Telemedicine systems deployment in the Kenyan healthcare system: A study of the role of organisation collaboration

A Thesis Submitted for the Degree of Doctor of Philosophy

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Abstract

The promise of telemedicine is great as observed in developed countries. However, its adoption in developing countries has been very slow. The Kenyan government approved telemedicine (use of ICT to overcome geographical barriers and increase access to health care services) as a strategic approach of improving healthcare delivery especially in the marginalised areas of the country. However, the adoption of telemedicine is further hindered in developing countries by the fact that the cost of implementing telemedicine technology is deemed high and the resources needed are scarce especially in the public sector. Extant literature on healthcare technological innovation indicates that organisation collaboration can expedite the adoption of telemedicine especially in developing countries. Since it is highlighted that empirical evidence on how organisation collaboration can facilitate telemedicine deployment in developing countries is still lacking, this research aims to develop a model to examine the potential of various organisation factors in facilitating telemedicine deployment in developing countries.

This study employed a conceptual research framework to examine organisation factors that may influence organisation collaboration in facilitating telemedicine deployment in developing countries. A questionnaire survey was conducted in 50 private and public hospitals located in Eastern Kenya. 177 valid questionnaires were received and analysed using SPSS software (*version 20*).

The findings of this research revealed that Kenyan hospitals collaborate with other organisations mainly to lessen budget restrained suffered during technological innovation process. Further, it was revealed that organisation affiliation might enhance their ability to adopt telemedicine. Organisation affiliation was observed to significantly influence organisation resources, organisation's innovation acceptance, organisation's innovative capacities, organisation agility and collaborative innovation aspects. In addition, all the organisational model factors were supported and explained 46.5% of the variance in collaborative innovation internal outcomes and 53.2% of the variance in collaborative innovation external outcomes. However, personnel innovation acceptance made no significant effect on collaborative innovation outcomes.

Acknowledgement

Firstly, all glory and honour to The Almighty Father for giving me the strength to complete this research.

Also, I would like to thank my principal supervisor Dr Rebecca De Coster and my 2nd supervisor Dr. Ali Mousavi for their efforts and support.

All thanks to my mum, family and everyone else who supported and helped me complete this work.

Special thanks to my beloved husband, Dr. Manene, for his love, patience and invaluable encouragement during the entire period of my research.

Dedication

I dedicate this work to my late father (May his soul rest in peace), who determinedly supported girl child education and always wanted to see me pursue doctorate degree. I am happy that his dream has come true and I know he is proud of me wherever he is now.

List of Publications

Journals:

- Nyamu, J., De Coster, R. and Taib, S. (2015) A framework for collaborative innovation to facilitate e-health systems adoption, *International Journal of e-Healthcare Information Systems (IJe-HIS),* Volume 2, Issue 2.

Conferences and Doctoral seminars:

- Nyamu, J. and De Coster, R. (2016). The role of organisation affiliation to facilitate e-Health systems adoption, Computer Science Doctoral Consortium, 21-22 April 2016, Brunel University London, UK.

- Nyamu, J., De Coster, R. and Taib, S. (2015). An empirical study of collaborative innovation as a facilitator to telemedicine deployment in developing countries, IEEE International Conference on Information Society (i-society 2015), 9-11 November 2015, London, UK.

- Nyamu, J. and De Coster, R. (2014). Collaborative innovation: The future of telemedicine in developing countries, British Academy of Management conference (BAM 2014), 9-11 September 2014, Belfast, UK.

- Nyamu, J. and De Coster, R. (2014). Telemedicine deployment in Developing Countries, 7th Annual Brunel University research conference (ResCon 2014), 23-26 June 2014, Brunel University London, UK.

- Nyamu, J. and De Coster, R. (2014). The Role of Collaborative Innovation in Telemedicine deployment in Developing Countries, British Academy of Management (BAM) Inter-Organisation Collaboration – SIG postgraduate research workshop, 20 June 2014, Cranfield University, UK.

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List of Abbreviations

ANOVA	Analysis of variance
β	Beta Coefficient
GDP	Gross Domestic Product
HCC	Health Care Centre
ICT	Information and Communication Technologies
IDT	Innovation Diffusion Theory
m	Mean
MoH	Ministry of Health
NACOSTI	National Commission for Science, Technology and Innovation
NGO	Non-Governmental Organisation
OECD	Organisation for Economic Cooperation and Development
R & D	Research and Development
SD	Standard deviation
SPSS	Statistical Package for the Social Science
TAM	Technology Acceptance Model
THE	Total Health Expenditure
TPB	Theory of Planned Behaviour
WHO	World Health Organisation

Declaration

I, Janerose Nyamu, declare that the presented work is my own unless otherwise stated and duly acknowledged.

Janerose Nyamu

26/04/2016

Chapter One: Introduction

1.1 Overview

A great challenge faces the healthcare sector globally especially in the management of chronic and multiple diseases due to the high rise of the aging population (Vitacca et al., 2009). However, the use of Information and Communication Technologies (ICT) has bridged the gap especially in the exchange of medical information from one site to another. Aided by high capacity digital networks, powerful computer hardware and software as well as high resolution digital image compression, the healthcare sector can be greatly transformed in areas that have adopted the technologies (Demiris, 2003).

To explain the phenomenon, the term telemedicine was coined by Thomas Bird in 1970s (Strehle and Shabde, 2006) which literally means healing at a distance (Zundel, 1996; Wootton et al., 2006). The prefix *tele* is a Greek word meaning far or distance (Zundel, 1996; Craig and Patterson, 2005; Wootton et al., 2006).

Nevertheless, telemedicine technology is primarily used in developed countries due to the high levels of economic and infrastructure development (Minoiu and Reddy, 2010). According to Vo (2008), *'implementation of telemedicine in the American healthcare system could save the country approximately $4.28 billion just from reducing transfers of patients from one location such as a nursing home for medical exams at hospitals, physicians' offices or other caregiver locations'*. However, groups that suffer from inadequate healthcare services mainly the under-developed and developing countries have the least implementation of telemedicine.

The World Health Organisation (WHO, 1997) claims that less than half of the population in developing countries has adequate access to healthcare. According to Heinzelmann et al. (2005), low infrastructure and economic level has contributed to failure in the delivery of reliable healthcare in these countries. However, Krueathep et al. (2010) claims that politicians have a great impact on the development of a country irrespective of its economic status. In addition, American Telemedicine Association chairman, Linkous, calls the government a lagging partner and the biggest barrier to new technology adoption in healthcare sector for over decades.

Telemedicine is a technology which may be used to bridge the gap between healthcare providers and the patient which is mainly as a result of geographical separation (WHO, 1997). This is a common phenomenon in underserved communities especially in developing countries. According to Wootton (2008), telemedicine allows less experienced doctors to liaise with specialised consultants who are hundreds of miles away. Although telemedicine cannot increase the number of specialised doctors in a country, it helps use the scarcely available resources more efficiently (Androuchko and Nakajima, 2004). In addition, scholars have argued that telemedicine saves lives since it links the unequipped healthcare centres in remote areas with the equipped healthcare centres in urban areas (Dario et al., 2004; WHO, 2006; Hurges, 2008).

1.2 Telemedicine situation in Kenya

Access to healthcare by people living in rural Kenya is still hindered by lack of physicians situated in those areas. According to a report published by Kenya National e-Health Strategy (2011), having equitable and affordable healthcare at the highest achievable standards to all citizens is one of the overall goals of Kenyan Vision 2030. Telemedicine was identified as one of the strategic areas of intervention in Kenyan e-Health strategy presented in Vision 2030 report. Basing on the Kenyan geographic distribution, the majority of citizens are located away from hospital where healthcare specialists are located. Figure 1.1 shows the map of Kenya and the distribution of hospitals where specialised doctors are located.

In a study on the reliability of telemedicine systems in rural Kenya, Qin et al. (2013) noted that patients living in rural Kenya fail to receive treatment due to the high costs involved to travel to urban areas where the medical specialists are based. On the other hand, specialists located in urban areas fail to visit the rural clinics due to their busy work schedule as well as costs involved in travelling to rural areas.

Key: Hospitals with specialised doctors

Figure 1.1: Distribution of Kenyan hospitals with specialists' doctors

(http://www.mapsofworld.com/kenya/)

According to a report published by Kenya National e-Health Strategy (2011), inadequate ICT infrastructure and equipment, insufficient human resources and skills and low funding to public healthcare sector are some of the challenges facing e-Health implementation. Generally, the amount of money (as a percentage of its GDP) the Kenyan government allocate to healthcare is small compared to that allocated by leading adopters of telemedicine in Africa. According to World Bank Gross Domestic Product and health expenditure reports (2015),

Kenya population: 44 Million

Kenya GDP: $ 55.24 Billion

Total expenditure on health as a % of GDP: 4.7% approx. $ 2.5 Billion

Health expenditure per capita: $ 56.8

When compared to South Africa which is the leading telemedicine adopter in Africa, the World Bank Gross Domestic Product report (2015) and World Bank health expenditure reports (2015) indicates that;

South Africa population: 55 Million
South Africa GDP: $ 366 Billion
Total expenditure on health as a % of GDP: 8.9% approx. $ 32.5 Billion
Health expenditure per capita: $ 591

Additionally, the World Bank Gross Domestic Product and health expenditure report (2015) indicates that Egypt, which is the second leading adopter of telemedicine in Africa, has the following statistics;

Egypt population: 82 Million
Egypt GDP: $ 271Billion
Total expenditure on health as a % of GDP: 5.5% approx. $ 14.9 Billion
Health expenditure per capita: $ 181.8

Basing on the above statistics presented by the World Bank, funding Kenyan telemedicine projects to be implemented by public healthcare sector may not be feasible due to underfunding of the health sector by the government. This is as a result of low GDP value. However, with the efforts to implement the Kenyan vision 2030 (Kenyan Vision 2030 report, 2013), the government zero rated (tax rate of zero)

healthcare ICT equipment. Additionally, collaboration between organisations was identified to be essential for successful implementation of the Kenyan e-Health strategy 2011-2017. However, it is reported that guidance on organisation collaboration so as to mitigate Kenyan healthcare sector weaknesses in attempt to implement e-Health is needed (Barnes et al., 2010; Kenya National e-Health Strategy, 2011).

Although telemedicine projects have been tested in Kenya, clinical telemedicine services aimed at benefiting the rural people have not been sustained (Wootton, 2001). According to Mars (2013), tele-conferencing and tele-education are the only e-Health projects that have been sustained in many parts of Africa.

1.3 Research motivation

Developing countries are greatly faced with a shortage of healthcare professionals (WHO, 2013). In addition, the few available healthcare professionals are mainly based in major towns of the country (Androuchko and Nakajima, 2004). As a result, people living in rural areas or the underserved communities have limited access to healthcare (WHO, 2010).

According to Wootton (2008), the promise of telemedicine is great. However, its adoption in developing countries has been observed to be very slow when compared to its adoption in developed countries (Wamala and Augustine, 2013). Additionally, it is claimed that the few telemedicine projects running in developing countries are mainly grant funded by developed countries and other international NGO's (Wootton, 2008). However, these projects are claimed to run until pilot study due to lack of funding to carry out the projects until full implementation stage (Wootton, 2008; Zanaboni and Wootton, 2012). Despite a large number of studies on barriers to telemedicine deployment in developing countries, it is claimed that rigorous studies on how to facilitate telemedicine deployment in developing countries is needed (WHO, 2013).

As a result, extant literature has highlighted that organisation collaboration can facilitate telemedicine deployment in developing countries (Goes and Park, 1997; Mitchell, 1999; Alajlani and Clarke, 2013; Jakobsen et al., 2014). However, empirical studies with organisation designs on how organisation collaboration can facilitate

telemedicine deployment are lacking (Goes and Park, 1997; Bommert, 2010). In addition, another fundamental concern from extant literature is that although various organisation collaboration network factors have been examined, there is lack of empirical studies examining the explanatory power of these organisation factors (Krueathep et al., 2010). Also, empirical studies with an explicit hypothecated link on the influence of organisation collaboration on healthcare technological innovativeness is needed (Greenhalgh et al., 2008). Therefore, studies with rigorous designs are needed to examine organisation factors and innovation practices influencing organisation collaboration in facilitating telemedicine deployment.

Pulling these concerns from extant literature proposes that a research to fill the present gap in terms of understanding which organisation collaboration factors and innovation practices influence organisation collaboration in facilitating telemedicine deployment in developing countries in needed.

1.4 Research aim, objectives and questions

1.4.1 Research aim

To examine healthcare organisation factors and innovation practices which influence organisation collaboration in facilitating telemedicine deployment in Kenya.

1.4.2 Research objectives

In order to achieve the aim of this study, the following objectives were completed:

1. To identify the issues that affects the adoption of telemedicine technology in developing countries.
2. To develop a conceptual framework for telemedicine deployment through organisation collaboration to promote a guideline framework for the Kenyan healthcare sector and policy makers.
3. To demonstrate that the framework on the adoption of telemedicine devised during these research can support the analysis of healthcare collaborative innovation performance.
4. To validate the conceptual framework developed by evaluating it in the context of the deployment of telemedicine deployment by conducting interviews.

1.4.3 Research questions

1. What factors affect telemedicine deployment in developing countries?
2. What is the status of the key infrastructural technologies affecting telemedicine deployment in Kenya?
3. To what extent does organisation collaboration influence healthcare innovation performance?

1.5 Thesis structure

This thesis is divided into eight chapters.

- **Chapter one:** *Introduction:* It is an introductory chapter highlighting the need for organisation collaboration in facilitating telemedicine deployment in developing countries. It also describes the aim, objectives and research questions of this study.

- **Chapter two:** *Background*: Reviews the body of research literature circumscribing the field of interest for this thesis which include telemedicine, technology innovation and organisation collaborative innovation.

- **Chapter three:** *Conceptual framework and hypotheses development:* Presents the conceptual framework developed using the factors extracted from chapter two and exploratory study. Further, hypotheses regarding the proposed model are formulated.

- **Chapter four:** *Research Approach:* Describes the research paradigm that has been followed in this study and research instruments used which include repertory grid and questionnaires.

- **Chapter five:** *Surveyed hospitals descriptive characteristics:* Presents the empirical survey outcomes of the sampled hospitals in terms of the demographic characteristics which include geographic coverage, ownership, number of collaborative innovation projects and personnel ICT skills. Also, the effect of organisation geographic coverage, ownership, number of collaborative innovation projects and personnel ICT skills on the model factors is examined using t-test and ANOVA test.

- **Chapter six:** *Research model testing:* Discusses the main statistical methods used for model testing. Subsequently, the hypotheses test results are reported. The validation interviews are also presented.

- **Chapter seven:** *Discussion:* Reports the research empirical findings in the context of the extant literature.

- **Chapter eight:** *Conclusion:* Provides a summary for this research by describing the limitation, implications and finally talks about future work which might support this study and make it more comprehensive.

1.6 Chapter summary

In this chapter, the foundation for the thesis was laid. The research problem was also introduced. It was highlighted that organisation collaboration can facilitate telemedicine deployment in developing countries. However, a gap in understanding which organisation collaboration factors and innovation practices influence organisation collaboration in facilitating telemedicine deployment in developing countries was identified. Additionally, research questions that laid the foundations of this research study were explained. In the succeeding chapter, extant literature circumscribing the field of interest for this study will be studied.

Chapter Two: Background

This chapter will provide an overview of previous studies that have been carried out on the main themes of this research namely: telemedicine, organisation technological innovation and organisation collaborative innovation. Factors that have led to the implementation of telemedicine as well as those affecting its implementation will be discussed. However, since a wide range of theories have been discussed, the literature will mainly focus on the dominant themes. These will include the background information on the development and application of telemedicine, the process of innovation adoption in healthcare as well as how organisations co-innovate on enabling technology adoption.

Aided by the information gathered from the existing research during the study, it is a clear indication that a lot of information on how to overcome the barriers to telemedicine deployment is needed. Actually, that has been pointed out as one of the key barriers to telemedicine deployment in the developing countries. This study is aimed at adding to the existing knowledge on how to improve the adoption rate of new technologies in healthcare by mainly focusing on collaborative innovation strategies among organisations.

2.1 Telemedicine

Despite a large number of studies on barriers to telemedicine deployment in developing countries, empirical studies on how to facilitate telemedicine deployment in developing countries are still lacking (WHO, 2013). According to Sanders and Bashshur (1995), the definition of term telemedicine may differ from place to place. In order to determine the true effects of telemedicine, it is essential to have a uniform and precise definition otherwise, it is difficult if not impossible to ascertain outputs when the inputs are not clearly and precisely defined and identified. Table 2.1 show the definition of the term telemedicine has viewed by different researchers.

Table 2.1: Definition of telemedicine by different scholars

Definitions	*References*
An integrated system of healthcare delivery that employs telecommunications and computer technology as a substitute for face-to-face contact between provider and client.	Bashshur, 1995
Exchange of medical information from one site to another via electronic communications for the health and education of the patient or healthcare provider and the purpose of improving patient care.	Demiris, 2003
The utilisation of communication technologies to deliver or support any aspect associated with medical care, regardless of physical distances separating patient and provider.	Menachemi et al., 2004
Use of ICT to overcome geographical barriers and increase access to healthcare services.	Alajlani and Clarke, 2013

Since these definitions are fairly similar, this study defines telemedicine as the delivery of healthcare using ICT where distance is a critical factor by patients and all healthcare professionals. This is because this study focuses on healthcare provision in underserved communities which are normally located in remote areas of Kenya.

2.1.1 Terminologies associated with telemedicine

As shown in Figure 2.1, e-Health encompasses all health activities that are performed with the aid of ICT technologies.

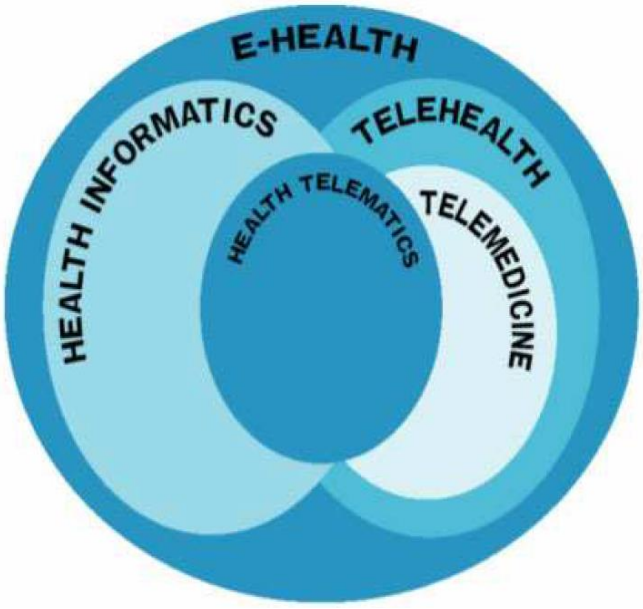


Figure 2.1: Terminologies associated with telemedicine (Dario et al., 2004)

Table 2.2: Terminologies associated with telemedicine

Term	*Definition*	*Reference*
e-Health	The transfer and delivery of healthcare by electronic means.	WHO, 1997
Telehealth	The use of ICT to monitor patients remotely to allow them live safely and independently.	Alvarez et al., 2011
Health Informatics	Collection, storage, retrieval, communication and optimal use of health related data, information and knowledge using ICT.	Hovenga, 2010
Health Telematics	Health activities, services and systems carried out over a distance by means of ICT for the purpose of global health promotion, disease control and healthcare as well as education, management and research for health.	WHO, 1997

Basing on the definitions highlighted in Table 2.2, telemedicine involves health telematics and health informatics. Telecare is mainly concerned with monitoring patients even when they are at their homes. This technology is deemed to require more resources when compared to telemedicine technology. Since developing countries suffer difficulties in adopting telemedicine technology especially the public sector due to scarcity of resources (Zanaboni and Wootton, 2012; Nyamu et al., 2015), telemedicine is deemed to be cheaper to adopt. This study focuses on eClinics, clinics set up to carry out the telemedicine technology. As shown in eClinic layout in Figure 2.2, eClinic consist of two sites, hub and spoke, which are both furnished with telecommunication systems.

Hub / provider / distance site: Site at which the licensed practitioner delivering the service is located at the time the service is provided through telecommunications system.

Spoke / receiver / originating site: Location of the patient at the time the service being furnished through a telecommunications system occurs.

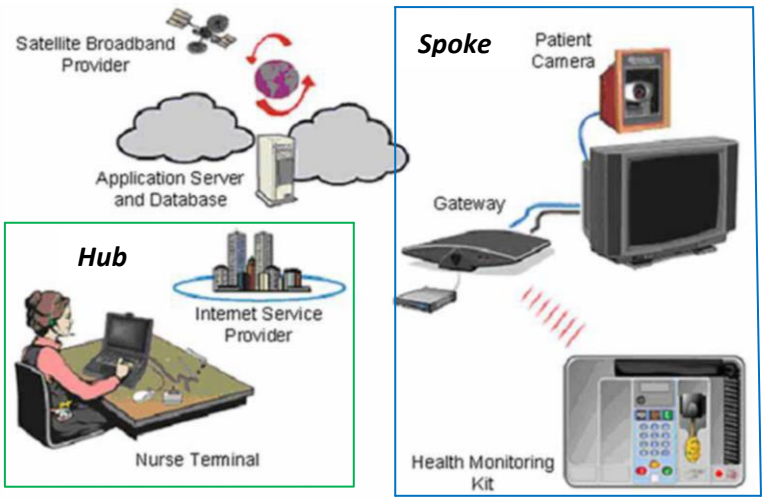


Figure 2.2: eClinic layout (Sachpazidis, 2008)

2.1.2 Telemedicine in developing countries

Telemedicine projects running in developing countries are mainly grant funded by developed countries (LeRouge et al., 2010; Wamala and Augustine, 2013) and other international non-governmental organisations (Wootton, 2008). As a result, economic sustainability is a major challenge to telemedicine deployment in these countries (WHO, 1997; Heinzelmann et al., 2005; Wootton et al., 2005). According to the Alma-Ata Declaration in 1978 (WHO, 1978), *'primary healthcare is essential healthcare based on practical, scientifically sound and socially acceptable methods and technology made universally accessible to individuals and families in the community through their full participation and at a cost that the community and country can afford to maintain at every stage of their development'*. However, healthcare provision in developing countries is still not a priority especially focusing on telemedicine technology (Al-qirim, 2005; WHO, 2010) which is believed to improve the distribution of healthcare specialties (Bashshur and Shannon, 2010).

According to Khan et al. (2007), developing countries have an average of one doctor serving every 44,000 people whereas developed countries have an average of one doctor serving 200-500 people, typically. In addition, Toure et al. (2012) claims that telemedicine might be the only healthcare technology which can improve the accessibility of healthcare by all. To enable developing countries to import medical devices used in telemedicine applications, World Trade Organisation (1996) which deals with global rules of trade between nations concluded that all telemedicine devices to be used in developing countries be reduced to zero tariff as well as having

duties and charges bound at zero. As a result, the cost of acquisition of the equipment is lower compared to that of developed countries. However, the adoption of telemedicine still faces challenges in developing countries especially due to the high costs of acquiring and maintaining the equipment as well as training the personnel (Menachemi et al, 2004; Jennett et al., 2009). However, Whited (2010) claims that what may be costly to the healthcare system of a country may result in cost savings to society. WHO help generate proposals and business plans which will help developing countries acquire the resources necessary to ensure the adoption and sustainability of telemedicine (WHO, 1997).

Telemedicine applications and sites should be selected pragmatically rather than philosophically (LeRouge et al., 2010). Since telemedicine is an expensive application to the healthcare system in developing countries (Strehle and Shabde, 2006; Wootton et al. 2006), an evaluation of the strengths and weaknesses to choose an area in which telemedicine could have the most favourable impact is necessary (LeRouge et al., 2010). In addition, the choice of telemedicine technology to be used should be based on how the need can be met by the least expensive and most accessible technology that complies with the standards (WHO, 1997). Similarly, the decision whether or not to adopt a form of telemedicine is multifaceted since various stakeholders exist and the viewpoints of every stakeholder should be considered (Menachemi, 2004). Likewise, a multidisciplinary collaboration between telecommunication operators, government as well as the healthcare professionals can promote the adoption of telemedicine in developing countries (Androuchko and Nakajima, 2004).

2.1.2.1 Total Health Expenditure (THE) in developing countries

The World Bank defines total health expenditure (THE) as *'the sum of public and private health costs which covers the provision of health services, family planning activities, nutrition activities and emergency aid designated for health but does not include provision of water and sanitation'* (World Bank health expenditure report, 2015). It is calculated as a percentage of Gross Domestic Product (GDP) of a country. Organisation for Economic Co-operation and Development (OECD, 2014) defines GDP as *'an aggregate measure of production equal to the sum of the gross*

values added of all resident institutional units engaged in production (plus any taxes, and minus any subsidies, on products not included in the value of their outputs)'.

According to WHO health financing report (2015) and World Bank health expenditure report (2015), developing countries have a lower allocation of the government funds to healthcare when compared to developed countries. According to Wamala and Augustine (2013), lack of political leaders support to healthcare financing affects the amount of finances allocated to healthcare. Also, WHO (2015) indicate that a country's GDP is an important factor for determining the amount of government resources to be allocated to healthcare. Figure 2.3 compares the GDP and THE of various developing countries basing on WHO statistics on GDP and THE.

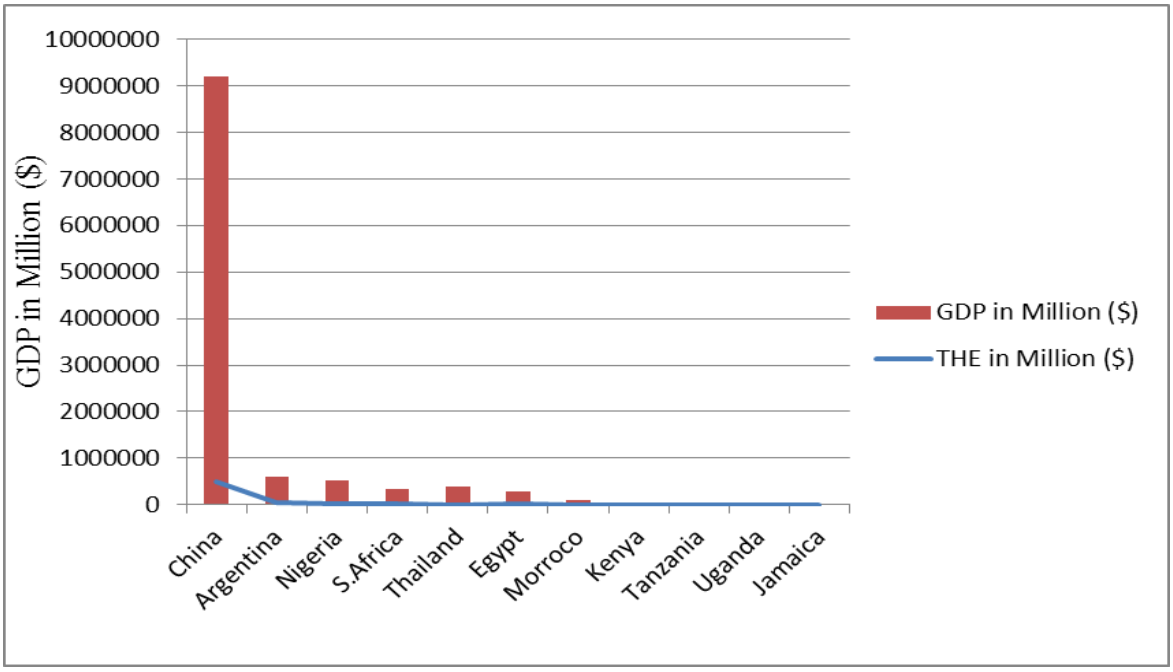


Figure 2.3: Comparison between THE and GDP of developing countries (World Bank, 2015)

2.1.2.2 Barriers to telemedicine deployment in developing countries

According to Wootton et al. (2006), the rate of telemedicine deployment in developing countries has stalled when compared to that of developed countries. As shown in Figure 2.4, continents with majority of developing countries such as Africa and Asia have the least telemedicine projects.

