <sup>a</sup>	9	.000
Likelihood Ratio	24.498	9	.004
Linear-by-Linear Association	12.542	1	.000
N of Valid Cases	50		

### Symmetric Measures

	Value	Approximate Significance
Nominal by Nominal Phi	.866	.000
Cramer's V	.500	.000
N of Valid Cases	50	



3. *Our lack of communication makes it hard for people to put forward innovative ideas \* In our organisation, innovation is key to reducing the cost of healthcare*

	In our organisation, innovation is key to reducing the cost of healthcare				Total
	1	2	3	4	
Our lack of communication makes it hard for people to put forward innovative ideas	2	0	0	0	2
1	13	2	0	0	15
2	7	3	4	1	15
3	3	9	2	3	17
4	1	0	0	0	1
5	26	14	6	4	50
Total					

**Chi-Square Tests**

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	23.149 <sup>a</sup>	12	.026
Likelihood Ratio	26.376	12	.009
Linear-by-Linear Association	9.873	1	.002
N of Valid Cases	50		

**Symmetric Measures**

	Value	Approximate Significance
Nominal by Nominal Phi	.680	.026
Cramer's V	.393	.026
N of Valid Cases	50	

4. *In our organisation, innovation is key to improving the service delivery of healthcare* \* *In our organisation, innovation is key to reducing the cost of healthcare*

	In our organisation, innovation is key to reducing the cost of healthcare				Total
	1	2	3	4	
In our organisation, innovation is key to improving the service delivery of healthcare	25	2	0	1	28
1	1	12	3	1	17
2	0	0	3	2	5
3	0	0	3	2	5
Total	26	14	6	4	50

### Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	54.395 <sup>a</sup>	6	.000
Likelihood Ratio	55.579	6	.000
Linear-by-Linear Association	29.028	1	.000
N of Valid Cases	50		

### Symmetric Measures

	Value	Approximate Significance
Nominal by Nominal Phi	1.043	.000
Cramer's V	.738	.000
N of Valid Cases	50	

### Hypothesis 3: Innovation & Service Delivery of HealthCare

1. In our organisation, innovation is viewed as a strategic imperative \* In our organisation, innovation is key to improving the service delivery of healthcare

	In our organisation, innovation is key to improving the service delivery of healthcare			Total
	1	2	3	
In our organisation, 1 innovation is viewed as a strategic imperative	9	5	1	15
2	18	10	2	30
3	1	2	2	5
Total	28	17	5	50

#### Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.345 <sup>a</sup>	4	.175
Likelihood Ratio	4.835	4	.305
Linear-by-Linear Association	2.351	1	.125
N of Valid Cases	50		

#### Symmetric Measures

	Value	Approximate Significance
Nominal by Nominal Phi	.356	.175
Cramer's V	.252	.175
N of Valid Cases	50	

2. *In our organisation, innovation is key to remaining competitive* \* *In our organisation, innovation is key to improving the service delivery of healthcare*

		In our organisation, innovation is key to improving the service delivery of healthcare			Total
		1	2	3	
In our organisation, innovation is key to remaining competitive	1	24	10	1	35
	2	3	7	1	11
	3	1	0	1	2
	4	0	0	2	2
Total		28	17	5	50

#### Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	29.441 <sup>a</sup>	6	.000
Likelihood Ratio	20.207	6	.003
Linear-by-Linear Association	14.472	1	.000
N of Valid Cases	50		

#### Symmetric Measures

	Value	Approximate Significance
Nominal by Nominal Phi	.767	.000
Cramer's V	.543	.000
N of Valid Cases	50	

3. *Our lack of communication makes it hard for people to put forward innovative ideas*

	In our organisation, innovation is key to improving the service delivery of healthcare			Total
	1	2	3	
Our lack of communication makes it hard for people to put forward innovative ideas	2	0	0	2
1	12	3	0	15
2	7	4	4	15
3	6	10	1	17
4	1	0	0	1
5	28	17	5	50
Total				

**Chi-Square Tests**

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	15.573 <sup>a</sup>	8	.049
Likelihood Ratio	16.569	8	.035
Linear-by-Linear Association	4.023	1	.045
N of Valid Cases	50		

**Symmetric Measures**

	Value	Approximate Significance
Nominal by Nominal Phi	.558	.049
Cramer's V	.395	.049
N of Valid Cases	50	