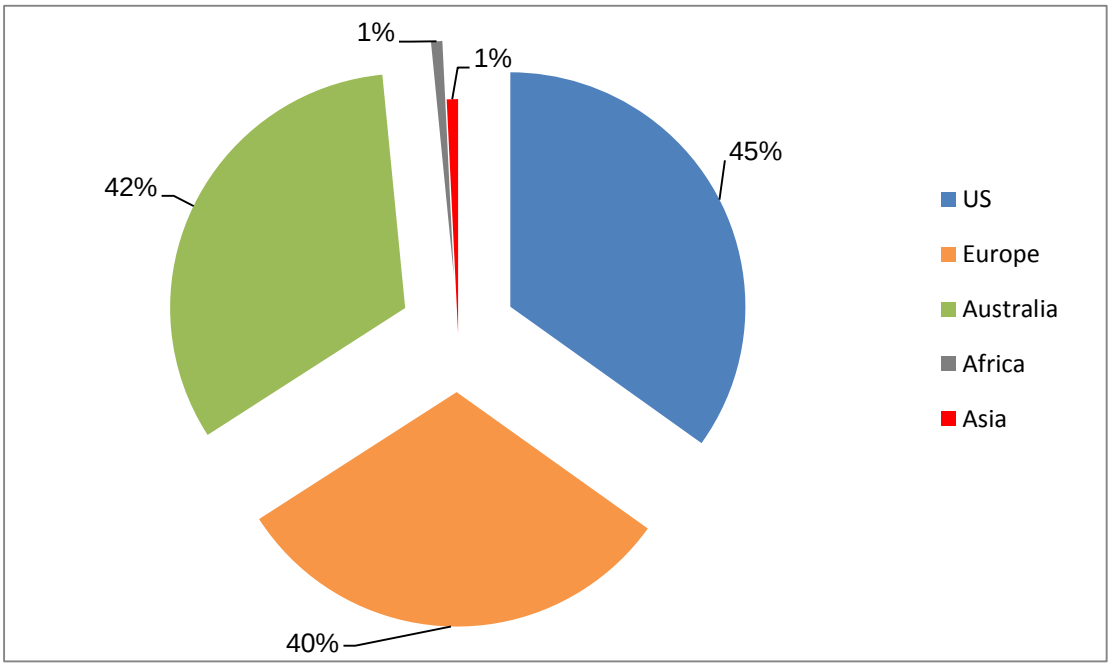


Figure 2.4: Telemedicine deployment globally (*Redrawn from data in Wootton et al., 2006*)

Various telemedicine scholars have highlighted that telemedicine deployment and diffusion in developing countries has stalled due to six main factors where economic factor has been highlighted by majority of the scholars as shown in Table 2.3.

Table 2.3: Barriers to telemedicine deployment in developing countries

Factor	*Reference*
Economic	Sanders and Bashshur, 1995; Wootton, 2001; Evans, 2003; Alverson et al., 2004; Martínez et al., 2004; Dario et al, 2004; Al-qirim, 2005; Hjelm, 2005; Heinzelmann et al., 2005; Wootton et al., 2005; Herzlinger, 2006; Strehle and Shabde, 2006; Khan et al., 2007; Wootton, 2008; WHO, 2010; LeRouge et al., 2010; Zanaboni and Wootton, 2012; Wamala and Augustine, 2013; Aranda-Jan et al., 2014; Weinstein et al., 2014;
Ethical	Sanders and Bashshur, 1995; Khan et al., 2007.
Legal	Sanders and Bashshur, 1995; WHO, 1997; Sisk and Sanders, 1998; Wamala and Augustine, 2013
Technical	Sisk and Sanders, 1998; Martínez et al., 2004; Call et al., 2015.
Administrative	Bashshur, 1995; Christensen et al., 2000; Dario et al, 2004; Hjelm, 2005; Jennett et al., 2009
Human and cultural factors	Sanders and Bashshur, 1995; Wootton et al., 2005; Khan et al., 2007; Alajlani and Clarke, 2013; Call et al., 2015

a) Economic issues

Availability of finances to sustain telemedicine projects in developing countries has been cited as the key barrier to telemedicine deployment. According to Heinzelmann et al. (2005), telemedicine projects existing in developing countries are mainly grant supported and will probably continue to face the challenge of economic sustainability. WHO (1997) claims that creative solutions such as collaboration with other segments within the country can enable developing countries overcome economic barriers to telemedicine implementation. This will improve their chances of acquiring the resources needed to make telemedicine come to reality. For instance, pilot telemedicine projects in developing countries have failed to be sustained once the funding ran out (Wootton, 2008; Zanaboni and Wootton, 2012).

Since telemedicine projects are expensive to implement (Wootton et al., 2005; Khan et al., 2007), the source of funding for these projects should be greatly taken into account before the actual implementation for longevity (LeRouge et al., 2010). The costs involved include: setting up a reliable telemedicine link (Martínez et al., 2004; Strehle and Shabde, 2006), purchasing and maintaining telemedicine equipment (Alverson et al., 2004) and training personnel (Menachemi et al., 2004; Herzlinger, 2006). Out of the three mentioned costs, ICT costs represent a significant proportion of the total cost of a telemedicine project (Harnett, 2006).

However, it is argued that ICT costs are falling due to increased competition in the telecommunications industry (Lamminen, 1999). These cost reductions are likely to facilitate telemedicine execution especially in developing countries which already face difficulties in funding the projects. However, the cost of acquiring, installing and maintaining a telemedicine system is also high therefore, a sustainable approach to funding telemedicine projects is essential (Al-qirim, 2005). According to Aas (2007), organisations wishing to go further with pilot projects after the initial external funding is no longer available can focus on measures such as collaboration with other organisations.

b) Ethical issues

Although various technological and legal means can be used to secure medical information, maintaining the confidentiality of patients' medical information has been considered as a challenging factor. According to Sanders and Bashshur (1995), law enforcement acts such as digital telephony act of 1994 which allow government bodies to have free access to any information transmitted via internet or phone raises concerns over patient medical data privacy. In addition, cultural differences among communities can hinder the adoption of telemedicine in developed countries.

c) Legal issues

Licensure, confidentiality and liability are the key legal issues affecting the implementation of telemedicine in developing countries. Violation of patient's right to privacy due to intrusion of the medical data is a major fear since unscrupulous persons may gain access to the information regardless of how the data is transmitted and stored (Sisk and Sanders, 1998). In addition, regulatory issues, high license fees, customs duties and non-tariff barriers impede the implementation of telemedicine in developing countries. According to WHO (1997), telemedicine medical software to be used in developing countries may take long to be cleared by the country of origin thus delaying the implementation of the technology.

d) Technical and administrative factors

Product diversity in healthcare sector is a major challenge to implementation of telemedicine in developing countries. This is because with constant advances of ICT, all devices to be used at the hub and spoke site have to be kept to date to enable interoperability. Although ICT has a tremendous potential for improving healthcare, rural areas of many developing countries have poor ICT network (Martinez et al., 2004). In addition, a long-term viability of ICT in rural areas of developing countries has to be considered in an attempt to enable the adoption and diffusion of telemedicine.

However, failure of organisation's administration to accept the new technologies has also hindered the speed of adoption of telemedicine technology in developing countries. According to Jennett et al. (2009), administrative readiness to accept

change facilitates the adoption of a new technology. However, Bashshur (1995) claims that the fear that telemedicine will replace the physician or relegate him to a less important role has also slowed the adoption of telemedicine. In addition, Christensen et al. (2000) claims that organisations providing expensive healthcare tend to fight simpler healthcare innovations since they threaten their livelihoods.

e) Human and cultural factors

Resistance to new ways of doing things by the patients, healthcare providers and society at large has a great impact on the speed of adoption of telemedicine technology in developing countries. Cultural differences, literacy level, attitude, beliefs, practices and routines are some of the human behaviours that influence the rate of adoption of new technologies (Heinzelmann et al., 2005). The perception of technology overtaking human skills is a major fear (Khan et al., 2007) by the physicians.

Lack of sufficient literature on the benefits of telemedicine has also been cited as a barrier to telemedicine deployment. According to Clark and Goodwin (2010), literacy levels, awareness and understanding of the benefits of a new technology to be adopted has a great impact on the degree of acceptance of the technology by the adopters. However, Wootton et al., (2005) claims that low levels of literacy has excluded the majority of communities in developing countries from attempting to adopt new technologies.

2.1.3 Telemedicine in developed countries

The earliest application of telemedicine was practised in developed countries during the mid-19th century in United States to transmit casualty list during the civil war using telegraphy signalling wires (Khan et al., 2007). Although the developed countries account for only 19% of the world population (United Nations world population prospects, 2012), they still face problems with healthcare provision. According to Lansisalmi et al. (2006), developed countries are facing pressure to reduce the healthcare cost without compromising the standards of healthcare. In addition, the foreseen shortage of healthcare professionals in developed countries (Heinzelmann et al., 2005) has also increased the need for telemedicine. Although telemedicine can never replace a physician or relegate him or her to a less important

role (Bashshur, 1995), it enables equal distribution of the scarce healthcare resources (Wootton, 2008).

America is the biggest adopter of telemedicine to date. NASA has established a number of telemedicine programmes in US the earliest one in 1960s aimed at understanding the impact of space flight on astronauts (Doarn et al., 1998). Biomedical data such as blood pressure and pulse rate were monitored by the ground controllers to evaluate the health of the astronauts. In addition, a telehealth programme known as Space Bridge was established during the 1988 Armenia earthquake which killed approximately 25,000 people leaving over 100,000 injured (Garshnek and Burkle, 1999). A satellite link was established to link the medical team in Armenia with specialised doctors in US where some treatment was done over the satellite link. Also, the first interactive video link was established in 1964 in America between Nebraska Psychiatric Institute in Omaha and the Norfolk State Hospital, 112 miles away (Zundel, 1996).

The growth of telemedicine in America has been mainly been due to the support the technology has received from the government. According to Christensen et al. (2000), the government and industrial leaders have an important influence to adoption of a new technology. One of the reasons leading to the expansion of telemedicine in America is support from the government. In 1960s to early 1970s, the federal government supported the implementation of seven telemedicine demonstration projects. The study demonstrated that telediagnosis can increase the availability of healthcare delivered to people living in remote areas (Strehle and Shabde, 2006). However, the American Telemedicine Association president, Linkous, calls the government a lagging partner in telemedicine deployment. He claims that, *“telemedicine technology could be covering most parts of the world were it not for the government policies which generally slow down its adoption process”.*

In Europe, telemedicine has not been greatly adopted as in the case of America. Clark and Goodwin (2010) claims that lack of robust evidence on the cost effectiveness of telemedicine has greatly limited the uptake of the emerging healthcare technology. In addition, a study carried out on telemedicine bi-lateral relationship between India and UK showed that data safety is the biggest worry with

India being deemed as data unsafe thus avoiding UK from making any contract with India (Alvarez et al., 2011).

In Australia, telemedicine applications have been used during World War 1. A radio communication link was established in remote areas of Australia to link the urban specialist with the remote ones (Zundel, 1996). In addition, Cadilhac et al. (2014) claims that telemedicine would help improve the delivery of acute stroke treatments in Australian rural communities due to the limited access to medical specialists. A Victorian Stroke Telemedicine project was established aimed at linking neurologists at the hub site in Melbourne who were located 200km away from the spoke site in Bendigo health centre. A 10% increase on the number of patients treated was observed during the period.

Although developed countries have good infrastructure and a strong economy, it is difficult to equip every clinic in remote areas with all medical equipment. In addition, the government of various developed countries has no control over the number of people willing to study and practice medicine. Furthermore, the medical practitioners cannot be forced to practice their careers in specific regions such as remote areas. Therefore, telemedicine is the only alternative to the current problem of shortage of medical specialist especially in remote areas. However, it is not a panacea of all medical problems (Wootton et al., 2006). Figure 2.5 shows telemedicine deployment in developed countries.

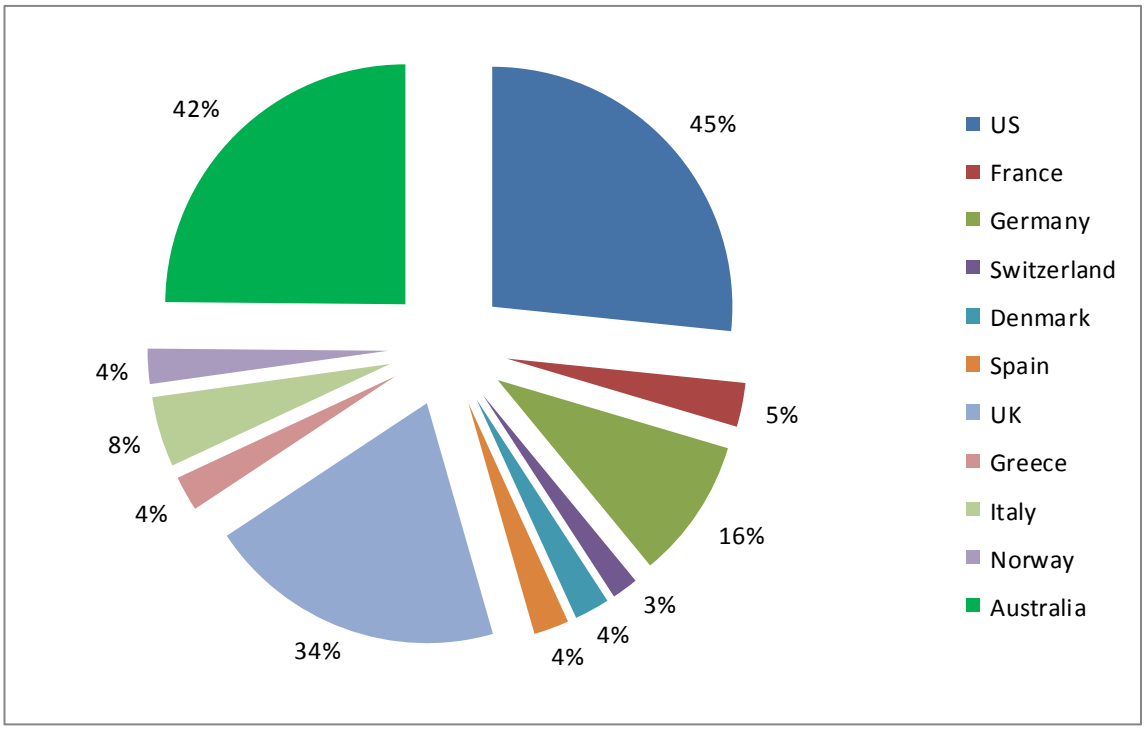


Figure 2.5: Telemedicine deployment in developed countries (*Redrawn from data in Wootton et al., 2006*)

On examining telemedicine deployment in UK, England has been identified as the leading adopter of telemedicine technology with the first UK telemedicine project taking place in Scotland in 1991 (Debnath, 2004). It was identified that most of the telemedicine projects were mainly used in medicine, education, mental health, elderly care and dermatology. Figure 2.6 show the deployment of telemedicine in UK.

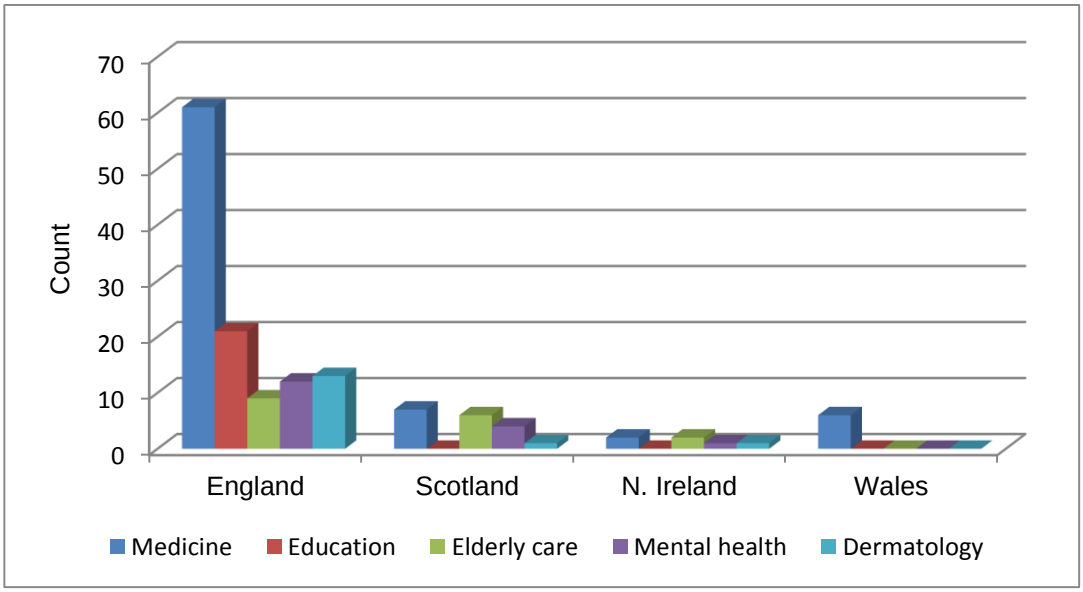


Figure 2.6: Telemedicine deployment in UK (*Redrawn from data in Debnath, 2004*)

2.1.3.1 Total Health Expenditure (THE) in developed countries

According to health statistics reports by WHO (2006) and OECD (2014), United States THE as a percentage of GDP is the highest worldwide. Also, World Bank health statistics report (2015) indicates that US has the highest GDP as shown in Figure 2.7. However, WHO health financing report (2015) indicates that a country's relative wealth is not the major factor that determines how much of the country's finances are to be allocated to health. Although developed countries have allocated a high percentage of the country's resources to healthcare, they still face difficulties in implementing telemedicine. This is an indication that there are other issues that need to be addressed to enable successful implementation of telemedicine in developed countries.

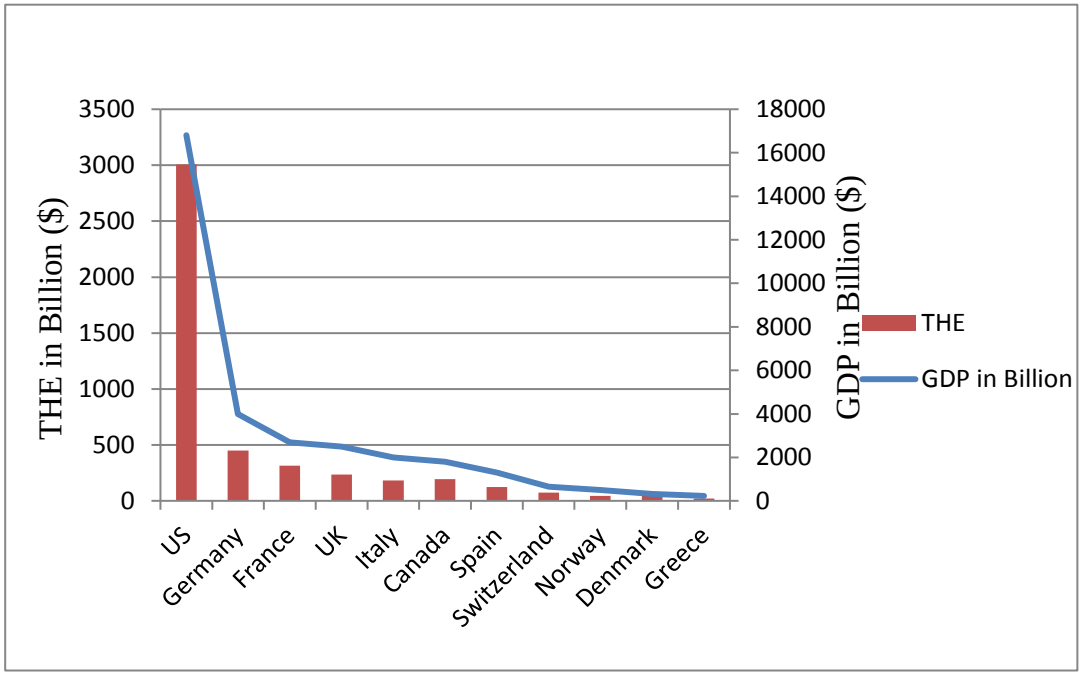


Figure 2.7: Comparison between THE and GDP of developed countries (World Bank, 2015)

2.1.3.2 Barriers to telemedicine deployment in developed countries

Although the focus of this study is not on developed countries, it is ideal to understand the barriers to telemedicine deployment in developed countries. According to Omachonu and Einspruch (2010), any attempt to understand the process of adoption of an innovation in healthcare must begin with an in-depth analysis of its challenges. Developed countries face a number of challenges in an

attempt to spread the practice of telemedicine. Table 2.4 highlights the three main barriers facing developed countries in an attempt to adopt telemedicine.

Table 2.4: Barriers to telemedicine deployment in developed countries

Factor	*Reference*
Legal / regulatory constraints	Dario et al., 2004; Gray et al., 2006; Alvarez et al., 2011; Zanaboni and Wootton, 2012; Medicaid, 2013
Interoperability	Al-Qirim, 2005; Harnett, 2006; Wootton et al., 2006; Clark and Goodwin, 2010
Reimbursement	Mitchell, 1999; Brown, 2006; Fogel and Sarin, 2016

According to Al-qirim (2005), the severity of these challenges varies from one healthcare provider or country to another. Legal constraints have been identified to be the most common barrier to telemedicine deployment and diffusion in developed countries (WHO, 1998; Zanaboni and Wootton, 2012).

2.1.4 Telemedicine classification

Telemedicine applications have been classified using various approaches by different researchers. According to Craig and Patterson (2005) and WHO (2010), telemedicine episodes can be classified basing on the type of interaction between the patient and the physician. However, Wootton et al. (2006) and Whited (2010) claims that telemedicine episodes can also be classified basing on the type of information being transmitted.

2.1.4.1 Asynchronous interaction

The medical information from the primary originating site is stored and forwarded at a later time to the referral hospital or to the medical expert. Originating site is the place where the patient is located at the time of examination. Asynchronous method is mainly used when immediate feedback or direct patient contact is not needed (WHO, 2010). It is used in specialties such as teleradiology, telecardiology, teleophthalmology, teledermatology and telepathology (Yellowlees et al., 2011). Nevertheless, the barrier to using this technique is that some medical images are very large and require a very big storage or need to be compressed to enable sending (Wootton et al., 2006).

2.1.4.2 Synchronous interaction

It involves use of a live two way interactive video where the patient and the medical expert are involved in a direct video contact. It is commonly used in space flight programs where immediate feedback is needed (Doarn et al., 1998). Some of the medical specialities using real time interaction include telesurgery, teleconsultation and telediagnosis. According to Dario et al. (2004), interoperability which encompasses equipment standardisation, integrating culture as well as financial and workflow systems is the major challenge to using real time medical interaction. The main advantage of this method is that the live interaction between the specialist and the patient enables the specialists obtain detailed medical information as if the patient walked in to the hospital (Wootton, 2006).

Focusing on the establishment of eClinics in underserved areas in Kenya, synchronous interaction is ideal since it enable live consultation with the specialist located in referral hospitals. Additionally, medical images are transmitted live thus not affecting the standards of the images transmitted as in the case of asynchronous transmission where images are first compressed and then stored (Wootton et al., 2006).

From the literature reviewed in the above session, it can be concluded that telemedicine is an emerging technology whose diffusion process is similar to that of any other technologies. It being a new technology in healthcare sector especially in developing countries, telemedicine fits the definition of innovation. The next section presents literature on telemedicine as an innovation in healthcare sector.

2.2 Organisation technology innovation

The concept of innovation was first put forward by Schumpeter in 1911 where innovation was defined as a procedure for introducing new production function. From an organisation perspective, innovation can be defined as the newness of an idea that in turn improves organisation performance (Camison and Villar, 2014). Various researchers have also defined technology innovation in various ways as shown in Table 2.5.

Table 2.5: Definition of technology innovation from various scholars

Definition	*Reference*
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.	Lansisalmi et al., 2006
An idea, practice, or object that is perceived as new by an individual or the unit of adoption.	Rogers, 2003; Menachemi et al., 2004
Introduction of a new concept, idea, service, process, or product with the long term goals of improving standards, safety, outcomes, efficiency and costs.	Omachonu and Einspruch, 2010
A dynamic process through which problems and challenges are defined, new and creative ideas are developed and new solutions are selected and implemented.	Sorensen and Torfing, 2012

The above definitions from different scholars have different views on innovation ranging from introduction of a new good and services, opening a new market, acquiring a new suppliers, introducing new production process, adopting new products and services before others do and integrating technical or administrative changes into the organisation structure. From the above definitions, it is clear that innovation captures three key features: novelty, application and intended benefit. In healthcare, telemedicine is a new technology whose outcome is aimed at improving the provision of patient care as well as to lower medical care costs.

Other key terms associated with technology innovation include:

- **Adoption:** The decision of potential users to make full use of an innovation as the best course of action available (Zanaboni and Wootton, 2012).
- **Diffusion:** The process by which an innovation is communicated or spread through certain channels over time among the members of a social system (Rogers, 2003).

According to Christensen et al. (2000), an organisation can introduce either disruptive or sustaining innovations irrespective of its focus. Disruptive innovations, also called radical, revolutionary, transformational or nonlinear occur when more affordable and accessible services are made available to every consumer.

Sustaining innovations, also called non-disruptive, incremental, evolutionary or linear occur when new and more advanced services or products are introduced aimed at serving more sophisticated consumers. As companies tend to innovate faster than their customers need evolve, most organisations eventually end up producing services and products that are sophisticated, expensive and complicated for many customers in the market. It is argued that healthcare technological innovations should be disruptive innovations aimed at making healthcare affordable and accessible to all (Yellowlees et al., 2011).

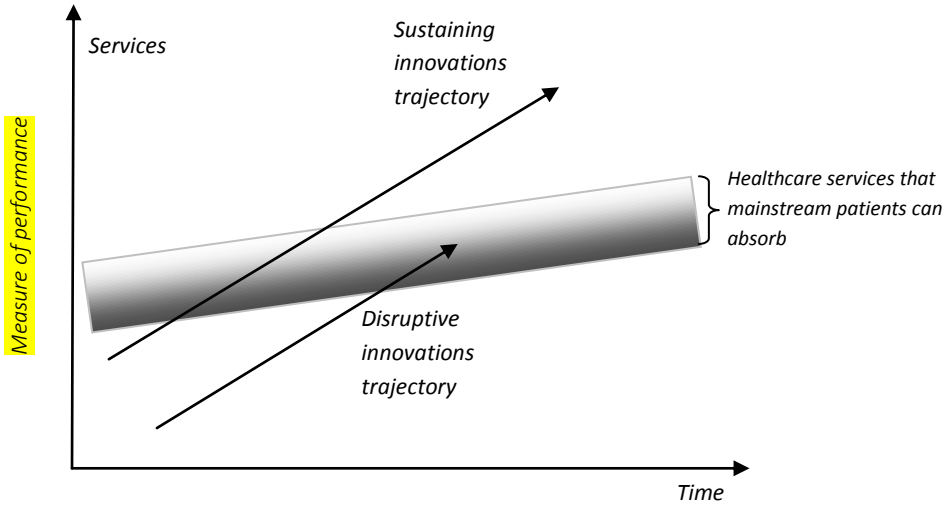


Figure 2.8: Disruptive and sustaining innovations in healthcare (Christensen et al., 2000)

In addition, Rogers (2003) claims that a preventive disruptive innovation is needed in healthcare sector to cope with the rising aging population which is likely to make healthcare provision a problem in the future. Preventive disruptive innovation is a disruptive innovation aimed at avoiding possible unwanted occurrence in the future. However, Hwang and Christensen (2008) claims that most of the sophisticated medical technologies introduced yearly are sustaining innovations which do little to make healthcare affordable and accessible. They are aimed at solving complex healthcare problems while the problem of inaccessibility of medical care by underserved communities remains. In healthcare sector, telemedicine can be considered as a disruptive innovation since it is aimed at providing medical care services to the mainstream patients at a more affordable and accessible manner.

2.2.1 Technology innovation generations

According to Rothwell (1994), innovation can be described in five generations which highlights how organisations structure their innovation processes over time. These generations are observed to be responding to economic growth, external competition, organisation expansion, unemployment and resource constraint.

1st generation: Technology push

Between 1950s to mid-1960, fast economic growth allowed a strong technology push and industrial expansion which enabled organisations to mainly focus on scientific breakthroughs. Research and development was considered as a corporate overhead by organisations.

2nd generation: Market pull (demand pull)

In mid-1960 to early 1970's, organisations shifted their development focus to respond to clients demands. Organisations aimed at meeting the demands of the market within the shortest time. In market pull generation, the market needs come first whereas in technology push generation, the technology comes first. In this generation, cost-benefit analyses and resources allocation of the innovative technology is made.

3rd generation: Interactive models

From the mid 1970's to mid-1980, technology-push and market-pull generations were brought together into a comprehensive model of innovation. This provided a more complete approach to factors involved in innovation process. Also, organisations moved away from individual research and development projects. However, it is argued that the model did not still explain why some organisations are more innovative than others (Shavinina, 2003).

4th generation: System models

From the early 1980 to the mid-90, strong linkages among organisations and close coupling with leading clients were established. Complexity of innovations required interaction within an organisation as well as with other organisations. It is argued that

organisations which do not have large pool of resources can benefit from establishing a network with other organisations.

5th generation: Evolutionary models and networking

From 1990s onwards, resource constraint in an innovation became central which encouraged system integration and networking. This enabled the automation of business processes as well as high levels of organisation collaboration.

Basing on the five generations discussed, telemedicine technology, especially in developing countries, has been introduced into healthcare sector mainly to serve the underserved communities (Zanaboni and Wootton, 2012). Furthermore, it is argued that due to the change in population demographics, there is increase in demand for advanced healthcare services (Mars, 2013). This can be viewed as a clinical pull technology rather than technology push.

2.2.2 Organisation technology innovation performance

Innovation is essential for the growth of an organisation. An organisation can innovate its technology, administrative processes or services. According to Damanpour et al. (2009), the composition of innovation types over time has an impact on organisation performance where the development of innovation capabilities for products, processes and technology can lead to superior organisation performance. Ho (2008) defines organisation performance as a measure of how well an organisation achieves its objectives. As shown in Figure 2.9, organisation innovation performance is mainly influenced by the environment it is operating in, organisation capacity and organisation motivation. Support from the external environment is essential when examining the innovation performance of an organisation. External environment includes political, culture, economic and stakeholder support. According to Wamala and Augustine (2013), lack of political leaders support to healthcare financing affects the amount of finances allocated to healthcare which in turn influences the innovation performance of healthcare organisations. Additionally, healthcare stakeholders influence the speed of adoption of these technologies. Similarly, organisation capacity is claimed to influence the innovation performance of an organisation. It is defined in terms of organisation processes, people and technology. According to Lusthaus (2002), organisation

capacity involves use of organisation resources to perform. Healthcare organisations with a wide pool of resources dedicated to innovation are more likely to be successful in executing innovations (Nyamu et al., 2015). Moreover, besides market oriented strategies, organisation culture has a great impact on organisation innovation performance. Innovations that integrate well with organisations culture are easily adopted by an organisation (Greenhalgh et al., 2008).

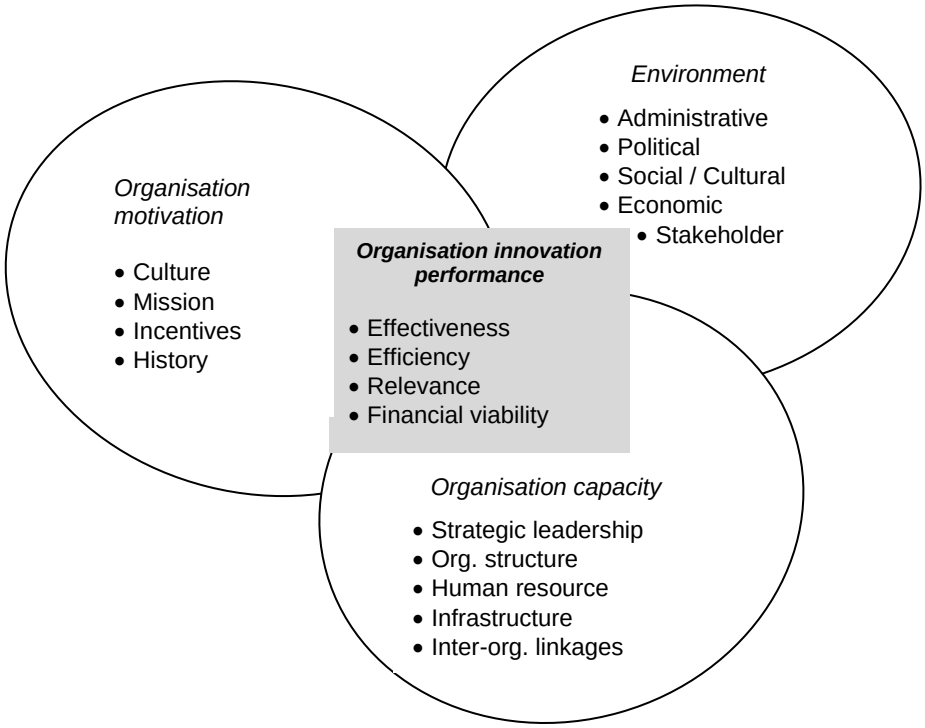


Figure 2.9: Organisation innovation perfomance model (Lusthaus, 2002)

Healthcare organisation performance can be measured in terms of clinical processes (Ho, 2008), health outcomes (Tidd, 2001), healthcare access, efficiency, productivity and employee variables (Battistella et al., 2015). Additionally, organisation innovation performance is influenced by the type of innovation and organisation configuration as shown in Figure 2.10. Amount of organisation resources available to innovate has been identified as an environmental factor where organisations can differ basing on the resources available. Damanpour and Gopalakrishnan (1998) acknowledged that favourable organisation resources facilitate radical innovations. It is argued that healthcare innovations with dedicated resources are more likely to be successful (Greenhalgh et al., 2008). Type of innovation or degree on novelty has also been identified to influence the innovation performance of an organisation. Organisations

executing radical or disruptive innovation have been identified to be highly innovative thus transforming the innovation performance of an organisation (Damanpour et al., 2009).

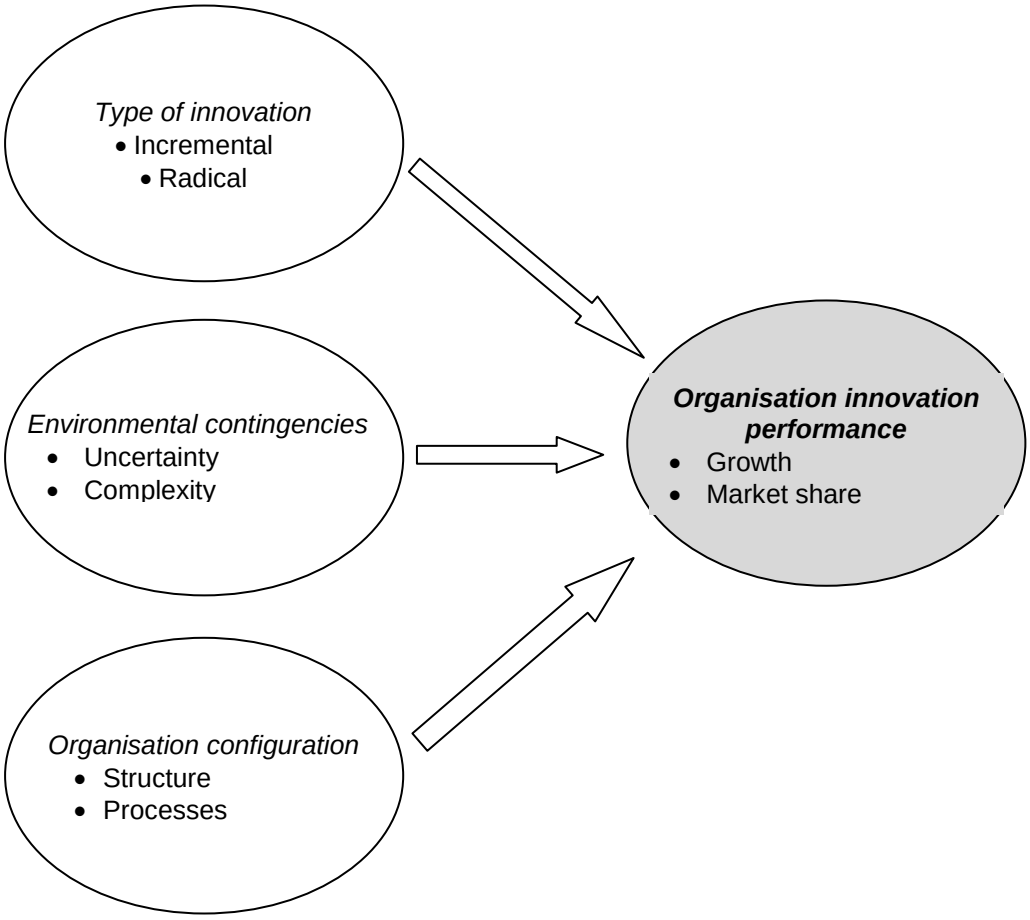


Figure 2.10: Organisation innovation perfomance model (Tidd, 2001)

Additionally, an organisation investing highly on R&D increases its innovation performance and contributes to the organisation's absorptive capacity. Absorptive capacity is the ability of an organisation to recognise the value of new external information, assimilate it, and apply and exploit (Cohen and Levinthal, 1990). An organisation may develop its absorptive capacity in a variety of ways. It may do so directly by sending employees for advanced technical training or by encouraging employees to monitor and read the technical literature in their areas of expertise (Battistella et al., 2015). An organisation’s absorptive capacity can be internally developed by hiring new personnel, contracting for consulting services or even through corporate acquisitions (Cohen and Levinthal, 1994).

Furthermore, organisation transformational leadership has been identified as an internal factor influencing the innovation performance of an organisation. Garcia-Morales et al. (2012) defines transformational leadership as leadership that enhances awareness of collective interest among the organisation members and helps them to achieve their collective goals. This influences innovation indirectly through communication processes and organisation learning which in turn enables organisations to be more innovative (Nonaka and Takeuchi, 1995). Figure 2.11 integrates factors influencing organisation innovation performance.

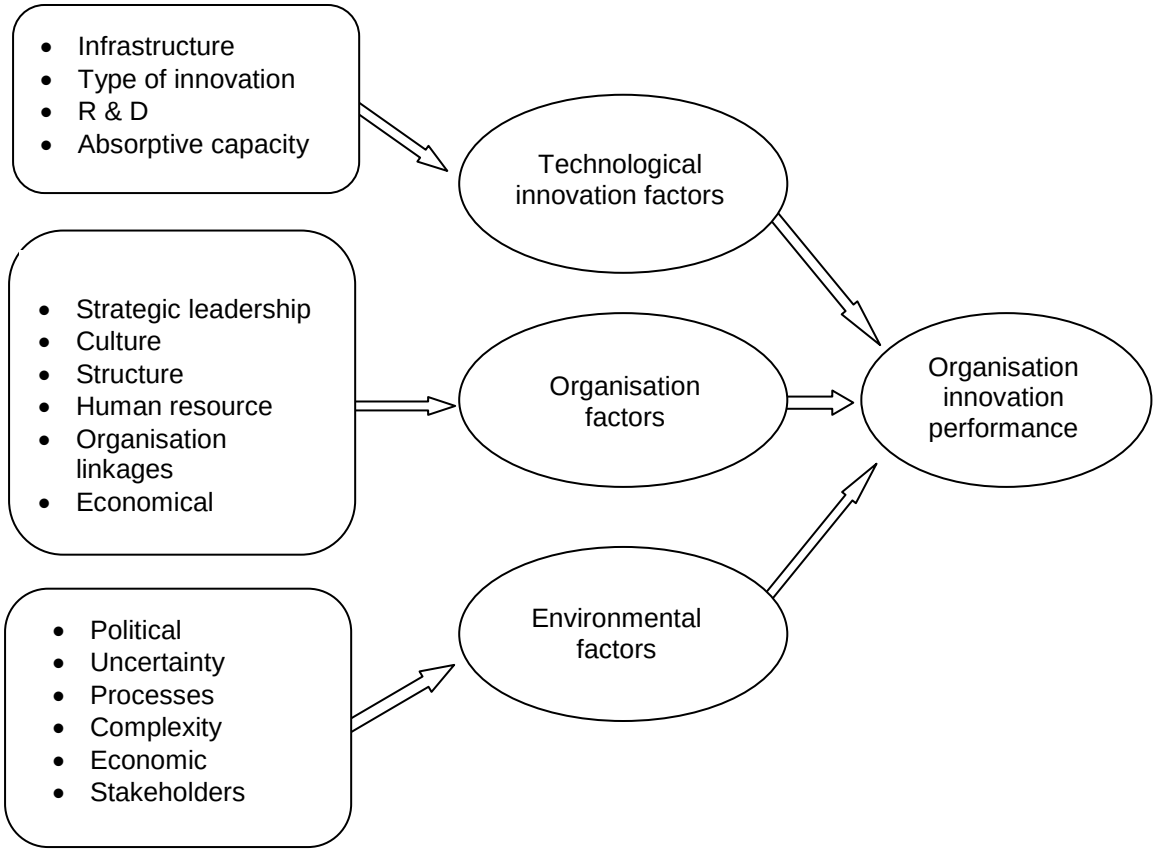


Figure 2.11: Factors influencing organisation innovation performance

Furthermore, organisation agility which means ability to deal with changes that often arise unexpectedly via rapid and innovative responses, has a great impact on the innovation performance of an organisation. It can be argued that an agile organisation is quick and flexible in responding to emerging technologies which improve its performance. Studies on organisation innovation performance revealed that agile organisation invest highly on ICT infrastructure. In a study to examine ICT impact on organisation competitiveness and innovation, it is observed that high level

of organisation ICT infrastructure has a positive influence on the responsiveness of an organisation towards innovation (Lopez and Muneta, 2012).

2.2.3 Innovation in healthcare

Innovation is claimed to be the major driving force in the expedition to balance cost containment and organisation performance. Innovation is expected to provide valuable benefits to the healthcare sector especially the cost and delivery of healthcare provided (Omachonu and Einspruch, 2010). Three main definitions of innovation in healthcare sector have been highlighted from previous studies as shown in Table 2.6.

Table 2.6: Definition of innovation in healthcare sector

Definition	*Reference*
A medical technology, structure, administrative system or service that is relatively new to the overall healthcare industry and newly adopted by hospitals in a particular region.	Goes and Park, 1997
A novel set of behaviours, routines and ways of working that are directed at improving health outcomes, administrative efficiency, cost effectiveness or users' experience and that are implemented by planned and coordinated actions.	Greenhalgh et al., 2008
Adoption of those best-demonstrated practices that have been proven to be successful and implementation of those practices while ensuring the safety and best outcomes for patients and whose adoption might also affect the performance of the organisation.	Thakur et al., 2012

Healthcare innovation has benefits from either the patient's point of view or organisation's point of view. From the patient's point of view, the intended benefits are either better health or less suffering due to illness (Faulkner and Kent, 2001). From an organisation point of view, the desired benefits are often enhanced efficiency of internal operations and / or the excellence of patient care (Thakur et al., 2012).

Clark and Goodwin (2010) claims that lack of innovation in public services leads to rise of public costs than the rest of the economy. However, the lack of robust evidence on the cost-effectiveness of healthcare innovations has been cited to

account for the slow uptake of the innovations (Menachemi et al., 2004). In addition, adoption of healthcare innovations is often regulated by state laws and other governing bodies which make the process laborious (Faulkner and Kent, 2001; Lansisalmi et al., 2006).

However, although there is evidence of the cost effectiveness of telemedicine in certain situations, its widespread adoption has not occurred (Zanaboni and Wootton, 2012). This implies that cost-effectiveness is a necessary condition but not a sufficient condition for telemedicine deployment. Therefore, an in-depth analysis to understand the process of innovation in healthcare is essential.

Nevertheless, organisation readiness to accept change has a great impact on the adoption of an innovation (William, 2011). Organisation readiness involves planning readiness and workplace readiness (Jennett et al., 2009). Planning readiness involves an in-depth assessment and analysis of the innovation to be implemented whereas workplace readiness involve preparing the staff through trainings, structural readiness though acquiring appropriate equipment as well as changing management and duty allocation.

Additionally, the key healthcare stakeholders needs, wants and expectations are also put into consideration when considering healthcare innovations. According to Omachonu and Einspruch (2010), healthcare innovations have five key stakeholders whose needs, wants and expectations vary as categorised in Table 2.7 and also affect the innovation process. According to Herzlinger (2006), the stakeholders can use various innovation approaches to improve the healthcare systems.

Table 2.7: Healthcare technological innovation stakeholders

Stakeholders	*Needs, Wants, Expectations*
Physicians	Improved clinical outcomes, improved diagnosis and treatment.
Patients	Improved patients experience, improved physiological well-being, reduced waiting time, reduced delay.
Organisations	Enhanced efficiency of internal operations, cost containment, increased productivity and outcomes improvement.
Innovator companies	Profitability, Improved outcomes.
Regulatory Agencies	Reduced risks and improved patient safety.

Technology innovation adoption is the decision of innovation potential users to make full use of an innovation as the best course of action available (Zanaboni and Wootton, 2012). Diffusion is the process by which an innovation is communicated or spread through certain channels over time among the members of a social system (Rogers, 2003; Clark and Goodwin, 2010). Consequently, diffusion of healthcare technological innovation such as telemedicine would permit decentralisation of work where patient care services offered at national level are devolved to community level (Craig and Patterson, 2005).

With the decentralisation of healthcare services aided by the adoption and diffusion of healthcare innovations such as telemedicine, the medical practitioners located at the national hospitals are able to attend to patients located in community hospitals without the need of any travel arrangements. However, the rate of adoption and diffusion of technological innovations within the healthcare sector is affected by various factors. According to Clark and Goodwin (2010), healthcare stakeholders influence the speed of adoption of these technologies. A blockage by any of the stakeholders to adopt the technology slows the entire progress of the innovation process. According to Liddell et al. (2008), organisation's external and internal factors also affect the rate of adoption and diffusion of technological innovations, as shown in Figure 2.12. External factors consist of those factors that the healthcare sector has no control over. They include the demand of the innovation by the targeted group of consumers or supply of the resources needed to develop and sustain the innovation. Internal factors consist of those factors that the healthcare sector has control over in facilitating or impeding the adoption and diffusion of healthcare technological innovations.

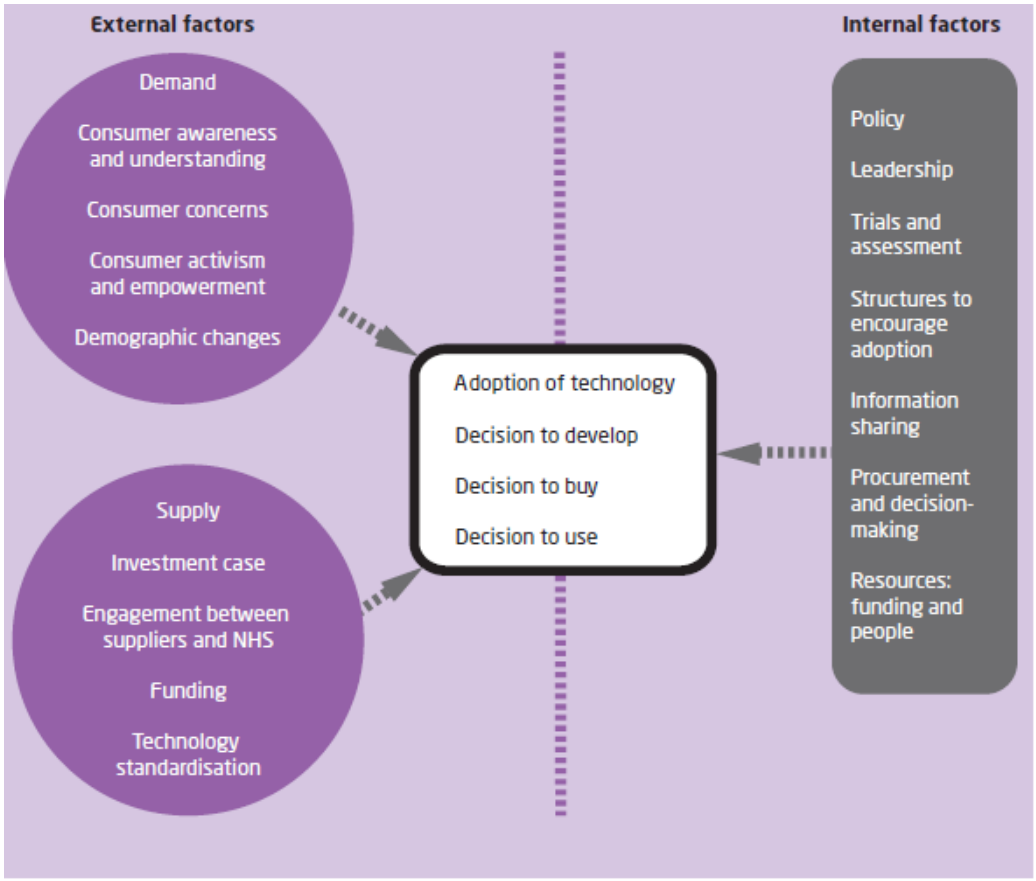


Figure 2.12: Factors influencing the adoption of healthcare organisation innovations (Liddell et al., 2008)

Moreover, various scholars' claims that the perceived attributes of an innovation have a great impact on the rate of absorption and diffusion of an innovation. The next section points out some of the attributes of an innovation especially in healthcare sector that influence the adoption and diffusion of healthcare technological innovations.

2.2.4 Attributes of innovation influencing its adoption and diffusion

The rate at which an innovation is accepted by the adopters varies. According to Davis (1986) and Rogers (2003), two theories mainly influence the rate of adoption of an innovation: technology acceptance model (TAM) and innovation diffusion theory (IDT). The two theories are viewed from the decision makers' and end users' perspective. In a study investigating telemedicine acceptance, perceived usefulness, relative advantage, ease of use and compatibility was observed to greatly influence the attitude of the adopting organisation and end users (Chau and Hu, 2002). The above mentioned attributes constitutes TAM and IDT.

2.2.4.1 Technology Acceptance Model *(TAM)*

An innovation cannot improve an organisation's performance if it is not accepted by the end users (Davis et al., 1989; Jennett et al., 2009). According to Davis et al. (1989), TAM is specially designed for information and communication related technologies. Additionally, TAM does not only predict human behaviour towards a system but also explains why a particular system may not be accepted by the organisation and the end users (Davis, 1986). TAM potentially plays a very significant role in explaining healthcare executives and practitioners' attitudes towards information and communication technology uses and assimilations (Thakur et al., 2012). Figure 2.13 show the components of TAM.

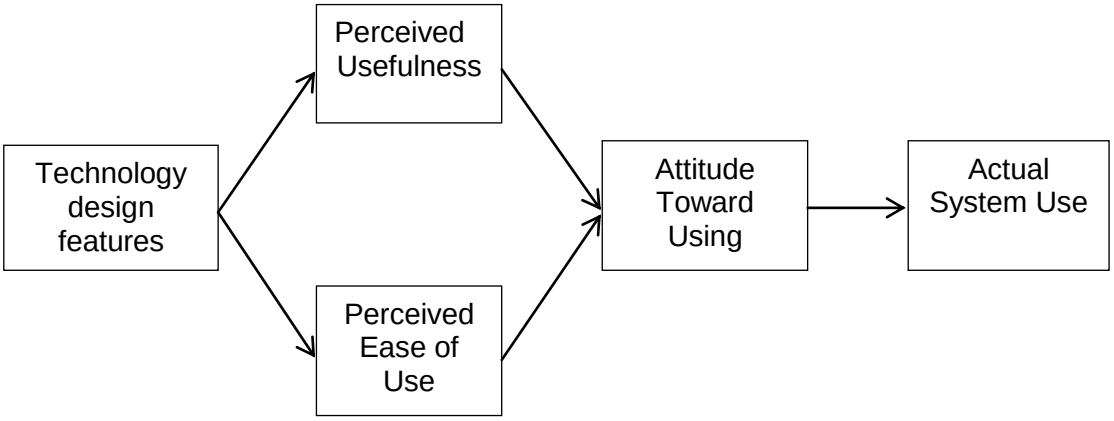


Figure 2.13: Technology acceptance model (Davis, 1986)

2.2.4.2 Innovation Diffusion Theory *(IDT)*

Diffusion of an innovation is a major challenge in all industries including healthcare (Omachonu and Einspruch, 2010) since they can be adopted or rejected (Rogers, 2003). The degree of influence upon an individual or organisation to adopt or reject an innovation is mainly based on the attributes of the innovation (Rogers, 2003). However, the rate of adoption of innovations differs although majority of the innovations follow S-shaped innovation logistic growth curve (Zanaboni and Wootton, 2012) where the gradient of the innovation adoption curve is influenced by five attributes described in Table 2.8.

Table 2.8: Attributes of Innovations (Rogers, 2003)

Attribute	*Description*
Relative advantage	The degree to which an innovation is perceived as being better than the idea(s) it supersedes. The innovation can be better in terms of economic aspects or general performance. The greater the perceived relative advantage of an innovation, the more rapid its rate of adoption is going to be.
Complexity	Degree to which an innovation is perceived as difficult to understand and use. As an innovation's complexity increases, the likelihood of adoption decreases. Innovation's complexity can be reduced through user training and demonstration (Greenhalgh et al., 2008).
Trialability	The degree to which an innovation may be tried on a limited basis. Trialability is more important in the early stages of adoption. Innovations that can be experimented on a limited basis are adopted more easily.
Observability	The degree to which the benefits of an innovation are clearly visible to the organisation and end users. Menachemi et al. (2004) defines it as the ease with which the relative advantage of an innovation can observed. The more clearly the adopting organisation and end users see or understand the innovation, the more likely they are to adopt the innovation.
Compatibility	The degree to which an innovation is perceived as being consistent with the existing values, past experiences and needs of potential adopters. The adoption of an incompatible innovation often requires the prior adoption of a new value system. An idea that is not compatible with the prevalent values and norms of the adopters will not be adopted as rapidly as an innovation that is compatible.

Out of the five innovation attributes, scholars have highlighted relative advantage to be the most important factor influencing the rate of innovation diffusion (Greenhalgh, 2008; Zanaboni and Wootton, 2012). However, all other attributes should also be considered since relative advantage alone does not guarantee widespread adoption of an innovation (Greenhalgh, 2008). Similarly, in the context of the healthcare industry, if the healthcare executives and practitioners are familiar with the technology, they will find the technology to be useful and easier to use reducing their fear and uncertainty in using the technology (Thakur et al., 2012).

2.3 Collaborative Innovation (Collaborative innovation)

Technological innovation within organisations has undergone a fundamental change. A shift in innovation paradigm has enabled organisations advance their technologies thus sustaining their operations (Chesbrough et al., 2006). Collaborative Innovation is an innovation that necessitates collaboration among various actors, levels or

segments (Royer and Bijman, 2009). According to Axelsson and Axelsson (2006), various factors lead to organisation collaboration as shown in Figure 2.14.

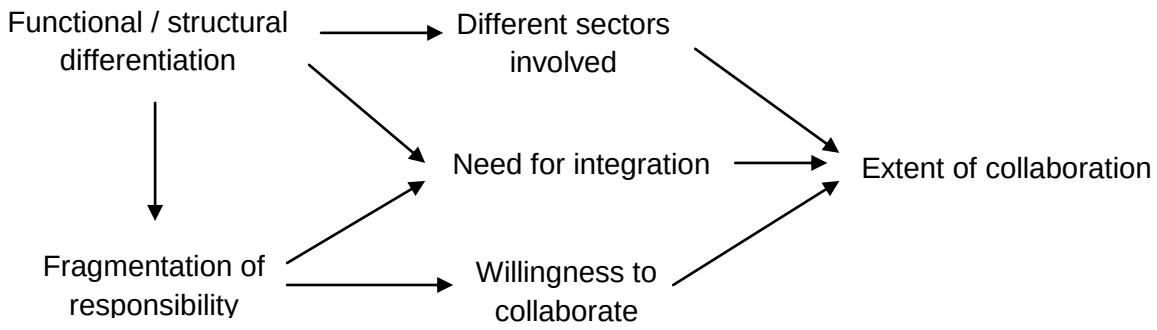


Figure 2.14: Factors leading to success of organisation collaboration (Axelsson and Axelsson, 2006)

One goal of collaboration is to enable innovation (Picard and Rabelo, 2010) since through collaboration, an organisation's abilities are not limited by its resources and expertise (Huxham and Vangen, 2005). In the healthcare sector, organisation collaboration improves the provision of healthcare by combining resources from various organisations. Furthermore, organisation collaboration offers large economic and technological benefits. Organisations choose to or are forced by the dynamic technological advancement to collaborate. Although more empirical studies on organisation collaborative innovation are needed, it has been pointed out that organisation collaboration enable collective efficiency through getting access to different resources needed to innovate, facilitates collective learning through shared learning process and generation of new ideas, innovation risks are shared collectively, reduce time taken to implement a new technology.

Organisation collaboration can be with their competitors which is referred to as horizontal collaboration or with their suppliers and / or end users which is referred to as vertical collaboration. Horizontal collaboration is aimed at introducing new technologies whereas vertical collaboration is aimed at reducing innovation costs (Belderbos et al., 2012). It is also important to note that different forms of collaboration exist. An organisation can adopt different approaches towards collaboration.