4. In our organisation, innovation is key to reducing the cost of healthcare

	In our organisation, innovation is key to improving the service delivery of healthcare			Total
	1	2	3	
In our organisation, 1	25	1	0	26
innovation is key to 2	2	12	0	14
reducing the cost of 3	0	3	3	6
healthcare 4	1	1	2	4
Total	28	17	5	50

**Chi-Square Tests**

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	54.395 <sup>a</sup>	6	.000
Likelihood Ratio	55.579	6	.000
Linear-by-Linear Association	29.028	1	.000
N of Valid Cases	50		

**Symmetric Measures**

	Value	Approximate Significance
Nominal by Nominal Phi	1.043	.000
Cramer's V	.738	.000
N of Valid Cases	50	

## Appendix 10: Mann Whitney U Test

**Hypothesis Test Summary**

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of information within organisation's contributes to decision makers being unable to make strategic decisions optimally is the same across categories of Executive.	Independent-Samples Mann-Whitney U Test	.000	Reject the null hypothesis.
2	The distribution of Organisations that do not communicate information effectively through ICT systems limits their ability to make key strategic decision is the same across categories of Executive.	Independent-Samples Mann-Whitney U Test	.007	Reject the null hypothesis.
3	The distribution of Our organisation utilises technology, in the form of Information Communication Systems (ICT's), effectively to communicate information for decision making is the same across categories of Executive.	Independent-Samples Mann-Whitney U Test	.859	Retain the null hypothesis.
4	The distribution of Our organisation communicates information effectively across functions and divisions to support the decision making process is the same across categories of Executive.	Independent-Samples Mann-Whitney U Test	.291	Retain the null hypothesis.
5	The distribution of Our organisation uses information effectively at all levels to make strategic and operational decisions is the same across categories of Executive.	Independent-Samples Mann-Whitney U Test	.822	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

**Hypothesis Test Summary**

	Null Hypothesis	Test	Sig.	Decision
6	The distribution of Our organisation uses current and historical information to support the decision-making process is the same across categories of Executive.	Independent-Samples Mann-Whitney U Test	.000	Reject the null hypothesis.
7	The distribution of In our organisation, current and historical information is easily accessible and available and transferrable across all decision making units is the same across categories of Executive.	Independent-Samples Mann-Whitney U Test	.991	Retain the null hypothesis.
8	The distribution of In our organisation, effective communication is an imperative to enable key decisions, albeit the abundance of information and technology is the same across categories of Executive.	Independent-Samples Mann-Whitney U Test	.000	Reject the null hypothesis.
9	The distribution of ICT plays a pivotal role in our organisation with regard to driving innovation through improved decision making is the same across categories of Executive.	Independent-Samples Mann-Whitney U Test	.056	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

**Hypothesis Test Summary**

	Null Hypothesis	Test	Sig.	Decision
10	The distribution of In our organisation, information is viewed as the key enabler of innovation is the same across categories of Executive.	Independent-Samples Mann-Whitney U Test	.001	Reject the null hypothesis.
11	The distribution of In our organisation, technology is viewed as the key enabler of innovation is the same across categories of Executive.	Independent-Samples Mann-Whitney U Test	.001	Reject the null hypothesis.
12	The distribution of In our organisation, communication is viewed as the key enabler of innovation is the same across categories of Executive.	Independent-Samples Mann-Whitney U Test	.955	Retain the null hypothesis.
13	The distribution of In our organisation, business processes are viewed as the key enablers of innovation is the same across categories of Executive.	Independent-Samples Mann-Whitney U Test	.635	Retain the null hypothesis.
14	The distribution of Communication through ICT systems is essential for innovation collaboration is the same across categories of Executive.	Independent-Samples Mann-Whitney U Test	.334	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

**Hypothesis Test Summary**

	Null Hypothesis	Test	Sig.	Decision
15	The distribution of Communication through ICT systems is essential for the quality of innovation is the same across categories of Executive.	Independent-Samples Mann-Whitney U Test	.376	Retain the null hypothesis.
16	The distribution of Integrated communication through ICT system is pivotal to the innovation ideation is the same across categories of Executive.	Independent-Samples Mann-Whitney U Test	.368	Retain the null hypothesis.
17	The distribution of Effective communication through ICT systems enables the diffusion of innovation is the same across categories of Executive.	Independent-Samples Mann-Whitney U Test	.195	Retain the null hypothesis.
18	The distribution of Communication through ICT systems can support critical business functions through more effective provisioning of business and customer insight through information management is the same across categories of Executive.	Independent-Samples Mann-Whitney U Test	.061	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

## Appendix 11: Turnitin Report

Please see next page for Turnitin Report.



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