Joint ventures

Carnovale and Yeniyurt (2014) define a joint venture as where two or more organisations pool their resources within a common legal organisation. In the context of technology acquisition, joint ventures are partnerships where two or more firms create a separate entity to develop new technology (Steensma, 1996). Each collaborating organisation contributes its own resources with a high level of interaction between the collaborating organisations (Pastor and Sandonis, 2002). Furthermore, the collaborating organisations can be from the same sector, also known as co-option venture, or from different sectors, also known as co-specialisation venture (Tidd and Bessant, 2013). Co-option venture is ideal when introducing new technologies to be used within the same sector whereas co-specialisation venture is ideal when unique competency is required so as to explore new markets. However, this form of venture is expensive and has high level of uncertainties due to the introduction of new technologies into a new market.

Lead user collaboration

Baldwin and Von Hippel (2011) define ‘user’ as a firm or individual consumer benefiting from using a design, product or a service. Lead users should be considered before implementing a new technology and also involved in the design of new technology. According to Tidd and Bessant (2013), incorporating lead users in the development of new technologies can provide insight to forecasting the diffusion of a new technology. Additionally, innovation performance expectancy by the lead users is argued to be the strongest predictor of intention to use a new technology (Venkatesh et al., 2003).

The level of collaboration can be between departments of an organisation also known as intra-organisation collaboration or amongst various organisations either nationally or internationally also known as inter-organisation collaboration (Bonney et al., 2007; Westerlund and Rajala, 2010; Dinesen et al., 2011). Inter-organisation collaboration is mainly used during product or service innovation whereas intra-organisation collaboration is mainly used during process innovations which involve novel ideas (Westerlund and Rajala, 2010; Dinesen et al., 2011).

In a study carried out by Berkowitz (2000) on organisation collaboration, internal and external factors have been identified to influence organisation collaboration. Lansisalmi et al. (2006) argued that strong leadership, shared and clear objectives, task orientation and sufficient resources are internal factors positively related to organisation collaborative innovation. Moreover, Thakur et al. (2012) also identifies organisation culture as an internal factor influencing organisations collaboration whereas market environment has been identified as one of the external factors.

2.3.1 Definition of collaborative innovation

According to Bollingtoft et al. (2012), organisation collaboration has the potential to solve technology innovation adoption problems because resources, relevant skills and knowledge are organised to focus on the problem. Nevertheless, defining the term collaborative innovation is critical as organisations commitment in terms of resources, skills, time as well as risk sharing requires an in depth understanding of the term collaborative innovation (Simonin, 1997). Extant literature explains a number of approaches to defining collaborative innovation as shown in Table 2.9.

Table 2.9: Definition of collaborative innovation from scholars

Definition	*References*
Innovation that necessitates cooperation among various actors, levels or segments.	Royer and Bijman, 2009
Public and private sectors joining hands to create innovations.	Singapore healthcare projects, 2014
A relationship between two or more entities involving substantial time, commitments, high levels of trust and significant access to each other's resources to achieve a common goal.	Romero and Molina, 2011
A platform where new ideas or approaches from various internal and external sources are applied differently to create new value or experience for all stakeholders	Lee et al., 2012[b]
Any activity where two or more partners contribute differential resources and know how to agree complementary aims.	Dodgson and Rothwell, 1996
Active participation in joint innovation projects with other commercial or non-commercial organisations.	OECD, 2007

Situation when participants work together to pursue a meta-mission while also pursuing their individual missions.	Huxham and Vangen, 2005
Process in which parties with a stake in the problem actively seek a mutually determined solution.	Bollingtoft et al., 2012

2.3.2 Elements of collaborative innovation network

Collaborative innovation network consists of various parties having their own organisation policies coming together to solve a joint task. Dinesen et al. (2011) defines network as the basic social form that permits inter-organisation interactions of exchange, converted action and joint production. Dinesen et al. (2011) points out five elements used to unify these parties as shown in Figure 2.15.

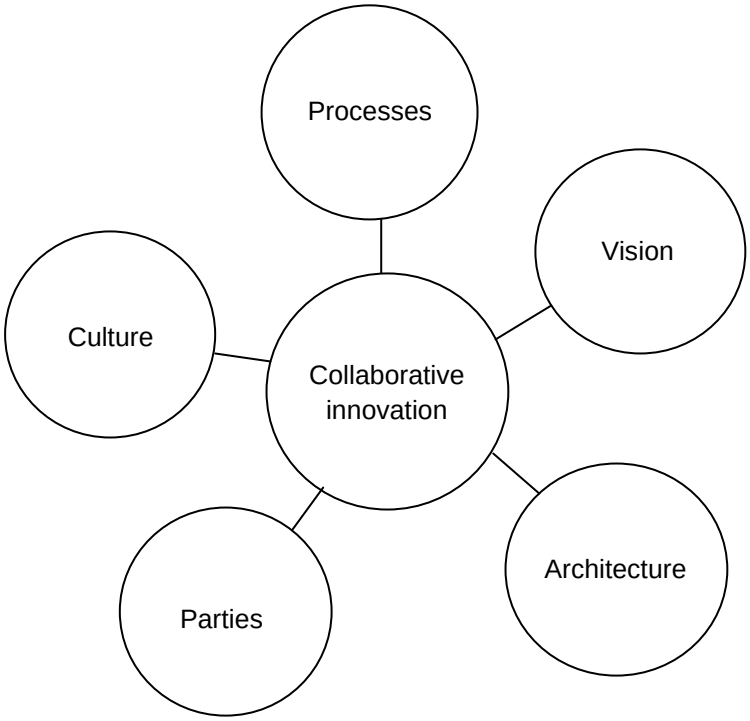


Figure 2.15: Elements of collaborative innovation network

Table 2.10: Elements of collaborative innovation network

Vision	The purpose and values of the collaborating organisations. The collaborating organisations need to have a common goal
Parties	Resources of the collaborative innovation network i.e. the collaborating organisations. A fundamental element between the collaborating parties is trust.
Processes	Procedures needed in order to accomplish the vision of the collaborating organisations. They are centered on exchange of coordination, information and joint problem-solving between the organisations.
Architecture	The structural framework for collaboration. It shapes the structural framework for collaboration.
Culture	The norms and values for interaction among the organisations.

The importance of organisation collaboration is to co-operate rather than to compete. According to Bommert (2010), the collaborating parties must overcome the problems of distrust, disrespect and outright antagonism in order to accomplish their mission. Additionally, high levels of transparency during collaboration process facilitate mutual adjustments in inputs, processes and outputs required during a collaboration process (Adler and Chen, 2011). According to Phillips et al. (2000), a careful selection of the collaborators should be considered to minimise collaboration failures. Extant literature identifies some of the potential causes of organisation collaboration failures as organisation culture mismatch (Boyer et al., 1998; San Martin-Rodriguez et al., 2005; Thakur et al., 2012; Tidd and Bessant, 2013), geographical mismatch (Knoben and Oerlemans, 2006; Bell et al., 2009; Tidd and Bessant, 2013), lack of collaborators commitment (Simonin, 1997; Romero and Molina, 2011), goal divergence (San Martin-Rodriguez et al., 2005; D'Amour et al., 2008), loss of control or ownership (Patel et al., 2012; Tidd and Bessant, 2013) and lack of trust (D'Amour et al., 2008; Bommert, 2010; Romero and Molina, 2011).

2.3.3 Paradigms to Collaborative innovation

2.3.3.1 Closed Innovation

According to Chesbrough (2003), closed innovation is an old paradigm where organisations believe that successful innovations require control. Organisations generate their own ideas, develop them, finance them and market them on their own. Furthermore, many organisations prefer working individually so that they can control

their intellectual property (Chesbrough, 2003). However, with increase in market demand of product or services as well as new technologies, individual organisations may face difficulties in attempt to cope with technology breakthroughs. Figure 2.16 depicts the boundaries of a closed innovation paradigm.

Since closed innovation is claimed to be slow in staying ahead of the changing technology demand (Lee et al., 2012[a]), new internal and external ideas are required to hasten the innovation process of any organisation (Chesbrough et al., 2006).

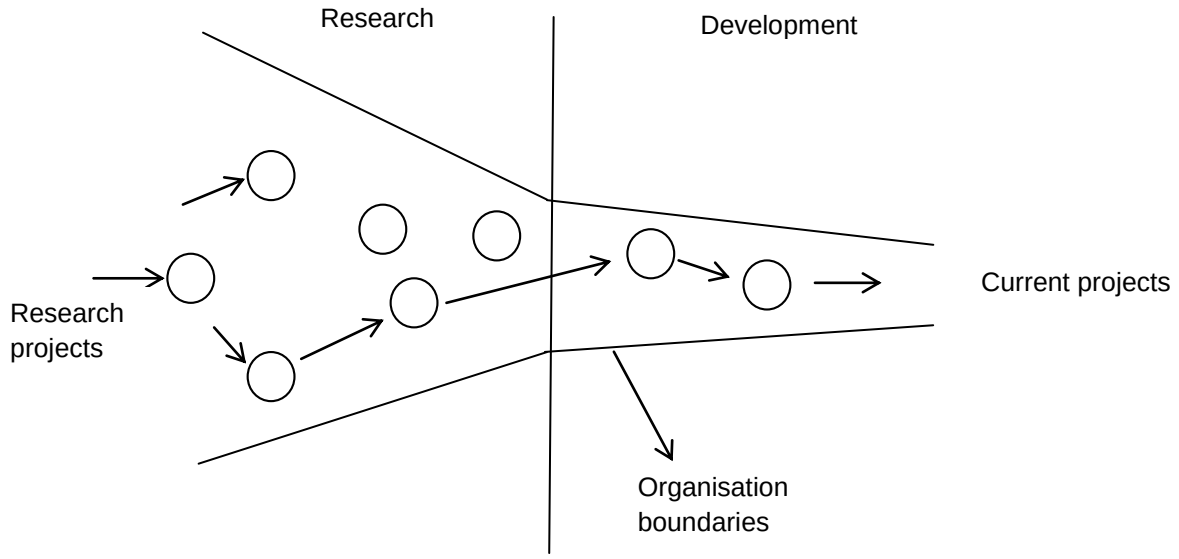


Figure 2.16: Closed Innovation paradigm (Chesbrough, 2003)

2.3.3.2 Open Innovation

Open innovation is a term coined by Chesbrough (2003) where organisations use internal and external ideas to accelerate the emergence of new technologies. The organisation collaborates with various organisations for idea generation. The novel design resulting from the collective internal and external ideas is protected where the ownership rights are granted to the organisation that initiated and funded the project (Schultz and Urban, 2012). However, the idea contributors in an open innovation can obtain a license to use the innovation (De Pablos-Heredero and Berzosa, 2012). Although open innovation enable sharing of internal and external ideas with other organisations, the resource commitment in executing new technologies is mainly individual tasks carried out by the organisation adopting the new technology (OECD, 2007; Lee et al., 2012[a]). Therefore, organisations executing costly innovative

projects could need external sustainable sources of funding (Baldwin and Von Hippel, 2011). Figure 2.17 depicts a paradigm of an open innovation.

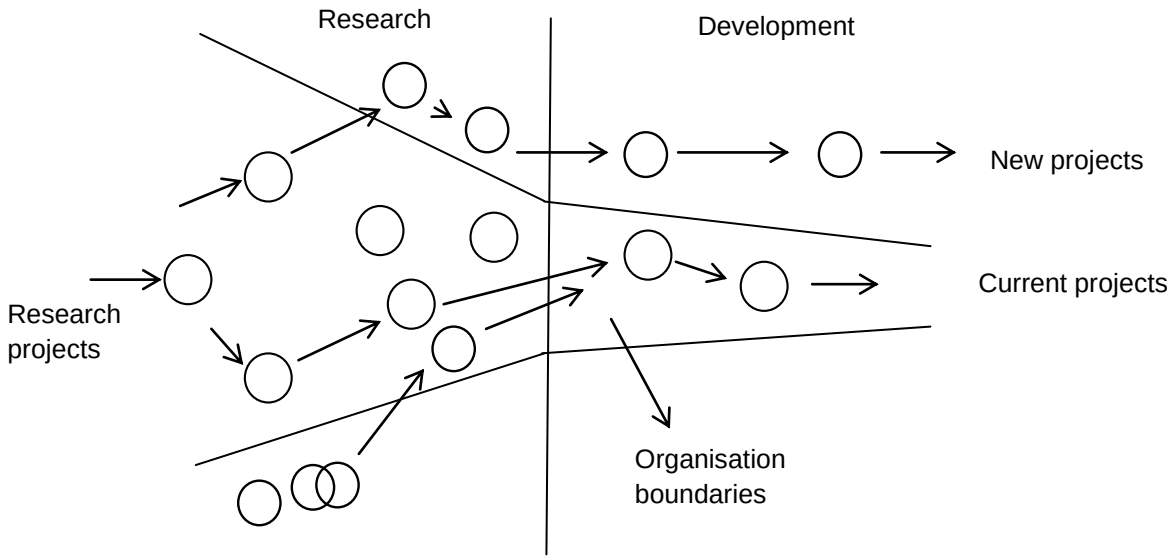


Figure 2.17: Open Innovation paradigm (Chesbrough, 2003)

2.3.4 Models of organisation collaboration

In a study on organisation collaboration in healthcare sector, D'Amour et al. (2008) illustrated that organisation collaboration can be analysed in four dimensions taking into account ten indicators. Figure 2.18 points out the four dimensions and the corresponding indicators.

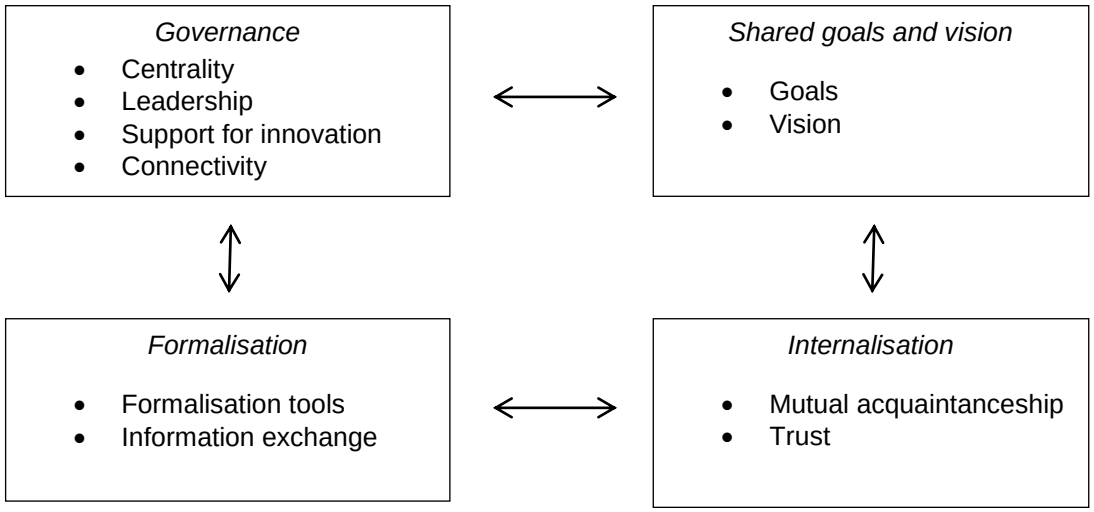


Figure 2.18: Four-dimensional model of collaboration (D'Amour et al., 2008)

Shared goals, vision and internalisation represents the relationship between collaborating individuals whereas formalisation and governance represents collaborating organisation's setting. Shared goals and vision presents common goals which are appropriate to the collaborators whereas internalisation focuses on individual's sense of belonging, knowledge of each other's values, discipline and mutual trust. Formalisation clarifies organisation's expectations and responsibilities while governance directs and supports the collaborators. The integration of the four dimensions influences the external and structural factors such as resources, financial constraints and organisation policies during collaborative processes as well as defining the strength of collaboration (D'Amour et al., 2008).

Additionally, Tidd and Bessant (2013) model for collaboration may be utilised to describe the rationale for collaboration (shown in Figure 2.19). Understanding the motives for collaboration is claimed to be essential. This includes response to end user needs, technology changes, reduce innovation risk and costs. Also, the competitive significance of a technology influences an organisation's decision about how best to acquire a given technology. As for the complexity of a technology, a single organisation is unlikely to maintain all technological expertise required to execute an innovation.

Furthermore, the need for tacit knowledge encourages organisation interaction. When organisations collaborate, they tap tacit knowledge from the expertise within the collaborating organisations and later transformed into explicit knowledge (Nonaka et al., 2014). Tacit knowledge is difficult to articulate and transfer unless those who possess the know-how in question can demonstrate it to others (Teece, 1986). Cavusgil et al. (2003) claims that organisation's tacit knowledge is the innovative knowledge. Similarly, an organisation's existing internal technical capabilities influences the way it decides to acquire a new technology. Lack of expertise may call for external sourcing of expertise which in turn leads to collaboration. Organisations encouraging sourcing expertise from other organisations allow the organisation to benefit from diverse organisations innovation culture and scientific approaches. Besides, organisations need to select collaborating partner who can contribute to what is needed, specify what is expected and agree on the speculated plan.

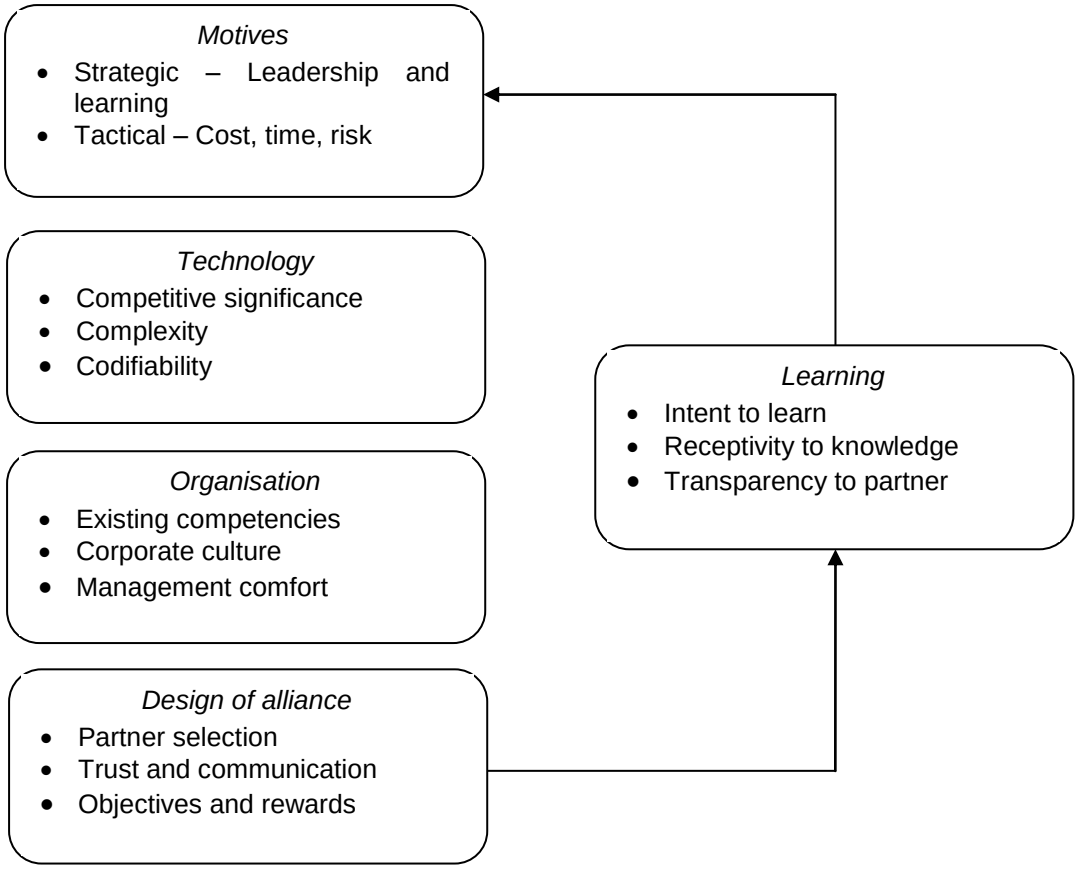


Figure 2.19: Model for collaboration (Tidd and Bessant, 2013)

Bucic and Gudergan (2002) collaborative innovation model suggests that the process of organisation collaboration to innovate combines three factors: individual level factors, group dynamic factors and alliance dynamic factors (shown in Figure 2.20). Individual level factors describe the attributes which are fundamentally personal to individuals such as individual motivation and critical thinking. Group dynamic factors comprise of individual's behaviours which are influenced by social factors such as diversity. Alliance factors are organisation factors influencing individuals within an organisation. The combination of these factors influences organisation innovation alliance which is a combined output of organisation's creativity process, learning process and the knowledge stock. "*Alliance innovation is the outcome of a collaborative, dynamic and renewable system and it is a novel solution that is of social or economic value"* (Bucic and Gudergan, 2002).

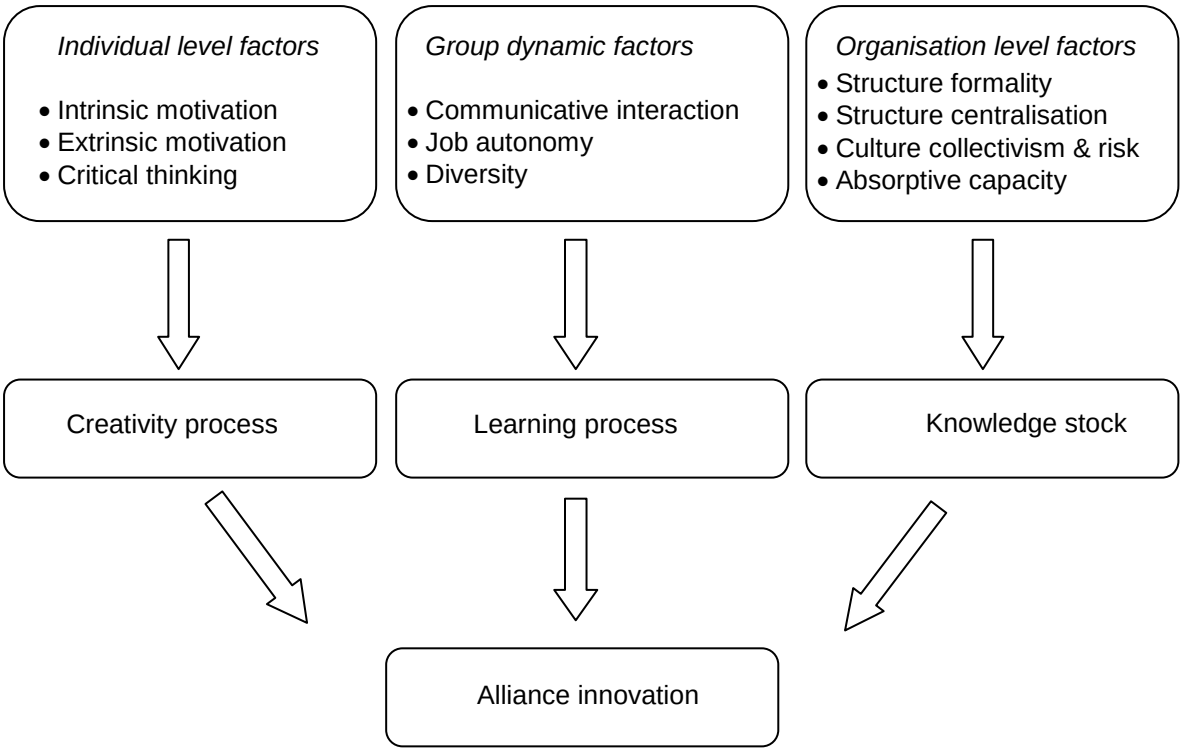


Figure 2.20: Organisation alliance innovation model (Bucic and Gudergan, 2002)

In order to understand collaborative innovation process, the researcher theoretically integrates factors adapted from collaborative innovation models as shown in Figure 2.21. These factors are derived from collaborative innovation models by D'Amour et al. (2008), Tidd and Bessant (2013), Bucic and Gudergan (2002). This model helps in understanding collaborative innovation process within an organisation. The model factors are categorised into organisation environment factors and technology environment factors. Organisation environment factors are set of organisation factors which influence the operations of an organisation. Technology environment factors are set of factors which influence the transformation of scientific discoveries within an organisation.

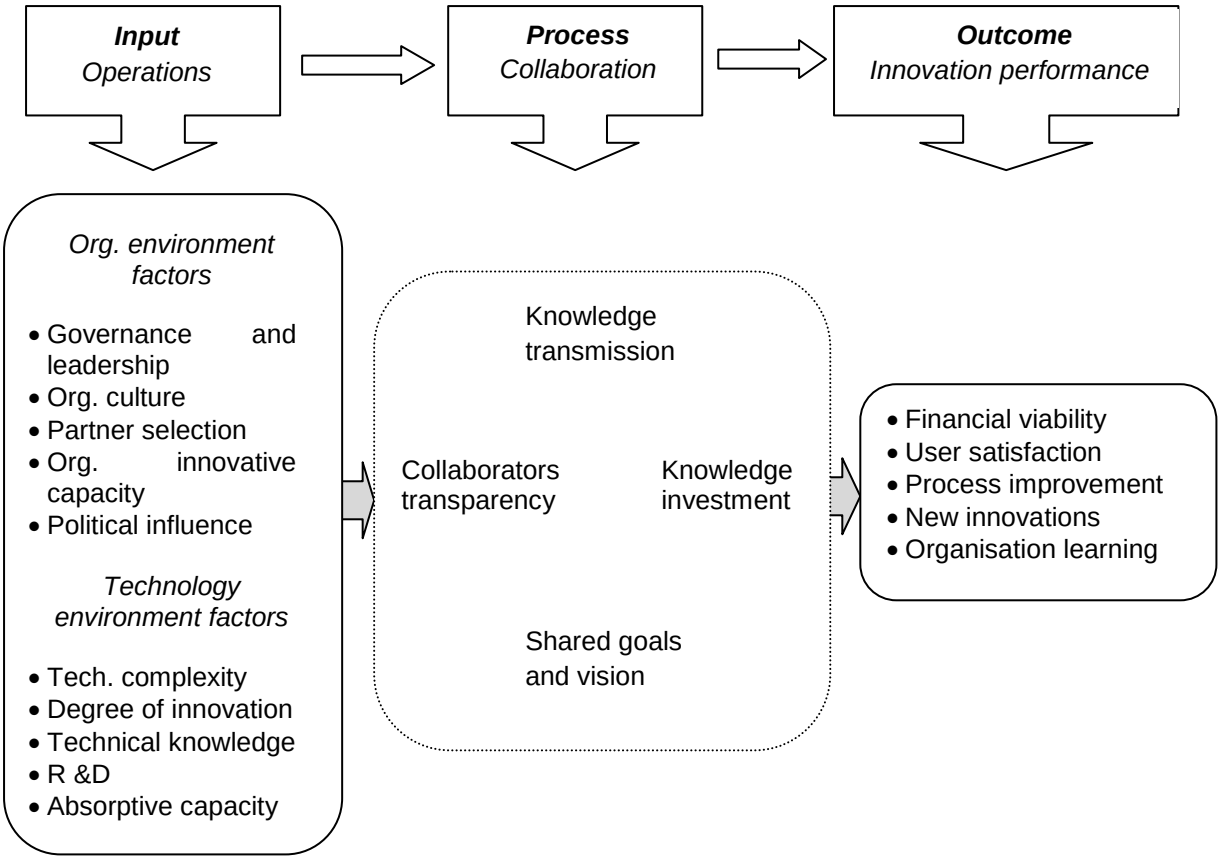


Figure 2.21: Process of inter-organisation collaboration innovation

Patel et al. (2012) examined benefits of organisation collaboration in CoSPaces projects which included increased profit through sharing expertise, reduction in costs through sharing best practices, improved decision making through sharing insights and knowledge, innovation through sharing ideas and an improved ability to pursue goals. Additionally, organisations engaging in collaborative innovation projects combine the best skills or core competencies and resources from other organisations (Bossink, 2002; Romero and Molina, 2011). This enables them to have the capacity of executing sophisticated innovations that could not be executed by an individual organisation (Sorensen and Torfing, 2012). In addition, collaborative innovation has been identified as one of the ways of decreasing risk of innovation failure (Michaelides et al., 2013). However, collaborative innovation in public sector is faced with scepticism regarding the capacity to innovate public policies, organisations and services (Bommert, 2010).

When the organisations decide to innovate collaboratively, they enter into contracts with each other and agree on the distribution of costs and revenues incurred during the collaborative innovation process (Bossink, 2002). In developing countries,

execution of telemedicine projects require sharing of costs and risks associated with it (Androuchko and Nakajima, 2004; Dario et al., 2004; WHO, 2010). Ansell and Torfing (2014) argue that collaborative innovation is suitable for public sector since it opens the innovation cycle to various actors and taps innovation resources across borders.

Since collaborative innovation allows partnership where various actors with a shared vision collaboratively create an environment for innovation (Bonney et al., 2007; Royer and Bijman, 2009), implementing expensive and expansive projects can be effectively managed and risks shared across the partners (Aneesh and Antonio, 2009). However, a study conducted by Maniak and Midler (2008) on collaborative innovation in car industries revealed that organisations tend to establish partnership at early phases of innovation even before the object of collaboration is defined. According to Segrestin (2005), the ability to manage such collaborations efficiently is likely to be complicated because there are no mutual liabilities at the early stages of the collaboration. In addition, since the organisations have very little knowledge of each other, time is needed to understand the corporate cultures and strategies of every organisation involved in the partnership (Boyer et al., 1998).

In a study on satellite communication in healthcare sector, Dario et al. (2004) argued that healthcare personnel, researchers, public organisations officials and private organisations officials must collaborate on a range of activities to facilitate telemedicine deployment. These activities included initiatives to build a robust health information system that provides equitable access, development of reliable health care technologies, audience-appropriate information and support services for specific health problems, and health-related decisions for all segments of the population especially for underserved persons and training of health professionals in the science of ICT.

2.4 Chapter summary

According to the literature gathered from this chapter, telemedicine fits the definition of an innovation which is defined as an idea, practice or object that is perceived as new by the unit of adoption. In healthcare, telemedicine is a new technology whose outcome is aimed at improving the standards of patient care as well as to lower medical care costs. However, telemedicine technology adoption has been identified to be lagging in developing countries. Large financial commitment of significant risks has been pointed out to be the key barrier to telemedicine adoption. Organisation collaboration in developing countries was indentified to facilitate telemedicine deployment in developing countries although empirical studies supporting these claims is claimed to be lacking.

In the next section, a conceptual framework on organisation collaboration to facilitate telemedicine deployment in developing countries will be developed by integrating various theories reviewed in this chapter. The related hypotheses for this research will also be formulated and later tested.

Chapter Three: Conceptual framework and hypotheses development

3.1 Introduction

A conceptual framework is a structural display consisting of a set of interrelated concepts and definitions from existing theory used in a particular study to form the basis of the research problem (Swanson, 2013). It allows the researcher to explore the relationship existing between constructs identified from extant literature in a logical manner (Anderson, 1998). Additionally, conceptual framework guides the researcher on developing research hypotheses and makes a choice of research methods to be used.

The conceptual framework of this study is developed by integrating the constructs elicited from the exploratory study on organisation collaboration, factors from innovation diffusion theory (IDT), technology acceptance model (TAM) and organisation innovation theory factors. TAM model which was developed by Davis (1986) and IDT model developed by Rogers (2003) has been previously used to explain the factors influencing the rate of adoption and diffusion of healthcare technologies. According to Damanpour (1991), organisation innovation adoption and diffusion is influenced by the organisation, individuals as well as the environment. Organisation factors have been pointed out to be the most influential determinants of innovation adoption and diffusion in organisations (Damanpour, 1987; Greenhalgh et al., 2008; Cresswell and Sheikh, 2013). Nevertheless, social aspects such as individual attitudes towards an innovation are integral to organisation issues. Merging these individual factors will provide an integrative approach to investigating telemedicine deployment in Kenya through organisation collaboration.

3.2 Conceptual framework factors

Factors chosen to investigate the role of organisation collaboration in facilitating telemedicine deployment are extracted from TAM, IDT, organisation innovation theory and factors highlighted during the exploratory study phase on organisation collaboration in healthcare sector. Integrating these factors provide different aspects to examine healthcare organisations ability to collaborate to facilitate telemedicine deployment. The framework is divided into three sections. The left side of the framework presents the precursors namely: ICT infrastructure, organisation affiliation

and patient telemedicine adoption. Basing on the extant literature, the three precursors directly influence healthcare organisation factors which include: organisation resources, organisation's innovation acceptance, personnel innovation acceptance, organisation's innovative capacities, organisation agility and collaborative innovation aspects. The healthcare organisation factors further influence the telemedicine collaborative innovation outcomes which are examined in two dimensions: internal innovation outcomes and external innovation outcomes. Additionally, it is claimed that moderating factors can yield more accurate estimates when examining the relationship existing between the hypotheses of interest. Figure 3.1 shows the conceptual framework developed for this study.

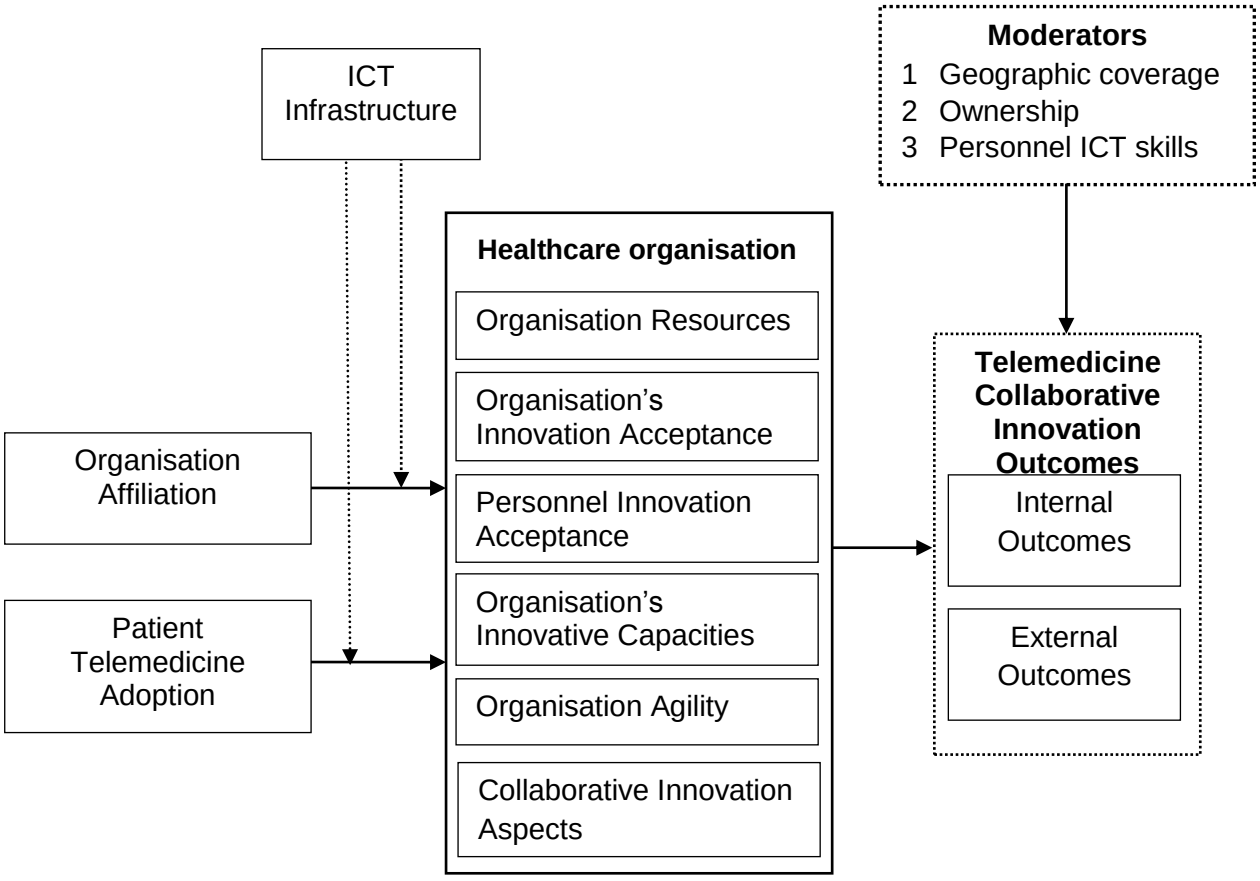


Figure 3.1: Preliminary conceptual framework

To develop the framework of this study, previous frameworks in the field of technology adoption were also considered. A difference existed especially in collaborative innovation factors that were addressed in this study. In a framework developed on innovation research in information systems (Jha and Bose, 2016), technology innovation theory and acceptance model, resource based theory and diffusion of innovation theory were considered.

3.2.1 Conceptual framework factors sources

To develop the conceptual framework for this research, various factors proposed to influence organisation collaboration to facilitate innovation as well as telemedicine deployment were identified from extant literature. Table 3.1 highlights these factors and their sources.

Table 3.1: Conceptual framework factors sources

Factor	*Sources*
Information and Communication Technology (ICT)	WHO, 1998; Ferrer-Roca et al., 2002; Perez et al., 2004; Zain et al., 2005; Herzlinger, 2006; Lu and Ramamurthy, 2011; Yeganegi and Azar, 2012; Lopez and Muneta, 2012; Michaelides et al., 2013; Hall et al., 2013; Silva et al., 2014
Organisation affiliations	Mitchell, 1999; Chesbrough, 2003; Androuchko and Nakajima, 2004; Dario et al., 2004; Atouba and Shumate, 2010; Bommert, 2010; Picard and Rabelo, 2010; Romero and Molina, 2011; Durugbo and Riedel, 2013; Michaelides et al., 2013; Singapore healthcare projects, 2014
Patient's TM adoption	Davis, 1986; Meyer, 1997; WHO, 1997; Menachemi et al., 2004; Zain et al., 2005; Zanaboni and Wootton, 2012
Organisation resources	Damanpour and Gopalakrishnan, 1998; Chesbrough, 2003; Perez et al., 2004; Greenhalgh et al., 2008; Wootton et al., 2005; Lee and Xia, 2006; Kazakci et al., 2008; Romero and Molina, 2011
Organisation's innovation acceptance	Davis, 1986; Agarwal and Prasad, 1997; Jennett et al., 2009; Dario et al., 2004; Rogers, 2003; Hameed et al., 2012
Personnel innovation acceptance	Davis, 1986; Davis et al., 1989; Eastlick and Lotz, 1999; Rogers, 2003; Evans, 2003; Venkatesh et al., 2003; Dario et al. 2004; Greenhalgh et al., 2008; Whitten and Mackert, 2005; Zain et al., 2005; Harnett, 2006; Jennett et al., 2009; Zanaboni and Wootton, 2012
Organisation's innovative capacities	Damanpour, 1991; Goes and Park, 1997; Mitchell, 1999; Szeto, 2000; Lemon and Sahota, 2004; Picard and Rabelo, 2010; Durugbo and Riedel, 2013; Salampasis et al., 2014
Organisation agility	Steensma, 1996; Goldman and Graham, 1999; Zain et al., 2005; Gallagher and Worrel, 2008; Yeganegi and Azar, 2012; Lu and Ramamurthy,

	2011; Lopez and Muneta, 2012; Hameed et al., 2012; Kwon et al., 2013
Collaborative innovation aspects	Bossink, 2002; Cohen and Levinthal, 1994; Romero and Molina, 2011; Lee et al., 2012[b]; Patel et al. 2012; Sorensen and Torfing, 2012; Michaelides et al., 2013 • Other factors were gathered from the exploratory study using repertory grid.

3.2.2 Moderating factors

Moderating factors, also known as extraneous variables (Spector and Brannick, 2011) or control variables (Atinc et al., 2012) measure the impact of any given variable above and beyond the effects of other variables. According to (Damanpour and Schneider, 2009), a moderator affects the direction or the strength of the relationship that exists between the independent and a dependent variable. Moderating variables can yield more accurate estimates of relationships among underlying theoretical constructs of interest (Spector and Brannick, 2011). According to Becker (2005), moderating variables rule out alternative explanations for researcher findings as well as increase statistical power. Additionally, researchers should provide rational behind the inclusion of a specific moderating variable (Carsrud and Brannback, 2014).

Basing on previous studies on organisation innovation, a number of moderating factors were included in this research. In previous studies, organisation size has been claimed to influence the operations of an organisation. Boonstra and Broekhuis (2010) revealed that large healthcare organisations are more receptive to the introduction of healthcare technological innovation such as electronic medical records. Cresswell and Sheikh (2013) argue that large organisations have large human, organisation and financial capital. Also, organisation ownership has been claimed to influence the innovativeness of an organisation. Private organisations are claimed to be more innovative than public organisations because private organisations are profit oriented. By contrast, innovation in the public sector is driven to improve service performance and add value in terms of public benefit (Lee et al. 2012[a]). Moreover, a study by Cresswell and Sheikh (2013) on organisation issues influencing technology implementation in healthcare sector revealed that the level of

competencies of personnel ICT literacy influenced the adoption of healthcare innovations. According to Ludwick and Doucette (2009), healthcare personnel as well as patients' previous experience on ICT use had a positive effect on the adoption of electronic medical records. Table 3.2 show the sources of moderating variables used in this research.

Table 3.2: Sources of moderating variables used in this research

Moderator	*Study*	*Source*
Organisation geographic coverage (Defining organisation size) • National • Provincial • County • Health centres	The grouping of Kenyan healthcare organisations was carried out basing on the Kenyan healthcare organisations categorisation.	Kenyan e-Health facilities (2015)
Organisation ownership • Government • Private	Ministry of Health report, Kenya	Kenyan e-Health facilities (2015)
Personnel ICT skills level	Organisation issues influencing technology implementation in healthcare sector.	Cresswell and Sheikh, 2013
	Adopting electronic medical records in primary healthcare.	Ludwick and Doucette, 2009
	Importance of ICT on knowledge transfer in healthcare organisations to facilitate innovation.	Sheng et al., 2013

3.3 Hypotheses development

Collis and Hussey (2013) define hypothesis as a proposition that can be tested for association or causality against empirical evidence. From the previous chapters, a research gap was identified from the extant literature on telemedicine deployment in developing countries was determined. It was noted that various scholars suggest that organisation collaboration can facilitate telemedicine deployment in developing countries (Androuchko and Nakajima, 2004; Standing et al., 2014). However, it was

claimed that there is insufficient understanding on how collaborative innovation at organisation level can facilitate telemedicine deployment especially in developing countries (Goes and Park, 1997; WHO, 1998; Mitchell, 1999; Alverson et al., 2004; Bommert, 2010; Alajlani and Clarke, 2013; Jakobsen et al., 2014). Moreover, researchers highlighted that there is lack of empirical studies on healthcare organisations perception towards collaborative innovation in facilitating telemedicine deployment. This section integrates factors from extant literature on open innovation theory, TAM and IDT to develop research hypotheses which will be tested so as to clearly understand how collaborative innovation at organisation level facilitates telemedicine deployment, healthcare organisations perception towards telemedicine and towards collaborative innovation.

This section is divided into two sub-sections. The first sub-section will focus on hypotheses relating to the influence of framework precursors namely: ICT, organisation affiliation and patient telemedicine adoption on healthcare organisation factors namely: organisation resources, organisation's innovation acceptance, personnel innovation acceptance, organisation's innovative capacity, organisation agility and collaborative innovation aspects. The second sub-section will focus on hypotheses relating to the influence of healthcare organisation factors on telemedicine collaborative innovation outcomes.

3.3.1 Hypotheses relating to the precursors

Three factors identified from extant literature are claimed to influence healthcare organisation attempt to innovate. They include: ICT, organisation affiliation and patient telemedicine adoption. In this section, hypotheses related to the model precursors will be developed.

3.3.1.1 Information and Communication Technology (ICT)

ICT is making use of science and technology to organise the obtained information (Yeganegi and Azar, 2012). A study conducted by Michaelides et al. (2013) on continuous innovation networks highlighted that organisation collaboration heavily rely on internet based technologies. The reliability of an ICT infrastructure can be examined using various approaches. In telemedicine adoption, a reliable ICT infrastructure entails:

- ICT infrastructure that is compatible with healthcare organisation's telemedicine devices (WHO, 1997).
- The bandwidth for a telemedicine link should be greater than 50Mbps (Mars, 2013).
- ICT link should be secure to enable data security (Mars, 2013).
- An affordable and sustainable ICT infrastructure by the adopting healthcare organisation (Lopez and Muneta, 2012).
- ICT infrastructure should integrate well with the healthcare organisation's culture (Lee et al., 2013).
- ICT infrastructure should be agile and capable of change so that future requirements of the healthcare organisation can be met with minimal impact on the healthcare organisation (Lu and Ramamurthy, 2011).

On the other hand, Gargallo-Castel and Galve-Górriz (2012) found an interaction between ICT and organisation resources in improving organisation's performance. Similarly, Jean (2007) found that integrating ICT within an organisation facilitates the coordination and monitoring of the organisation's resources. On the other hand, Lee et al. (2013) highlighted the importance of how well the ICT infrastructure integrates with the organisation's culture. Schein (2004) defines organisation culture as a pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration that has worked well enough to be considered valid and therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems. According to Hofstede (2010), ICT that integrates well with organisation's culture will be easily adopted by the organisation. In a study by Gagnon et al. (2005) on telehealth adoption in an organisation perspective, a positive link between ICT and organisation culture was identified where it was observed that ICT that integrated well with organisation's culture was easily adopted. Figure 3.2 show hypotheses relating to organisation ICT infrastructure.

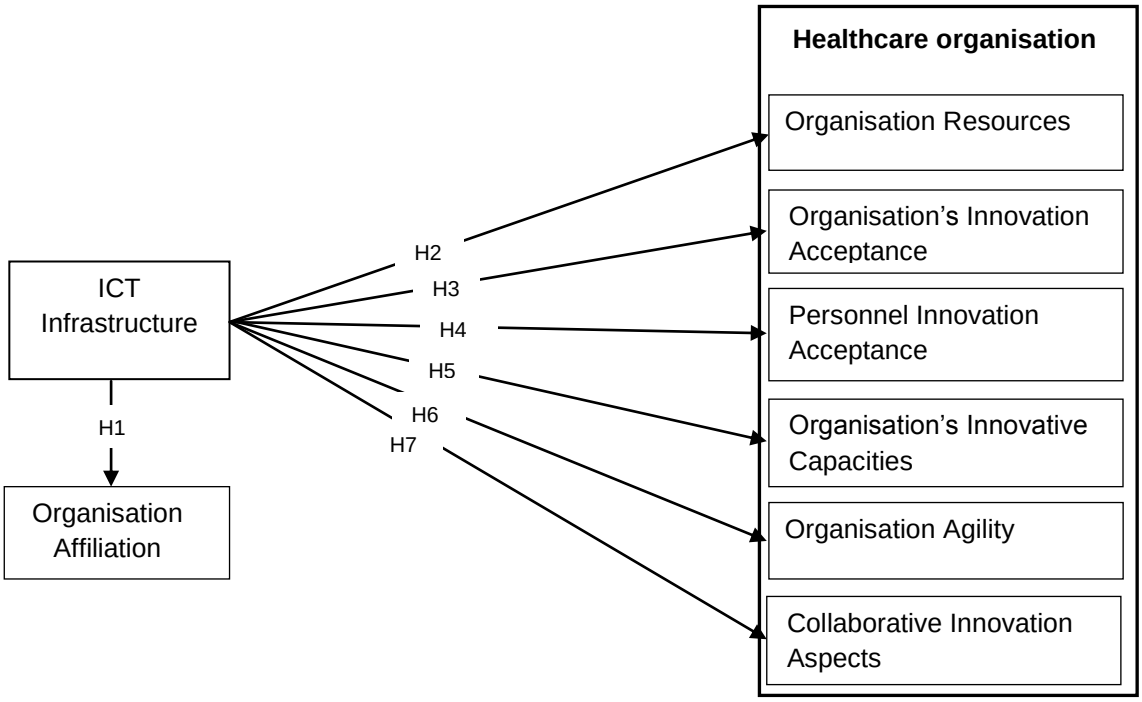


Figure 3.2: Hypotheses relating to ICT infrastructure

Therefore, it is hypothesised that:

H1: Organisation ICT infrastructure has a positive effect on organisation affiliation.
H2: Organisation ICT infrastructure has a positive effect on organisation resources.
H3: Organisation ICT infrastructure has a positive effect on organisation's innovation acceptance.
H4: Organisation ICT infrastructure has a positive effect on personnel innovation acceptance.

Moreover, evidence presented from previous studies on e-Health revealed that use of ICT facilitated the innovativeness of healthcare organisations (Perez et al., 2004). It was observed that the significant spread of telemedicine in Ethiopia and South Africa healthcare system is attributed to improved ICT infrastructure (Wamala and Augustine, 2013). Furthermore, a study carried out on organisation's agility (Lu and Ramamurthy, 2011) argued that an organisation's investment in ICT fosters its innovativeness since ICT is generally considered an enabler of organisation's agility.

Additionally, Bi et al. (2013) presented a positive correlation between organisation's investment on ICT and its agility. Similarly, literature highlights that availability and sustainability of ICT is a facilitator to adoption of new healthcare technologies such

as telemedicine (WHO, 1997). Moreover, Herzlinger (2006) argues that ICT has the potential to promote healthcare innovations that connect many islands of information in the healthcare system. Moreover, ICT is related to organisation collaboration to facilitate innovation. Swink (2006) reveals that ICT helps an organisation to overcome organisation barriers when collaborating to develop new technology or services since it facilitates exchange of superior and timely information.

A study by Michaelides et al. (2013) on continuous innovation networks suggested that organisations collaborative innovations relied heavily on internet based technologies. Additionally, Silva et al. (2014) argued that ICT helped firms overcome social, technical and organisation barriers during collaboration process. Furthermore, a study by Zain et al. (2005) on Malaysian organisations presented a positive correlation between ICT technology and the level of expertise of the individual using the technology. Additionally, Ferrer-Roca et al. (2002) argued that the complexity of ICT technology used in e-Health influences the speed of adoption of telemedicine by the healthcare personnel as well as by the organisation. According to Rogers (2003), the complexity of a technology decreases its adoption rate. Results presented by Saigi-Rubio et al. (2014) in a study on the drivers of telemedicine use showed that the ease of use of the telemedicine technology being adopted by an organisation has a positive effect on the rate of adoption by healthcare personnel. Gagnon et al. (2005) argued that like any other information and communication technology, telehealth needs to be perceived as user friendly in order to be adopted in practice.

Therefore, it is hypothesised that:

H5: Organisation ICT infrastructure has a positive effect on organisation's innovative capacities.
H6: Organisation ICT infrastructure has a positive effect on organisation agility.
H7: Organisation ICT infrastructure has a positive effect on collaborative innovation aspects.

3.3.1.2 Organisation affiliation

Extant literature highlights the impacts of organisations collaboration on organisation resources. Romero and Molina (2011) argue that organisation affiliations enable organisations access a wider pool of resources that induce innovation. This enables them to have the capacity of executing sophisticated innovations that could not be executed by an individual organisation (Sorensen and Torfing, 2012). According to Goes and Park (1997), organisations cannot internally generate all the resources needed for innovation. Michaelides et al. (2013) argue that organisation collaboration enable sharing of resources, reciprocity of information, engaging with experts of different knowledge sets and capabilities as well as enhancement of collective knowledge. Cresswell and Sheikh (2013) claims that technological innovations in healthcare require expertise. According to Cohen and Levinthal (1994), organisation collaboration enables working with expertise who know more precisely what additional information will be required to be able to exploit effectively any new advances that may materialise and also know better where and how to find that information. Furthermore, improving the innovation capacity of an organisation is dependent on various factors including continuous availability of innovation resources (Szeto, 2000). Figure 3.3 shows the hypotheses relating to organisation affiliation.

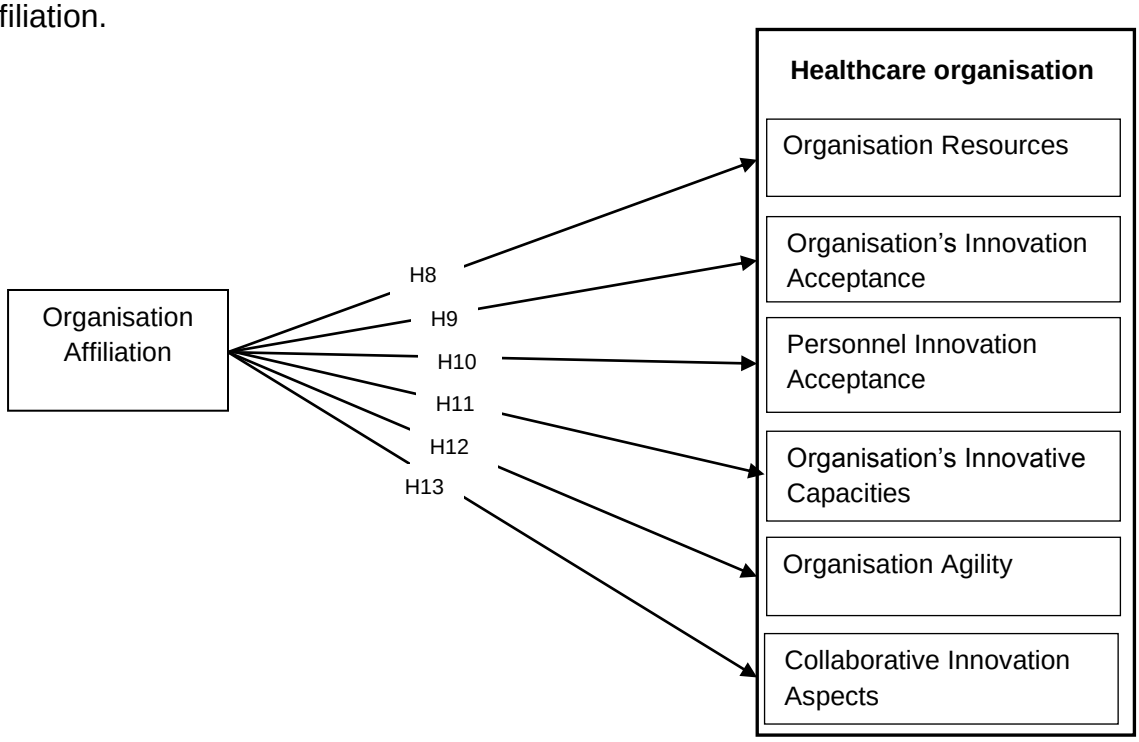


Figure 3.3: Hypotheses relating to organisation affiliation

Therefore, it is hypothesised that:

H8: Organisation affiliation has a positive effect on organisation resources.

Moreover, Carpenter et al. (2011) highlighted that organisation affiliations are associated with accelerated innovation diffusion within the adopting organisations. According to Goes and Park (1997), individual organisations often lack the competence to identify viable innovative projects as well as the fear of risks associated with innovations. From an organisation perspective, Nonaka and Takeuchi (1995) argue that information received from several organisations is stored as knowledge base for a single organisation. Additionally, the adoption of innovation by an organisation is also influenced by affiliations with professional organisations (Damanpour and Schneider, 2009; Chor et al., 2014).

Therefore, it is hypothesised that:

H9: Organisation affiliation has a positive effect on organisation's innovation acceptance.

In a study on organisation collaboration in public sector, Sorensen and Torfing (2012) argued that organisation collaboration promotes trust amongst the actors, generation of creative ideas as well as formation of joint ownership projects. Furthermore, teams' cohesiveness is increased as well as empowering individuals thus increasing the responsiveness of respective teams (Patel et al., 2012). Additionally, a study from an organisation perspective (Lee et al., 2012[b]) shows that organisations collaboration create shared values for its entire workforce. Moreover, differing power and thoughts from various actors has an impact on the interaction among the collaborators thus influencing the decision making process as well as the overall performance of the actors (Patel et al., 2012).

Therefore, it is hypothesised that:

H10: Organisation affiliation has a positive effect on personnel innovation acceptance.

Several studies have highlighted the importance of organisation affiliation in facilitating technological innovation. A study conducted by Picard and Rabelo (2010)

on how organisations can leverage their engagement in collaborative networks pointed out that one goal of organisation collaboration is to increase the innovative capacity of an organisation. Szeto (2000) defines innovation capacity as a constant improvement of the overall capability of an organisation to innovate. According to Romero and Molina (2011), organisation collaboration allows organisations access new knowledge and share risks. In a study on the effects of organisations affiliations on its behaviour, Beckman (2006) theorised that members who have worked at different organisations have unique ideas that encourage exploration or exploitation behaviour.

According to Katila and Ahuja (2002), exploration behaviour involves radical innovation, experimentation, broad search, frequent change, and technological discoveries whereas exploitation behaviour involves incremental innovation, implementation, refinement, routinisation, local search, and efficiency. Similarly, organisations' focussing on collaboration are claimed to maintain continuity in adopting new technologies (Durugbo and Riedel, 2013). Furthermore, Goes and Park (1997) argues that organisation collaboration enhances the innovative capabilities of organisations by providing opportunities for shared learning, transfer of technical knowledge, legitimacy and resource exchange. According to Bommert (2010), employees with different professional backgrounds generate new ideas thus increasing the technological responsiveness of an organisation.

Moreover, Dario et al. (2004) found that organisation collaboration is needed for the smooth implementation of telemedicine. Mitchell (1999) highlighted the lack of organisations partnership as one of the major barriers to uneven adoption of telemedicine in Australia. According to Singapore healthcare projects (2014), organisations partnership has fostered high level of telemedicine activities in Singapore. Furthermore, Androuchko and Nakajima (2004) argue that implementation of e-Health services requires multidisciplinary collaboration with the active participation of various healthcare professionals.

Salampasis et al. (2014) argues that organisation collaboration in innovation plays a vital role especially in fields where technology shows rapid development. Furthermore, it is argued that an organisation may not have all the skills and

competences needed to innovate so as to remain in competition as a solo player or as a lonely driver.

Therefore, these observations lead to the following hypotheses:

H11: Organisation affiliation has a positive effect on organisation's innovative capacities.
H12: Organisation affiliation has a positive effect on organisation agility.
H13: Organisation affiliation has a positive effect on organisation collaborative innovation.

3.3.1.3 Patient telemedicine adoption

Technology acceptance is a measure of the positive influence that an object has on its recipient. According to Davis (1986), a technology that is perceived as easy to use is more easily accepted by its users. For many telemedicine applications, the healthcare personnel claims that patients make their perceptions and satisfaction an important consideration on hospital decisions to adopt telemedicine technology (Menachemi et al., 2004). On the other hand, it is argued that patient's lack of information and training on telemedicine technology hinders the speed of its adoption by the adopting organisation (WHO, 1997).

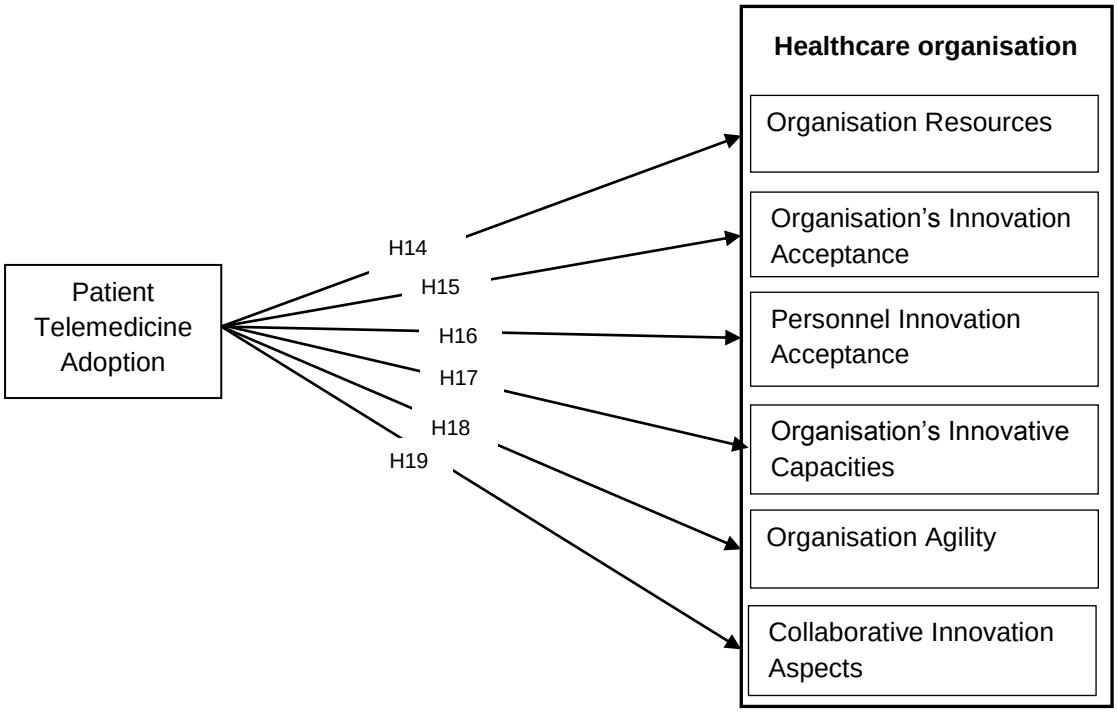


Figure 3.4: Hypotheses relating to patient telemedicine adoption

Additionally, the perception about a technology by the adopters has been claimed to influence the willingness of the users to accept it. According to Stanberry (2001), protecting patient privacy, making sure that patients are sufficiently well informed about their treatment to provide valid consent and ensuring that clinicians conform to appropriate standards of care is an ethical concern influencing telemedicine deployment.

Furthermore, in a study on technology acceptance in Malaysia (Zain et al., 2005), it was observed that a technology that is perceived as useful and easy to use by the end users is easily adopted. This was claimed to increase the agility of an organisation.

Therefore, it is hypothesised that:

H14: Patient telemedicine adoption has a positive effect on organisation resources.
H15: Patient telemedicine adoption has a positive effect on organisation's innovation acceptance.
H16: Patient telemedicine adoption has a positive effect on personnel innovation acceptance.
H17: Patient telemedicine adoption has a positive effect on organisation's innovative capacities.
H18: Patient telemedicine adoption has a positive effect on organisation agility.
H19: Patient telemedicine adoption has a positive effect on collaborative innovation aspects.

3.3.2 Hypotheses relating to the influence of healthcare organisation factors on telemedicine collaborative innovation outcomes

This sub-section will focus on developing hypotheses relating to the influence of healthcare organisation factors on telemedicine collaborative innovation outcomes. Telemedicine collaborative innovation outcomes are examined in two dimensions: internal innovation outcomes and external innovation outcomes. The internal innovation outcomes are the operational benefits achieved within the healthcare organisation. External innovation outcomes are benefits achieved in delivering healthcare services to the public. In a study on the adoption of electronic health records (Ford et al., 2006), internal innovation effects are termed as effects

influencing the potential adopters operations within an organisation whereas external innovation effects influence the operations delivered outside the organisation. Item seven and eight of the questionnaire (see Appendix A) aims to measure the internal and external innovation outcomes respectively.

3.3.2.1 Organisation resources

According to Ortega (2010), organisation resources are assets that an organisation owns. Barney (1991) classifies organisation resources into three categories; Physical capital resources, human capital resources and organisation capital resources. Physical capital resources include organisation assets, geographic location and raw materials. Human capital resources include manpower, trainings and tacit knowledge. Organisation capital resources include planning and controlling systems as well as organisation relationship with other organisations. A study by Perez et al. (2004) on adoption of teleworking technology in an organisation identified availability of resources such as human, funds and technology influence the rate of adoption of a new technology.

Furthermore, Lee and Xia (2006) confirmed that small organisations suffer resource poverty resulting in more barriers to innovation adoption when compared to large organisations whose resources are diverse. Extant literature has also examined the effects of availability of resources to radical and incremental innovations. According to Camison and Villar (2014), only organisations with certain resources are able to achieve superior performance. Similarly, Lee et al. (2012[b]) argue that working with various partners' increases organisation's resources as well as new ways to find innovative ideas and solutions. Likewise, IT-enabled organisation resources also may be linked with impro*ved* operational performance of an organisation (Nevo and Wade, 2011; Chen, 2012). If an organisation has improved operational performance, there is the potential to achieve its strategic objectives (Peteraf and Barney, 2003)

Damanpour and Gopalakrishnan (1998) acknowledged that favourable organisation resources facilitate radical and incremental innovations. According to a study by Kazakci et al. (2008) on organisation collaboration, it was suggested that intensive innovation may require organisations to collaborate so as to increase access to external resources to be used in innovation. In a study on spreading and sustaining

innovations in health service delivery, Greenhalgh et al. (2008) argued that healthcare innovations with dedicated resources are likely to be successful. Moreover, Wootton et al. (2005) found that availability of suitable resources such as technology and human facilitates the adoption and sustaining of telemedicine projects. Additionally, organisations are engaging in new forms of highly collaborative mechanisms and networked structures capable of providing a competitive advantage by combining the best skills or core competencies and resources of two or more organisations (Romero and Molina, 2011). Figure 3.5 show hypotheses relating to organisation resources.

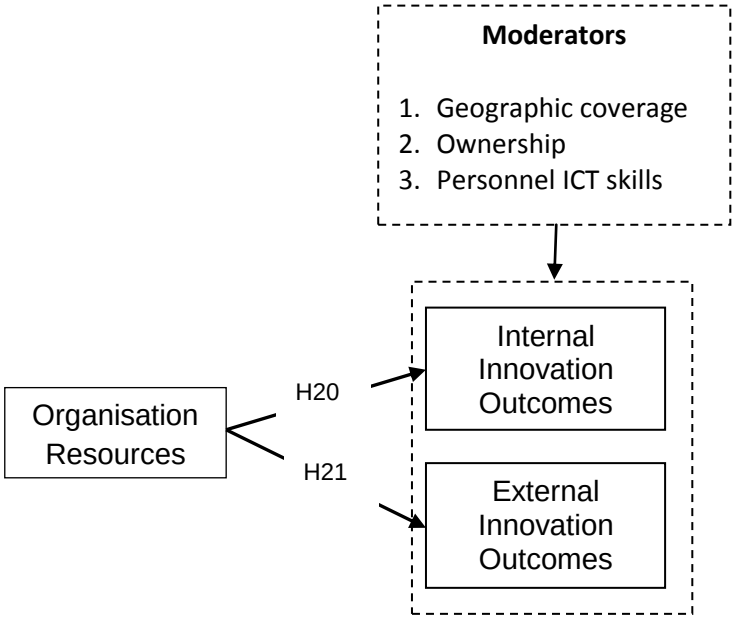


Figure 3.5: Hypotheses relating to organisation resources

Therefore, these study hypotheses that:

H20: Organisation resources have a positive effect on internal innovation outcomes.
H21: Organisation resources have a positive effect on external innovation outcomes.

3.3.2.2 Organisation's innovation acceptance

Agarwal and Prasad (1997) defined technology acceptance as current use of a system and intentions to continue to use the system in the future. According to Jennett et al. (2009), telemedicine implementation will not succeed without widespread acceptance of its applications. However, Dario et al. (2004) argue that organisations ready to use new technologies such as telemedicine have training and

continued professional development plans in place for the personnel. Additionally, organisation's innovation acceptance is linked with organisation performance. Camison and Villar (2014) presented a positive correlation between organisation's innovation acceptance and organisation performance. Rogers (2003) stated that the common problem for many organisations is how to speed up the rate of innovation acceptance within an organisation. Innovation diffusion theory (IDT; Rogers, 2003) pointed out complexity, relative advantage, compatibility, trialability and observability as the attributes influencing the adoption rate of an innovation. Furthermore, organisation technology adoption readiness, information infrastructure, top management support, IT expertise and resource availability influence the acceptance of a technology (Hameed et al., 2012). Similarly, organisation's innovation acceptance increases the innovative capacity of an organisation (Hervas and Sempere, 2015). Figure 3.6 show hypotheses relating to organisation's innovation acceptance.

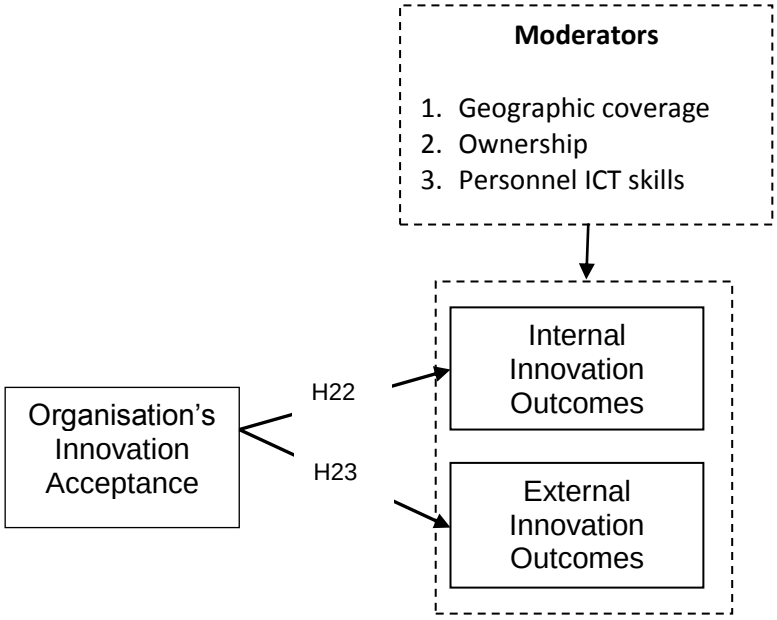


Figure 3.6: Hypotheses relating to organisation's innovation acceptance

Therefore, these study hypotheses that:

H22: Organisation's innovation acceptance has a positive effect on its internal innovation outcomes.

H23: Organisation's innovation acceptance has a positive effect on its external innovation outcomes.

3.3.2.3 Personnel innovation acceptance

Organisation's personnel play an important role in influencing the adoption and diffusion of an innovation. In a study on organisation readiness by Jennett et al. (2009), it was argued that technology end users must be considered before implementing new technologies. Successful routinisation of an innovation in an organisation depends on the motivation, capacity, and competence of individual end users (Greenhalgh et al., 2008). Although organisation innovations are useful to both individuals and organisation processes (Cresswell and Sheikh, 2013), the end users have a great impact on the overall adoption level of new innovations (Boonstra and Broekhuis, 2010). According to Venkatesh et al. (2003), innovation performance expectancy by the users is strongest predictor of intention to use a new technology. Figure 3.7 show hypotheses relating to personnel innovation acceptance.

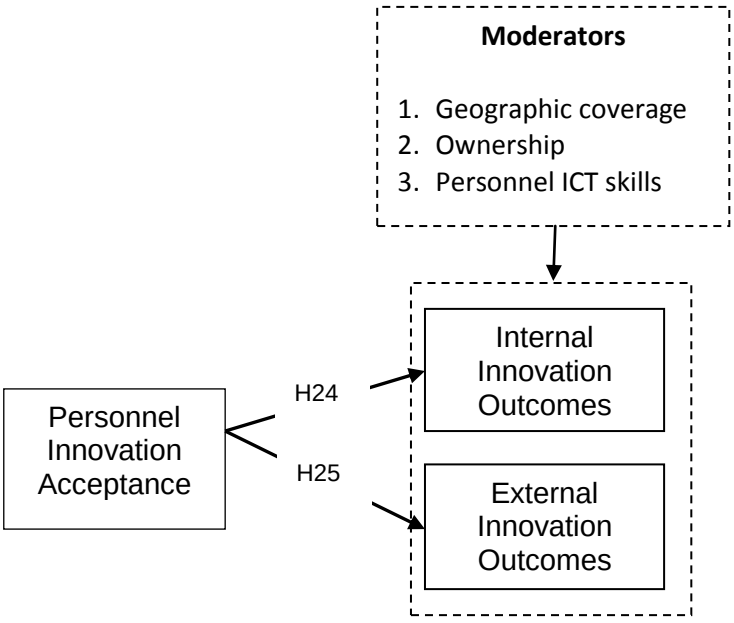


Figure 3.7: Hypotheses relating to personnel innovation acceptance

Therefore, it is hypothesised that:

H24 Organisation's personnel innovation acceptance has a positive effect on its internal innovation outcomes.

H25: Organisation's personnel innovation acceptance has a positive effect on its external innovation outcomes.

3.3.2.4 Organisation's innovative capacities

Szeto (2000) defines innovation capacity as a continuous improvement of the overall capability of an organisation to generate innovation for developing new products and services to meet market needs. In a study on healthcare innovations, Thakur et al. (2012) highlights various benefits of healthcare innovations. Minimising of error rate that is due to complex interactions between healthcare stakeholders and lowering the costs of healthcare services are some of the highlighted benefits. Further, Hjelm (2005) reported that adoption of telemedicine increased communication between health professionals whereas Dario et al. (2004) claims that telemedicine will increase access to healthcare records. Furthermore, Camison and Villa (2014) present a positive correlation between organisations technological innovative capabilities and its overall performance. Figure 3.8 show hypotheses relating to organisation's innovative capacities.

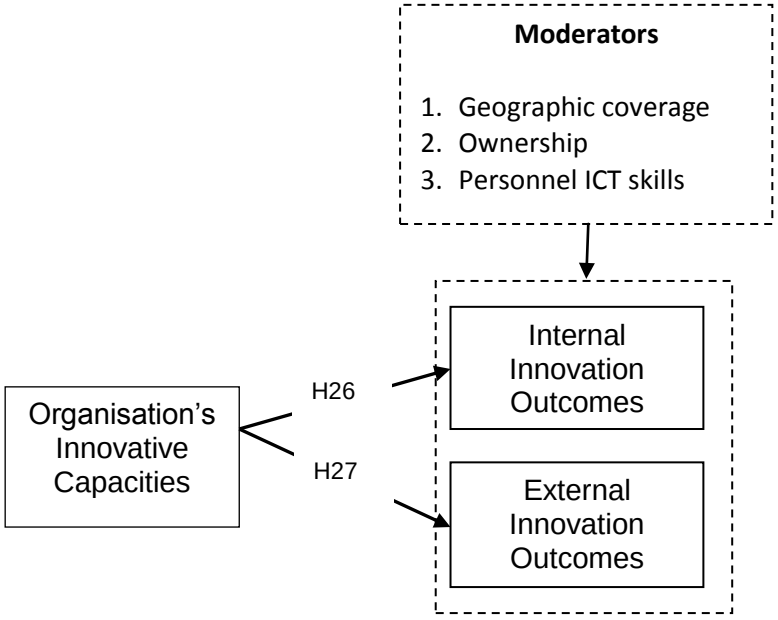


Figure 3.8: Hypotheses relating to organisation's innovative capacities

Therefore, it is hypothesised that:

H26: Organisation's innovative capacities have a positive effect on its internal innovation outcomes.

H27: Organisation's innovative capacities have a positive effect on its external innovation outcomes.

3.3.2.5 Organisation agility

Lu and Ramamurthy (2011) identified organisation agility as organisation's ability to deal with changes that often arise unexpectedly through rapid and innovative responses that exploit changes as opportunities to grow and prosper. According to Yeganegi and Azar (2012), agility is viewed from four perspectives namely: speed, responsiveness, competency and flexibility. Empirically, Chakravarty et al. (2013) found that organisation agility is positively related to organisation's performance. Figure 3.9 show hypotheses relating to organisation agility.

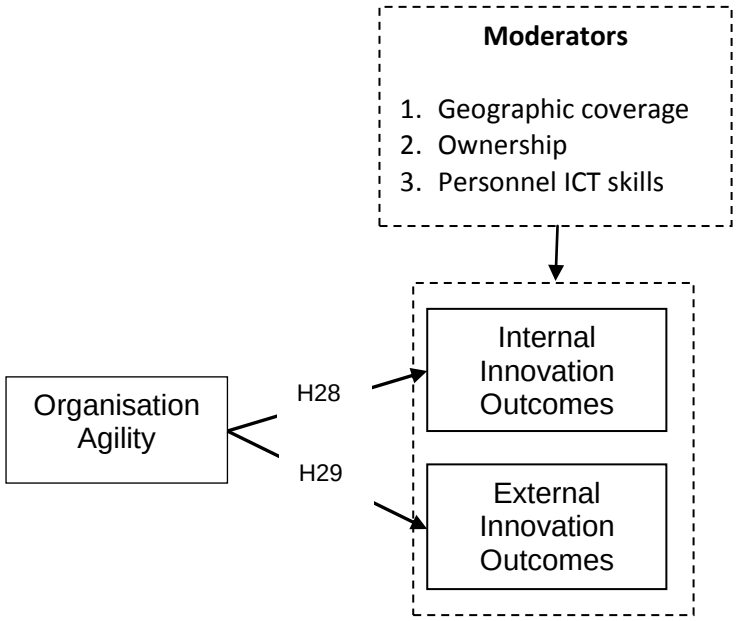


Figure 3.9: Hypotheses relating to organisation's agility

Therefore, it is hypothesised that:

H28: Organisation's agility has a positive effect on its internal innovation outcomes.
H29: Organisation's agility has a positive effect on its external innovation outcomes.

3.3.2.6 Organisation collaborative innovation aspects

Organisation collaboration is defined as collaboration that necessitates partnership among various actors, levels or segments (Royer and Bijman, 2009). According to Picard and Rabelo (2010), one goal of organisation collaboration is to facilitate innovation. Various organisation collaboration scholars have reported that collaboration leads to sharing expertise, reduction of organisation costs through

sharing best practices, improved decision making through sharing insights and knowledge, innovation through sharing ideas and an improved ability to pursue goals (Bossink, 2002; Lansisalmi et al., 2006; D'Amour et al., 2008; Romero and Molina, 2011; Patel et al., 2012).

Similarly, Ansell and Torfing (2014) argue that collaborative innovation is suitable for public sector since it opens innovation cycle to various actors and taps innovation resources across borders. Furthermore, Dario et al. (2004) claims that healthcare researchers, public organisations officials and private organisations officials must collaborate on a range of activities to facilitate telemedicine deployment. According to Torchia et al. (2015), organisation partnerships offer innovative methods with a good chance of producing the desired outcomes since each organisation contributes what it most has to offer. Figure 3.10 show hypotheses relating to organisation's collaborative innovation aspects.

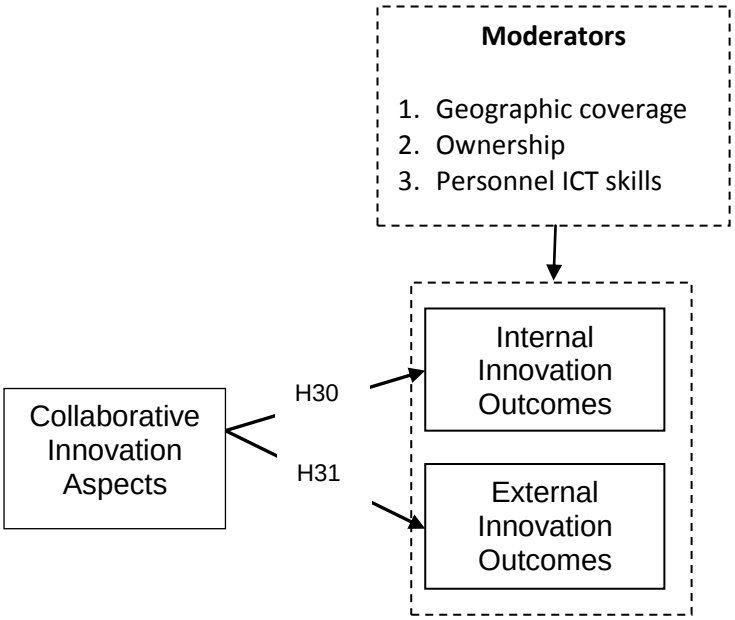


Figure 3.10: Hypotheses relating to collaborative innovation aspects

Therefore, it is hypothesised that:

H30: Organisation's collaborative innovation aspects have a positive effect on its internal innovation outcomes.

H31: Organisation's collaborative innovation aspects have a positive effect on its external innovation outcomes.

The researcher further carried out an exploratory study in Kenya and UK to examine the importance of organisation collaboration in reference to healthcare technology innovation deployment. The factors elicited from the exploratory study using repertory grid are presented in Chapter 4.

3.4 Chapter summary

In this chapter, the conceptual framework of this research was developed where framework factors were extracted from extant literature related to technology adoption and organisation collaboration. The framework is composed of three sections which include: precursors (ICT infrastructure, organisation affiliation and patient telemedicine adoption), healthcare organisation factors (resources, organisation's innovation acceptance, personnel innovation acceptance, organisation's innovative capacities, organisation agility and collaborative innovation aspects) and the telemedicine collaborative innovation outcomes. Also, research hypotheses were stated and will be tested later in Chapter 6.

In the next chapter, different approaches used for carrying out research will be examined and compared so as to identify the appropriate approach for this study. Additionally, approach to data collection which include exploratory study, questionnaire design, pilot study and main field study will be covered.

Chapter Four: Research methodology

4.1 Introduction

The primary focus of this chapter is to discuss the research methods employed in this research. Research paradigm inherent in organisation collaboration research as well as telemedicine will be identified. Also, the design and distribution of the questionnaires used in this research will be discussed. The chapter further covers the ethical considerations prior to conducting the field research. Additionally, the process involved in conducting the exploratory study, pilot study and main field study is discussed.

4.2 Research paradigms

Collis and Hussey (2013) defines research paradigm as a framework that guides how research should be conducted based on people's philosophies and their assumptions about the world and nature of knowledge. According to Hussey and Hussey (1997), a paradigm provides a framework that includes an accepted set of theories, methods and ways of defining data. Saunders et al. (2012) identifies positivism and interpretivism as the two research paradigms that a researcher can select in order to guide a particular research.

4.2.1 Positivism versus interpretivism

According to Orlikowski and Baroudi (1991), positivism involves drawing inferences about a phenomenon from a population sample, quantifying measures of variables and hypotheses testing. Hair et al. (2010) claims that positivism studies mainly use structured quantitative approaches such as questionnaires and experiments. Myers and Avison (2002) argue that positivism studies can combine quantitative and qualitative approaches with quantitative dominating. Additionally, positivism advocates the application of natural science methods in a study (Bryman and Bell, 2015).

Interpretivism studies assume that people create and associate their own subjective and intersubjective meanings as they interact with the world around them (Orlikowski and Baroudi, 1991). According to Collis and Hussey (2013), interpretivism studies

develop theories to understand phenomena. Positivism research uses a deductive approach that involves developing a conceptual structure that is investigated empirically. Deductive approach is mainly used in quantitative researches. On the other hand, interpretivism research uses an inductive approach to develop a theory from an observation. Interpretivism approach is mainly used in qualitative researches (Saunders et al, 2012). Table 4.1 presents a comparison between positivism versus interpretivism research approach.

Table 4.1: Comparison between positivism versus interpretivism (Collis and Hussey, 2013)

Positivism	*Interpretivism*
Uses large data sample	Uses small data sample
Concerned with hypotheses testing	Concerned with generating theories
Generates precise quantitative data	Generates rich qualitative data
Allow results to be generalised from the samples to the population	Allow results to be generalised from one setting to another similar setting
Objective point of view	Subjective point of view
Deductive approach	Inductive approach

Therefore, this research adopted positivism paradigm because the researcher wanted to get the respondents opinion on the role of collaborative innovation in telemedicine deployment and to generalise the results to the wider population. To meet the conditions of positivism paradigm, a conceptual framework was developed using extant literature, hypotheses were formulated, questionnaires were used to gather information from a data sample of 177 respondents and the hypotheses developed were tested using SPSS version 20 statistical software.

4.2.2 Quantitative, qualitative and mixed methods

Creswell (2013) classifies research methods into three categories namely: quantitative, qualitative and mixed methods. *"Quantitative research refers to testing objective theories by examining the relationship among variables which are further measured on instruments so that the data can be statistically analysed"* (Creswell, 2013). Additionally, the researcher has substantial amount of literature available at the start of a study to provide direction for research questions or hypotheses (Creswell, 2013). According to Myers and Avison (2002), quantitative research

methods were originally developed in natural sciences to study natural phenomena. Examples of quantitative data collection approaches include use of questionnaires and experimental measurements.

On the other hand, Creswell (2013) defines qualitative research as *"an approach for exploring and understanding the meaning individuals or groups ascribe to a social or human problem".* According to Myers and Avison (2002), qualitative methods were developed in social sciences to enable the researcher to study social and cultural phenomena. Examples of qualitative data collection approaches include interviews, case studies, focus groups and observations.

Furthermore, quantitative and qualitative research method can be integrated in one study. This study uses mixed research method. Johnson et al. (2007) broadly defines mixed research method as *"a type of research in which a researcher integrates aspects of qualitative and quantitative research methods for the broad purposes of breadth and depth of understanding".* Mixed research method can either be purely mixed where both quantitative and qualitative methods have equal input to the research, have a dominant quantitative approach (QUAN + qual research) or have a dominant qualitative approach (QUAL + quan research) (Johnson et al., 2007).

According to Creswell (2013), a researcher may start with qualitative research method if the field of study has not been explored much in the extant literature. In this research, the researcher developed some of the quantitative measures from a qualitative data because the researcher wanted to gather more information on those measures to represent the population being studied. In addition, the topic collaborative innovation in healthcare sector is not well developed in the extant literature hence the need to get a clearer understanding from the population being studied. Table 4.2 presents a comparison between quantitative, qualitative and mixed research methods.

Table 4.2: Comparison between quantitative, qualitative and mixed research method (Creswell, 2013)

Quantitative	*Qualitative*	*Mixed*
Large data sample	Small data sample	Either large or small data sample
Associated with scientific research	Associated with social and cultural research	Associated with both scientific and social or cultural research
Tests hypotheses	Explores new occurrences	Tests hypotheses and explores new occurrences
Statistical analyses	Text and image analyses	Statistical and text and image analyses
Closed ended questions	Open ended questions	Both closed and open ended questions

Furthermore, Yin (2013) identifies mixed research method as an approach that collects richer and stronger arrays of information that may be difficult to collect by a single research approach.

4.3 Research paradigm adopted for this research

Identifying the appropriate research approach to be used in a study is a fundamental task for every researcher (Collis and Hussey, 2013). The aim of this research is to understand how Kenyan healthcare organisations collaboration can influence the adoption of telemedicine. In order to get an overall picture of the research focus and get the results generalised, collecting data from a large sample size is necessary. According to Maxwell (2008), identifying the right paradigm for a study is one of the critical decisions that the researcher will need to make. As highlighted in section 4.1, positivism and interpretivism are the two main paradigms from which a researcher can select in order to guide a particular research. Research paradigm will guide the researcher on how to collect and analyse the field data.

After considering the two research paradigms, positivism paradigm was adopted for this research where mixed research method was used where quantitative method was dominant (QUAN + qual research). Since large numbers of organisations were to be recruited in this study, applying interpretivism paradigm methods such as case study, interviews, focus groups and observations would require large amounts of finances, manpower and time. According to Yin (2013), one of the criterions for identifying a research paradigm is identifying one that will answer the research

questions using the available limited resources. Furthermore, existing literature related to the researcher's field of study can also be used as a guide to identifying the research paradigm appropriate for a study (Maxwell, 2008).

In this study, extant literature on telemedicine and organisation collaboration was examined to identify the appropriate research approach that might be used. The following researchers previously adopted positivist research approach in studies related to this study: Chau and Hu (2002) in a study on the acceptance of telemedicine by healthcare practitioners, Kifle et al. (2008) in a study on telemedicine transfer model for sub-Saharan Africa, Saigi-Rubio et al. (2014) in a study on drivers of telemedicine use, Mengesha et al. (2014) in a study on telemedicine deployment in Ethiopia, Hemmert et al. (2014) in a study on university–industry research collaborations, Shiferaw and Zolfo (2012) in a study on the role of ICT in telemedicine projects in Ethiopia, Greenhalgh et al. (2008) in a study on the diffusion of innovations in health service organisation, Westerlund and Rajala (2010) in a study on innovation in inter-organisation network collaboration. Therefore, the researcher also used previous related studies as a guide to identifying the research paradigm to be used in this study.

4.4 Research design

According to Easterby-Smith et al. (1991), organising research activities, selecting the right data collection technique and data analyses technique enable the researcher to achieve the research aim. According to Nachmias and Nachmias (2008), research design is a link between the existing theory, argument and the empirical data collected. As shown in Figure 4.1, three stages were undertaken in this research.

In stage one, exploratory approach was adopted where repertory grid was used for data collection. According to Shields and Rangarajan (2013), exploratory study is carried out to develop working hypotheses when the understanding of the topic under study is not well established. In this study, exploratory study was carried out for organisation collaborative innovation aspects where the researcher wanted to learn more on why healthcare organisations collaborate.

In stage two, empirical data gathered from stage one as well as from the extant literature was used to develop a conceptual framework for this research. The developed framework was presented at Cranfield University, UK doctoral symposium where experienced scholars in the field of organisation collaboration and innovation gave some feedback. One of the feedbacks was to include organisation management system as one of the moderating factors. However, on carrying out the main field study, it was observed that the management of Kenyan private hospital's finances is decentralised and the management of Kenyan public hospital's finances is centralised. Therefore, organisation ownership also explained organisation management system. Questionnaire was developed by extracting factors from the exploratory study as well as factors from extant literature in the area of telemedicine, technology innovation and collaborative innovation. A pilot study was carried out in Kenya where healthcare practitioners were engaged into the study. The results were presented at a Brunel University research seminar to obtain feedback from academics within the field. The questionnaire was amended and preceded to main field study where 50 healthcare organisations in Eastern Kenya participated in the study. The results were analysed using SPSS.

In stage three, interviews were carried out with five top officials within the Kenya healthcare sector to validate the results of this study.

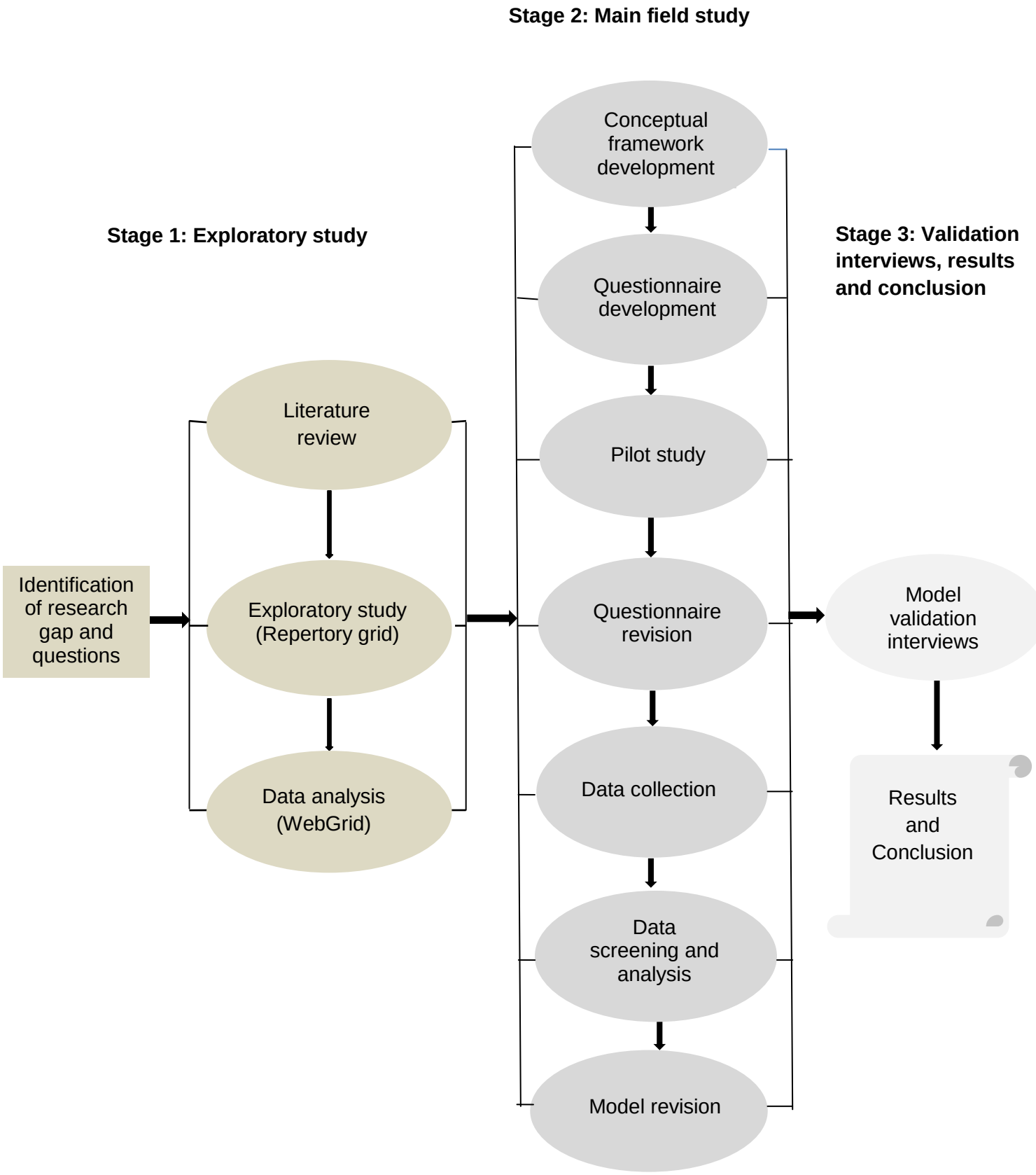


Figure 4.1: Research design used in this study

4.5 Exploratory study

Various scholars claim that ample extant literature on collaborative technological innovations in healthcare sector is lacking (Wootton et al., 2005; Bommert, 2010; LeRouge et al., 2010). According to Shields and Rangarajan (2013), exploratory study is carried out to develop working hypotheses when the understanding of the topic under study is not well established. Therefore, the need to carry out an exploratory study was necessary so as to understand organisation collaboration within the Kenyan healthcare sector. The elicited constructs were used to develop the collaborative innovation aspects section of the questionnaire.

4.5.1 Repertory Grid (RepGrid)

The exploratory phase of the study was carried out using repertory grid software. RepGrid software was originally developed by Dr Mildred Shaw during her PhD studies at Brunel University in 1978. RepGrid software is currently supplied by the Centre for Person-Computer Studies (CPCS) in Canada. According to Burnay et al. (2014), elicitation interviews enable the participant to discuss the topic under study spontaneously thus lowering the chances of missing important information. Repertory grid also known as RepGrids (Shaw, 1980) is an elicitation technique devised by an American clinical psychologist George Kelly in 1955 (Kelly, 1955). Jackowicz (2004) defines RepGrid as a set of rating scales which uses individual's own constructs as the subject matter on which ratings are carried out. According to Shaw (1980), it is a matrix of events against abstractions. RepGrids enable structured discussions between the researcher and participant where the participants give their individual meaning of the subject under study without any influence by the researcher (Zuber-Skerritt and Roche, 2004). They enable clarification of tacit knowledge (Jackowicz, 2004). Through laddering which is asking the participant to explain and clarify further the answer given in order to get the finest answer (Crudge and Johnson, 2007), the researcher is able to get detailed clarification of the participant's thoughts on the subject under study (Boyle, 2005; Wright and Cheung, 2007).

RepGrids have previously been used for various studies in various fields. Edward et al. (2009) used repertory grid to research on software engineering, Zuber-Skerritt and Roche (2004) to evaluate the postgraduate supervision, Wright and Cheung

(2007) to learn about managers appraisal experiences and (Frewer et al., 2001) to understand patient's preferences for treatment. According to Edwards et al. (2009), RepGrids can be full, partial or fixed. Table 4.3 presents the difference between the three RepGrids.

Table 4.3: Types of RepGrids

Elements	*Elicited*	Partial RepGrid	Full RepGrid
	Supplied	Fixed RepGrid	Partial RepGrid
		Supplied	*Elicited*
		Constructs	

In this study, partial RepGrids were used. Partial RepGrids (where the interviewee is supplied with only the elements) were preferred since they retain the capability to compare grids based on common items, usually with the objective of creating a consensual grid (Tan and Hunter, 2002; Wright and Cheung, 2007).

4.5.2 Participants selection and construct elicitation

Specific participants with knowledge on their organisation's technological innovation history were selected to take part in the study. The participants were individuals from Kenyan healthcare sector, mainly chief healthcare practitioners and hospital management who have adequate information about the organisation's technological innovations and collaboration history. To carry out the exploratory study, 15 participants were recruited into the study. Each participant was allocated one partial RepGrid which was completed electronically using version 1.03 of Rep 5 software. The RepGrid title (organisation collaboration in healthcare sector) was supplied. The elements used in the study were supplied jointly with the participants. Administrative and non-administrative doctors in Kenyan national hospitals were used to supply the elements to be used across the study. This minimised the risks of omitting some elements (Jankowicz, 2004). The uniformity of the elements across all the participants was to enable the researcher make a meaningful comparison between

the elements (Jankowicz, 2004) as well as enable quantitative statistical analysis (Edwards et al., 2009). Figure 4.2 shows a snapshot of the Rep 5 software which was presented to the participants for elicitation of constructs.

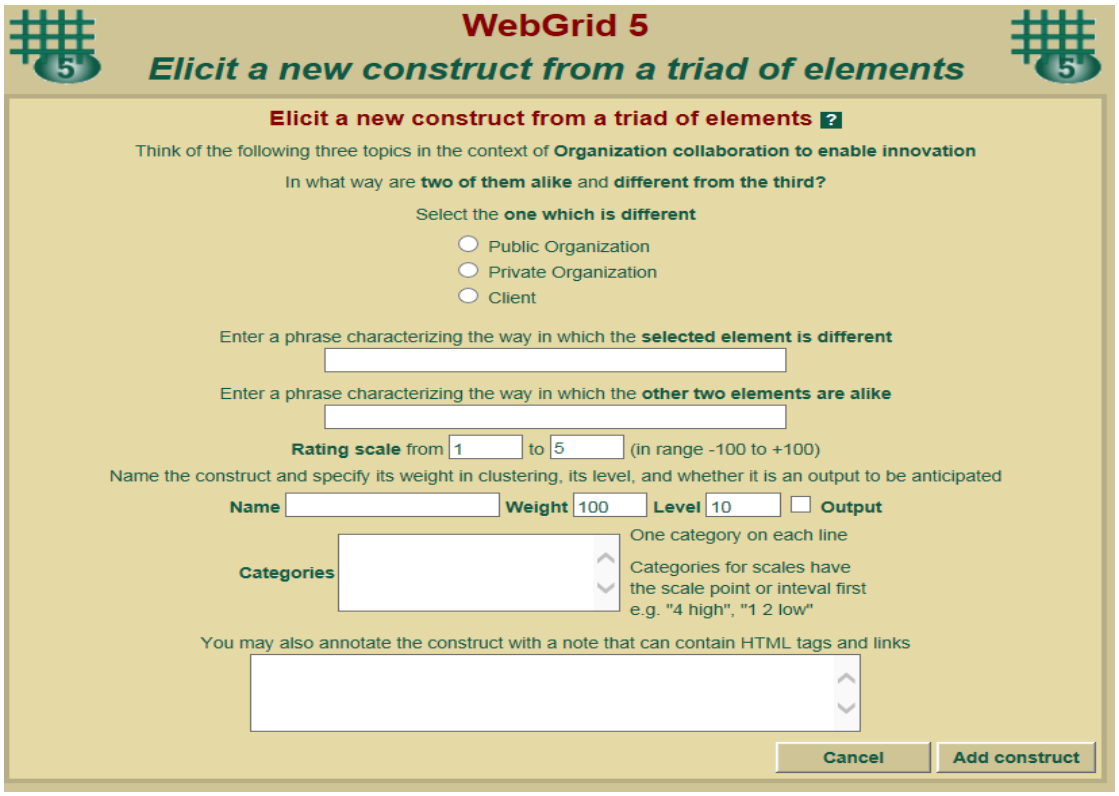


Figure 4.2: A screenshot of RepGrid 5 construct elicitation window

Although the sample size may be considered small in comparison to other data collection methods such as questionnaires and traditional interviews, the data elicited from RepGrids interviews is very rich and insightful (Wright and Cheung, 2007; Siau et al., 2010). A study by Dunn et al. (1987) indicated that saturation point was reached on the tenth interview with all the other interviews adding no new construct. Corbin and Strauss (2008) define saturation in determining a sample size as a point where additional investigation does not contribute to any additional knowledge about the subject under study. Therefore, saturation point was also used to determine the sample size. For this study, saturation point was reached at the 9th interview. Additional elicitations were carried out but generated no additional constructs. Additionally, the participants were given a 5-point Likert scale to rate the constructs developed against the elements. Figure 4.3 presents a matrix of all the five distinctive constructs generated after construct clustering using RepGrid clustering

tool. The elicited constructs were included in the questionnaire as a measure of collaborative innovation aspects.

Figure 4.3: Exploratory study elicited constructs matrix

4.6 Questionnaire design

A questionnaire was designed in order to test the research framework developed by determining which variables are related as far as organisation collaborative innovation is concerned. Use of questionnaires was preferred to other data collection methods such as interviews, case studies and focus groups because of the following reasons:

- Questionnaires have been previously used in numerous organisation technology adoption studies in both developing and developed countries (Hu et al., 1999; Shiferaw and Zolfo, 2012; Dunnebeil et al., 2012; Mengesha et al., 2014; Camison and Villar, 2014; Hemmert et al., 2014)

- Questionnaires are easy to distribute to several locations thus enabling the collection of large amount of data (Bryman and Bell, 2015).

- They are economical especially when dealing with large data samples (Nachmias and Nachmias, 2008).

- They are less time consuming and ideal when collecting information from busy respondents (Mengesha et al., 2014).

The questionnaire used in this study was developed using the extant literature and factors elicited from the exploratory study. The front page of the questionnaire comprised of an information sheet describing the purpose this study and the confidentiality information. Also, a consent form issued by Brunel University was included.

A 5-point Likert scale was used to rate various measures used in the questionnaire. 5-point Likert scale has been previously used in previous studies on healthcare technology innovation (Chau and Hu, 2002; Chismar and Wiley-Patton, 2003; Page, 2014; Hung et al., 2015). Additionally, scales beyond 5-point are claimed to be difficult to use with a 7-point Likert scale being the limit of most people's discriminative power (Edwards et al., 2009). An odd scale was also used to give a neutrality point so as not to enforce preferences (Jackowicz, 2004). A copy of the questionnaire is provided in Appendix A.

4.7 Ethical considerations

According to Silaigwana and Wassenaar (2015), ethical research committees are organisation research bodies mandated to protect the rights, safety, welfare and dignity of research participants by reviewing and approving proposed research especially in the medical field. As for this research, the targeted sample was healthcare practitioners at managerial positions as well as practicing ones. Firstly, an application was submitted to Brunel University research ethics approval committee. The approval was granted by the college. Secondly, since the study was to be conducted in the Eastern region of Kenya, a research approval application was submitted to the Kenyan Eastern region chief medical superintendent and Kenyan National Council for Science, Technology and Innovation (NACOSTI). NACOSTI issues research permits for any technological research intended to be carried out in Kenya. It took 2 weeks for the application to be approved by the chief medical superintendent, Eastern region of Kenya and 1 month to have the research approved by NACOSTI.

The survey package comprised of questionnaire, participant consent form and a cover letter explaining the purpose of the research. The cover letter highlighted the purpose of the study, voluntariness to participate, no competing interest and

anonymity of the participant. Burton (2000) argues that when dealing with ethical considerations, the law allows the participants to protect their ideas prior to publication through the law of confidentiality. Therefore, information regarding the publication of the analysed data on academic materials as well as government's research archives was given although anonymity was assured. All this information was issued to the participants prior to administering the questionnaire.

4.8 Administration and distribution of the questionnaire

Once the questionnaire was designed, it was distributed to healthcare practitioners, mainly the administrative doctors and senior nurses for piloting. Basing on previous related studies, self-administered questionnaires were preferred to internet surveys. Although internet surveys are argued to be cheaper and can cover variety of demographic (Shaughnessy et al., 2011), Bethlehem and Biffignandi (2012) claims that the excellence of online surveys is considered inferior because the participants may be people who are not very committed to providing credible information because of various reasons such as level of education, age and language barrier.

Additionally, not all targeted group has access to internet (Balter et al., 2005). However, self-administered face to face questionnaires are claimed to deliver credible results especially when administered to participants located in several geographic locations (Bryman and Bell, 2015). Furthermore, the researcher is able to get feedback from the specific targeted group (De Rada and Alvarez, 2014; Rowley, 2014). Additionally, previous studies have claimed that the response rate when using self-administered questionnaires is higher than when using web surveys or mail questionnaires (Rogers, 2003; Sax et al., 2003; Duffy et al., 2005; Rowley, 2014). However, Kaplowitz et al. (2004) suggest that advanced notice can increase the response rate from all surveys. Therefore, prior to visit, the targeted respondents were given a phone call with a brief explanation of the research and a confirmation that permission had been granted by the Kenyan national research committee.

4.9 Pilot study

Hulley et al. (2013) defines pilot study as a small study conducted to determine whether a full scale study is feasible and to optimise the logistics to maximise the efficiency of full scale study. According to Bryman and Bell (2015), it is desirable to conduct a pilot study prior to administering questionnaires. Pilot study improves the reliability of the questionnaire (Saunders et al., 2012) as well as demonstrating that the chosen data collection instrument is reliable (Hulley et al., 2013).

In this study, a pilot study was carried out for the whole month of October 2014. 25 questionnaires were distributed to hospital administrators located in the Eastern region of Kenya. The choice of participating healthcare organisations was random thus utilising a comprehensive list of healthcare organisations located in Eastern region of Kenya. However, choosing the list of individual participants within each healthcare organisation chosen was not random because the researcher wanted to get feedback from administrative healthcare practitioners and long-term serving practitioners. Also, getting a comprehensive list of healthcare practitioners in Eastern province was not feasible.

According to Mathieson (2014), conducting a random sample requires the researcher to have access to a comprehensive list or registry of those in the target population. 15 questionnaires were returned giving a response rate of 60%. Additionally, the respondents gave their views on the standard of the questionnaire and areas of improvement. Quoting respondent A: *"The questionnaire is long. It will be ideal if it is shortened so as to take about 10 minutes for completion instead of 17 minutes".* Quoting respondent B: "*Question 4c needs to be simplified. It is difficult to understand the technical terms. Also, the questionnaire is long".* Quoting respondent G: *"Give a brief explanation of abbreviations used".* Quoting respondent J*: "Question 3b and 3e are similar".* Basing on these comments, the questionnaire was amended and later 4 questionnaires were resent to 4 previous respondents who presented some comments for a quick scan. The respondents did not have any problem with the modified version of the questionnaire. The edited version took approximately 10 minutes to complete and was used for the main field study. The final version of the questionnaire is attached in Appendix A.

4.9.1 Pilot study sample profile

The pilot study consisted of 5 hospitals located in the Eastern region of Kenya. 5 questionnaires were issued to each participating hospital totalling 25 questionnaires. At the end of the pilot study, 15 questionnaires were returned giving a response rate of 60%. Table 4.4 show the sample profile of the pilot study.

Table 4.4: Pilot study sample profile

Characteristic		*Frequency*	*%*
Organisation ownership	Private	2	40
	Government	3	60
Geographic coverage	National	1	20
	Provincial	1	20
	County	2	40
	Health centre	1	20
Organisation management system	Decentralised	2	40
	Centralised	3	60
Past collaborative projects	None	1	20
	1 - 3	2	40
	4+	2	40

Additionally, the ICT skill level of the respondent was examined. According to Sheng et al. (2013), the level of ICT knowledge of technology users influences its adoption and diffusion rate. Some respondents reported that their failure to adopt new ICT technologies was greatly influenced by their low level of ICT skills. Furthermore, the management of several healthcare organisations in the survey reported that there is a need to advance the ICT literacy skills for the employees so as to facilitate the uptake of new technologies such as telemedicine. Figure 4.4 presents the respondents ICT skills level categorised in three levels namely: entry, intermediate and advanced level. The ICT skills level categorisation was adopted from Akoojee and Arends (2009) and Garrido et al. (2010).

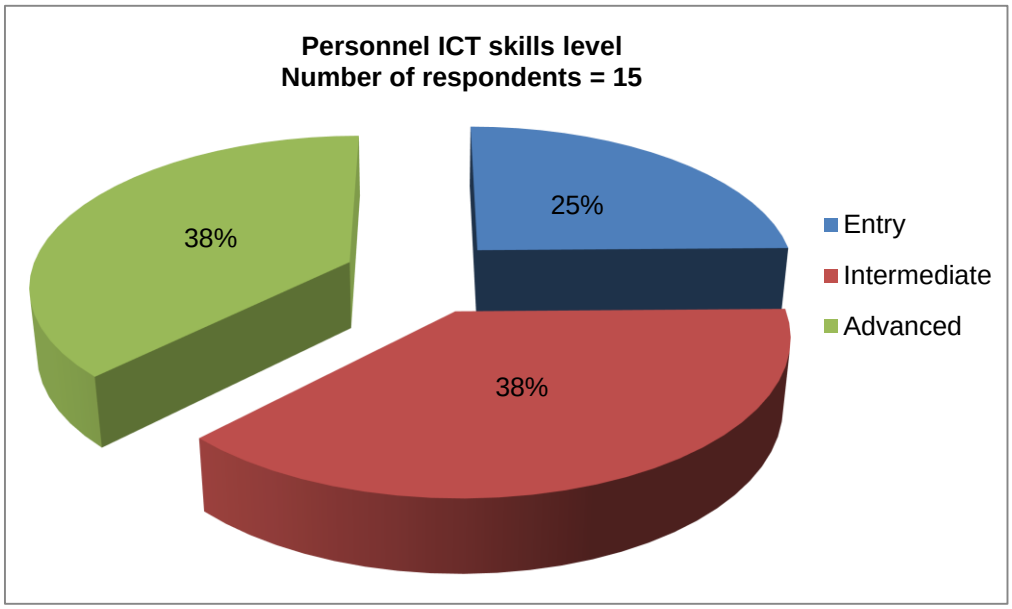


Figure 4.4: Pilot study personnel ICT skills level

4.9.2 Pilot study reliability test

Beside the amendments made basing on the respondents views during the pilot study, reliability test was also carried out to determine the internal consistency of the test items (Nunnally and Bernstein, 1994; Pallant, 2013). Cronbach alpha is the widely used approach for calculating the internal reliability of a test scale. Cronbach alpha was developed by Lee Cronbach in 1951 to provide a measure of the internal consistency of a test and it is expressed as a number between 0 and 1 (Streiner, 2003; Tavakol and Dennick, 2011). Basing on the reliability test results, personnel innovation acceptance did not achieve the recommended threshold value of 0.70 (Pallant, 2013). However, Nunnally and Bernstein (1994) suggest that a value of 0.50 to 0.60 is acceptable for the early stages of research. Therefore, the researcher was satisfied with the current results and progressed to main field study. Also, organisation agility had only one measure. According to Pallant (2013), reliability test is carried out on factors with more than three measures. Table 4.5 presents the reliability test results for the pilot study.

Table 4.5: Reliability test for the pilot study

Test factors	*Cronbach alpha (α)*
ICT Infrastructure (ICT)	.745
Organisation Affiliations (OrgAff)	.722
Patient TM Adoption (PatTmAdp)	.712
Organisation Resources (OrgRes)	.742
Organisation's innovation acceptance (OrgInnAcc)	.713
Personnel Innovation Acceptance (PsnlnnAcc)	.682
Organisation's innovative capacities (OrgInnCap)	.749
Collaborative Innovation aspects (CoInno)	.762
Internal Innovation Outcomes (InOut)	.782
External Innovation Outcomes (ExOut)	.822

4.10 Main field study sample size choice

Field (2013) defines a sample as a smaller (but hopefully representative) collection of units from a population used to determine truths about that population. Additionally, Gill and Johnson (2002) argue that engaging all members of a population in a study is not practical. Collis and Hussey (2013) define a population as a body of people or collection of items under consideration for statistical purposes. In a study on organisation research, Bartlett et al. (2001) argued that inappropriate, inadequate or excessive sample sizes influence the accuracy of a research. Therefore, identifying a reasonable sample size is needed before the survey responses can be used to represent the population as a whole. Bryman and Bell (2015) suggested that there are two categories of sampling techniques namely: probability and non-probability sampling.

Probability sampling involves using random selection to draw subjects from the targeted population where each unit of the population has an equal probability of inclusion in the sample (Bryman and Cramer, 2011). According to Mathieson (2014), conducting a random sample requires the researcher to have access to a comprehensive list or registry of those in the target population which is often impossible or unfeasible. Furthermore, Blumberg et al. (2008) argued that probability sampling is ideal when cost and time are not among the central issues.

Bryman and Bell (2015) refers to non-probability sampling as an umbrella term that captures all forms of sampling that are not conducted according to the canons of probability sampling. Non-probability sampling is preferred when there is lack of access to a comprehensive list or registry of those in the target population (Mathieson, 2014), when targeting specific individuals or organisations (Teddlie and Yu, 2007) as well as when time and money is a constraint (Blumberg et al., 2008). Bryman (2012) classifies non-probability sampling into three categories namely: convenience sampling, snow balling (networking) and quota sampling.

In this research, a sampling frame was developed where snow balling sampling technique was used. A sampling frame is the listing of the targeted population units from which the sample is drawn (Collis and Hussey, 2013). Snowballing or networking is a form of convenience sampling where sample elements are identified by successive respondents within the organisation or target group (Bryman and Bell, 2015). According to Wu et al. (2007), snowballing is appropriate in healthcare sector to minimise the chances of low survey response rates reported in healthcare industry. The provincial medical superintendent suggested that active medical practitioners and administrative medical practitioners based in different hospitals are appropriate for this study. Through snowballing approach, the medical superintendent of hospitals visited referred the researcher to specific medical practitioners to participate in the survey. The managerial position of the superintendent played a role in increasing the response rate of the study.

To determine the sample size, various approaches within the field of organisation research were considered. According to Bryman (2012), larger sample size gives a higher precision. However, Schutt (2014) claims that smaller samples are needed when researchers expect to find very strong relationships among the variables. For this research, sample size determination guide was adopted from organisation research sample size determination by Bartlett et al. (2001) as well as SPSS statistical analyses sample size determination by Pallant (2013) and Tabachnick and Fidell (2013). According to Bartlett et al. (2001), a population of 100 organisations requires a sample size of 50 organisations.

In order to determine the number of respondents required, Nunnally and Bernstein (1994) recommend 10 observations per framework factor. For example, this research

has 11 framework factors therefore, a minimum of 110 observations per every factor is needed. The target group was active medical practitioners and administrative medical practitioners based in Eastern region of Kenya. Self-administered paper questionnaires were given to the participants on the agreed time. A total of 186 questionnaires were distributed to 50 healthcare organisations.

In order to get an accurate perception concerning telemedicine deployment in Kenyan healthcare organisations through organisation collaboration, the researcher employed more than one questionnaire in each organisation. 5 questionnaires were distributed to each national hospital, 5 questionnaires were distributed to each provincial hospital, 3 questionnaires were distributed to each county hospital and 3 questionnaires were distributed to each healthcare centre. National hospitals received a higher number of questionnaires since they are the largest in size (based on geographic coverage), followed by provincial hospitals and county hospitals. Healthcare centres are smallest in size. At the end of the field study, 9 questionnaires were not returned. The remaining 177 questionnaires were confirmed to be usable.

A second approach to recheck the sample size was using SPSS statistical analyses guide since SPSS software package will be used for analyses in this research. According to Pallant (2013) and Tabachnick and Fidell (2013), the following formula is used to calculate the sample size for a data set to qualify for SPSS statistical analyses:

$N > 50 + (8 \times m)$; where m is the number of predictors.

For this study, $N > 50 + (8 \times 6) = 98$…… $N = 177$

4.11 Main field study sample profile

This section presents the demographic characteristics of the 50 healthcare organisations that participated in the survey. 177 respondents who consisted of medical doctors, nurses and administrative medical superintendents participated in the study. The field study was carried out from January 2015 to March 2015. Table 4.6 presents the sample characteristics of the 50 healthcare organisations that participated in the survey.

Table 4.6: Main study sample profile

Characteristic		*Frequency*	*%*
Organisation ownership	Private	21	42
	Government	29	58
Geographic coverage	National	7	14
	Provincial	7	14
	County	20	40
	Health centre	16	32
Organisation management system	Centralised	29	58
	Decentralised	21	42
Past collaborative projects	None	6	12
	1 – 3 projects	35	70
	4+	9	18

Additionally, the ICT skills level of the respondents was examined. According to Sheng et al. (2013), the level of ICT knowledge of technology users influences its adoption and diffusion rate. Some respondents reported that their failure to adopt new ICT technologies was greatly influenced by their low level of ICT skills. Furthermore, the management of several healthcare organisations in the survey reported that there is a need to advance the ICT literacy skills level of their employees so as to facilitate the uptake of new technologies such as telemedicine. Figure 4.5 presents the respondents ICT skills level categorised in three levels namely: entry, intermediate and advanced level.

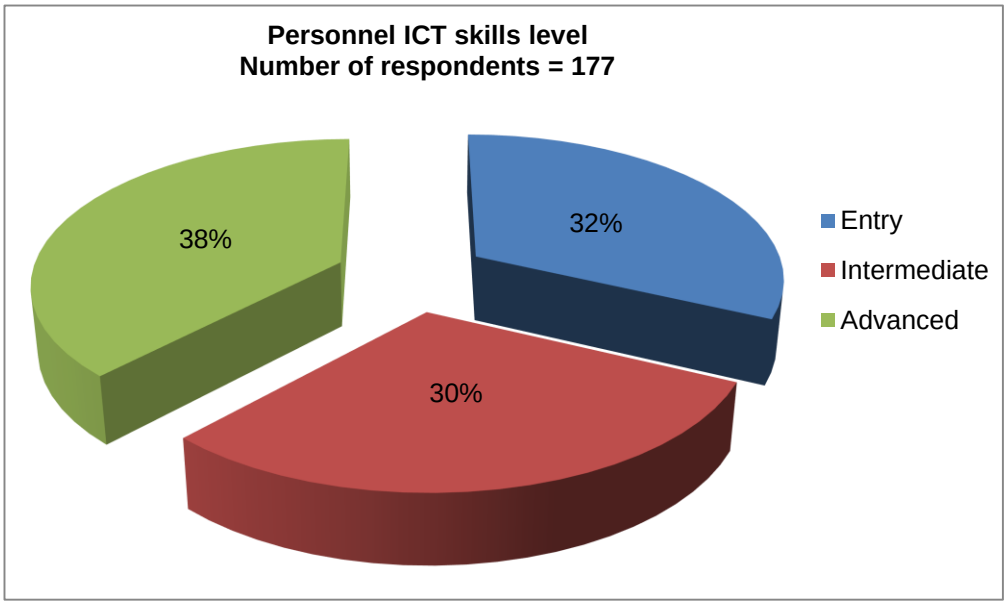


Figure 4.5: Main study personnel ICT skills level

As shown in Figure 4.4, 38% of the respondents (68 respondents) had an advanced level of ICT skills whereas 32% (56 respondents) had entry level of ICT skills. 30% of the respondents (53 respondents) had intermediate level of ICT skills.

4.12 Chapter summary

This chapter focused on the research approach that will be adopted in this study. Different paradigms have been highlighted where positivism paradigm was considered for this research. The choice was made basing on the objectives of this study and the approach used in previous related studies. Additionally, the ethical considerations of this research were presented where the permission to carry out this research was approved by Brunel research committee and Kenyan technological innovation research committee. The exploratory and pilot study results were also discussed.

The next chapter presents the findings of the main study which will include determining the sample size, screening of the survey data and carrying out the statistical analyses which will include ANOVA test, t-test and regressions analysis.

Chapter Five: Surveyed hospitals' characteristics

5.1 Demographic characteristics

In this chapter, the demographic characteristics of the healthcare organisations examined in this study will be examined. The healthcare organisations examined included public and private hospitals whose geographic coverage includes: national, provincial, county and healthcare centres. Data in this research is grouped basing on healthcare organisation geographic coverage (organisation size) and healthcare organisation ownership. The healthcare organisations included in this study are located in the Eastern region of Kenya.

5.1.1 Organisation geographic coverage

According to the Kenyan healthcare system, organisation size is defined by its geographic coverage. Additionally, healthcare organisation bed capacity also defines the organisation size with national hospitals having the largest bed capacity when compared to provincial hospitals and healthcare centres having the least number of beds. Four main categories exist in the Kenyan healthcare system namely: national, provincial, county and healthcare centres. Healthcare centres are local clinics catering for a population of about 15,000 people located within a small region. Figure 5.1 show the distribution of healthcare organisations sampled in this study in terms of their geographic coverage.

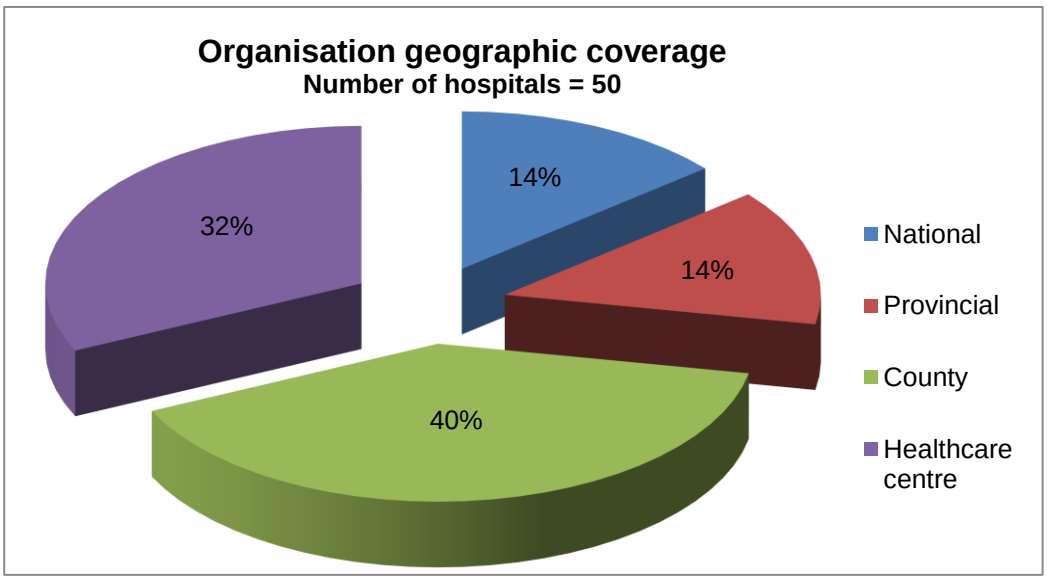


Figure 5.1: Distribution of data based on organisation geographic coverage

Out of the 50 hospitals that took part in the survey, 14% (7 hospitals) are national hospitals, 14% (7 hospitals) are provincial hospitals, 40% (20 hospitals) are county hospital and 32% (16 hospitals) are healthcare centres. According to the Kenyan healthcare system, county level hospitals are the majority in the entire country because they are dedicated to handling less comprehensive medical procedures. Any comprehensive medical procedure is forwarded to provincial or national hospitals which have complex medical equipment and medical specialists.

5.1.2 Organisation ownership

The Kenyan healthcare organisations are owned by the government or private organisations. Private healthcare organisations are owned by: churches, schools, non-governmental organisations, armed forces, companies and individuals. According to Chanyagorn and Kungwannarongkun (2011), private organisations are organisations for private profits and are not controlled by the government. In this study, the targeted healthcare organisations were those located in Eastern region of Kenya. Figure 5.2 present the ownership distribution of the healthcare organisations under this study.

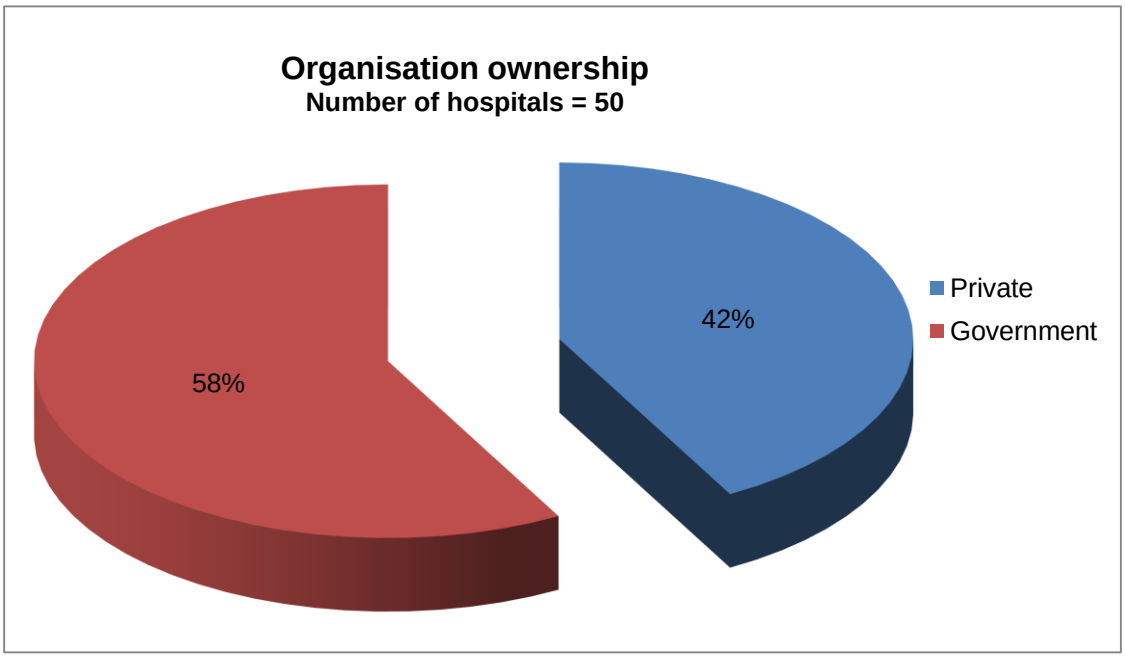


Figure 5.2: Distribution of the data based on organisation ownership

As shown in Figure 5.2, 42% of the surveyed hospitals (21 hospitals) are privately owned whereas 58% of the surveyed hospitals (29 hospitals) are government owned.

The researcher further examined whether a relationship exist between organisation ownership and various organisation factors as presented in the subsequent sections.

5.1.3 Organisation collaborative innovation aspects

Firstly, using the results from the exploratory study (see Figure 4.3), questions were asked to understand why Kenyan organisations would like to get involved in collaborative projects. The respondents were given five main reasons which were highlighted during the exploratory study. A 5-point Likert scale was used to identify why various healthcare organisations collaborate. Scores were dichotomised using SPSS median split. Score dichotomisation is where a variable is split at the median to form high and low groups (MacCallum et al., 2002). Using SPSS median split, it was observed that the median for collaborative innovation aspects is 3. Therefore, scores of 3 and below were counted as 'disagree' and scores of 4 and above were counted as 'agree'. Scores of 4 and above were counted and used to determine why Kenyan healthcare organisations would like to undertake collaborative projects.

What were your objectives for undertaking healthcare collaborative projects?

	Strongly Disagree	***2***	***3***	***4***	***Strongly Agree***
A) Introduce new healthcare technologies.	☐	☐	☐	☐	☐
B) Improve the existing technologies.	☐	☐	☐	☐	☐
C) Solve the problem of innovation budget restraint.	☐	☐	☐	☐	☐
D) Share innovation risks with collaborators.	☐	☐	☐	☐	☐
E) Expand technological knowledge.	☐	☐	☐	☐	☐

As shown in Figure 5.3, the dominant motivating force for getting involved in organisation collaboration is to lessen budget restraints that arise during innovation process. Introducing new technologies was also a prime factor. Several respondents commented, *"technological innovation in healthcare sector requires high levels of capital. Telemedicine technology itself is a very beneficial technology in our country but the cost of implementing it requires a collective effort from various organisations from both government and private sector".*

Additionally, other respondents commented, *"in our organisation, we need a wider pool of individuals with diverse knowledge of emerging healthcare technologies. Although our organisation organises trainings, some knowledge cannot be just acquired through trainings. An extensive interaction with individuals possessing that*

knowledge is very important". Fewer respondents pointed out that the main reason for getting involved in organisation collaboration is to improve the existing technologies. Some respondents commented, *"healthcare technologies are very dynamic. Most of the technologies in the organisation have been in the organisation for over 15 years. By this time, we find that they are obsolete hence no need to renovate them".*

Also, some respondents argued that tacit knowledge in needed to facilitate innovation. *"We highly depend on research institutions and expertise from other organisations to gather external innovative ideas which are later assimilated in our organisation".*

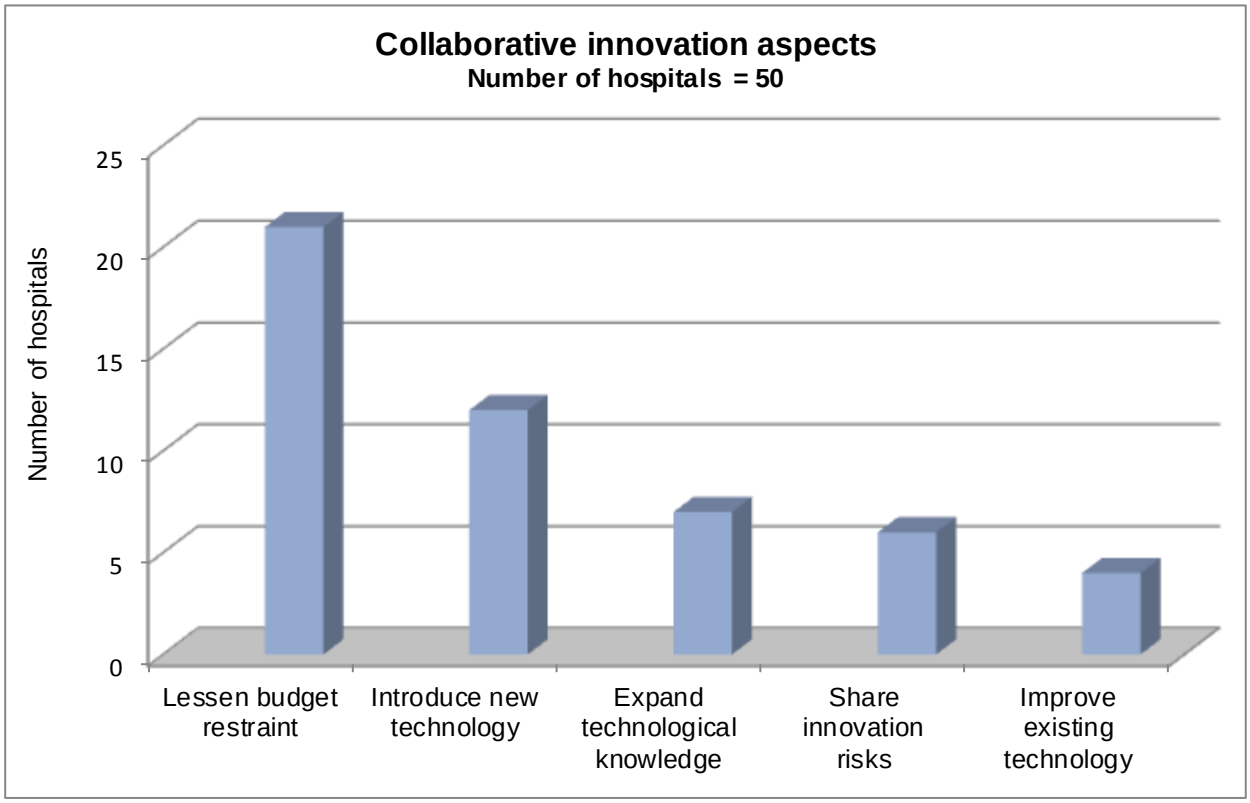


Figure 5.3: Reasons for undertaking collaborative projects

5.1.4 Personnel ICT skills level

The level of ICT knowledge of technology users influences its adoption and diffusion rate (Sheng et al., 2013). During the survey, some respondents reported that their failure to adopt new ICT technologies was greatly influenced by their low level of ICT skills. Furthermore, the management of several healthcare organisations in the survey reported that there is need to advance the ICT literacy skills for the employees so as to facilitate the uptake of new healthcare technologies. Figure 5.4 presents the respondents ICT skills level categorised in three levels: entry, intermediate and advanced level.

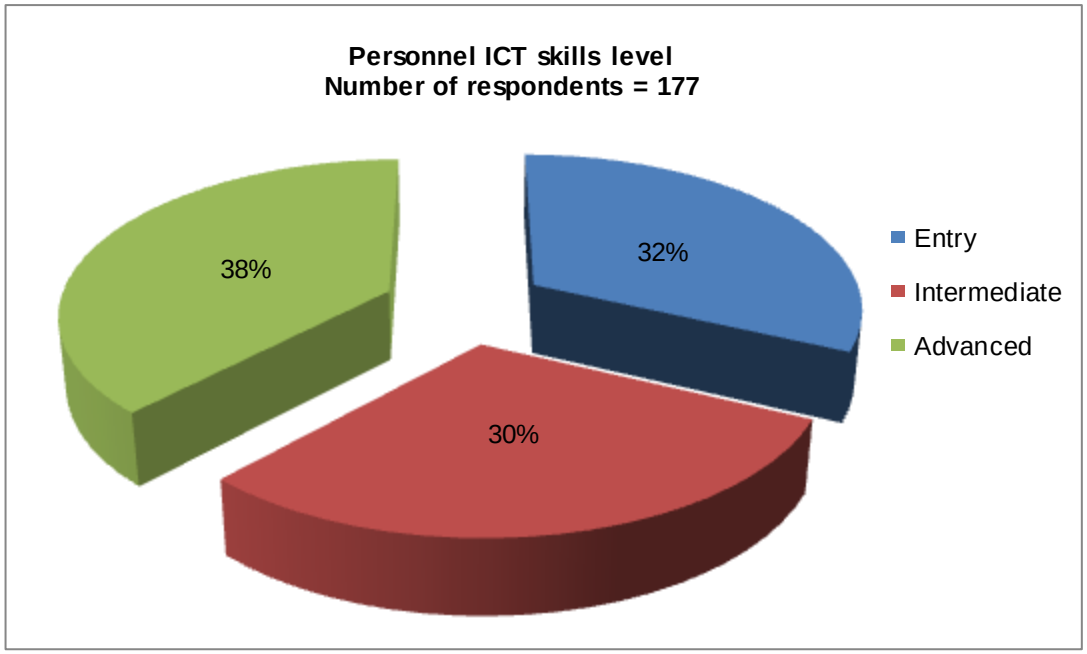


Figure 5.4: Data distribution based on personnel ICT skills level

From the survey, 32% of the respondents (57 respondents) have entry level of ICT skills, 30% (53 respondents) have intermediate level of ICT skills and 38% of the respondents (67 respondents) have advanced level of ICT skills. Furthermore, some respondents highlighted their interest to increase their ICT skills level so as to cope with the drastic changes in healthcare technology.

5.2 Effect of organisation geographic coverage on study factors

5.2.1 ICT infrastructure based on organisation geographic coverage

The relationship existing between organisation geographic coverage (organisation size) and organisation's ICT infrastructure level was also examined. As shown in Figure 5.5, national hospitals were observed to have a well-developed ICT infrastructure when compared to provincial, county and healthcare centres. Healthcare centres were reported to have the least developed ICT infrastructure. On looking at the raw data, 1 healthcare centre was reported to have a well-developed ICT infrastructure. The specific healthcare centre is government owned whose operations are dedicated to the military.

Some respondents commented, *"national hospitals are the largest healthcare organisations in Kenya. As a result, the government has invested a larger amount of its resources in those hospitals".* It was also argued, *"in order for healthcare organisations to work together, a well-developed ICT infrastructure is needed for medical reasons as well as administrative reasons".*

This study is related to previous studies where it was observed that large organisations invest more on ICT because they use ICT systems to a greater extent when compared to small and medium sized organisations (Bloom et al., 2014).

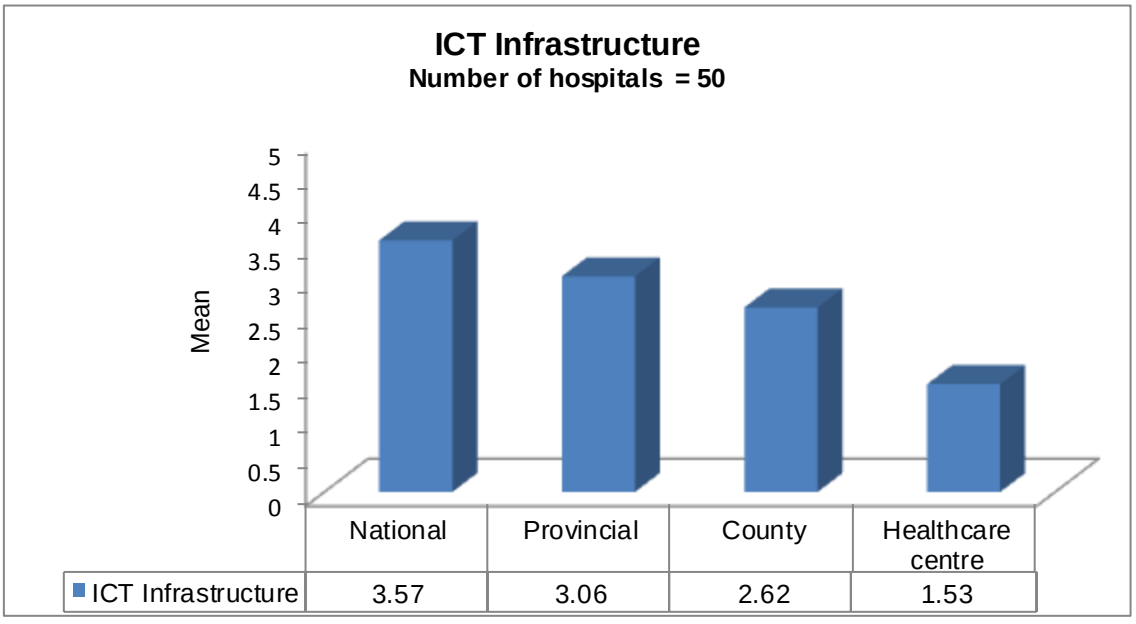


Figure 5.5: Organisation ICT infrastructure based on geographic coverage

5.2.2 Organisation affiliation based on organisation geographic coverage

The researcher also examined the relationship existing between organisation geographic coverage (which also defines organisation size) and organisation affiliation. As shown in Figure 5.6, national hospitals were observed to be more affiliated to other organisations when compared to other healthcare organisations in terms of their geographic coverage.

Some respondents explained, *"when an organisation gets affiliated with another organisation, especially an organisation which has established itself well within the healthcare sector, the chances of adopting new technologies is very high".* However, it was argued that the lack of trust may hinder the level of affiliation especially when involving for profit organisations.

Large organisations have been claimed to be involved in more complex innovations than medium and small size organisations (Mortara et al., 2011). As a result, previous studies have argued that highly collaborative networks are required so as to combine the best skills or core competencies and resources of two or more organisations (Romero and Molina, 2011).

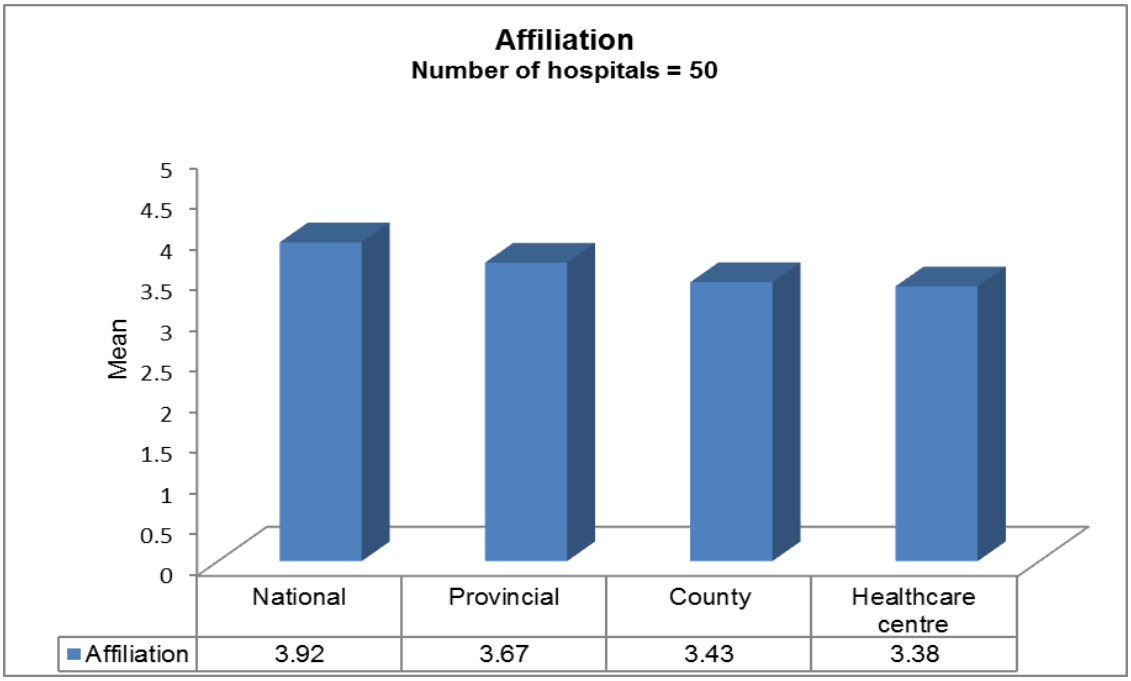


Figure 5.6: Organisation affiliation based on organisation geographic coverage

5.2.3 Organisation resources based on organisation geographic coverage

Additionally, the researcher examined the relationship existing between organisation geographic coverage and organisation resources. As shown in Figure 5.7, national hospitals have more resources compared to provincial, county and healthcare centres. On looking at the raw data collected from the respondents, one healthcare organisation recorded a high level of resources. It was reported that the healthcare organisation is a government clinic dedicated to the military.

Also, national hospitals were reported to have more resources than other hospital categories. Some respondents reported, "*since national hospitals are large healthcare organisations, the government has dedicated more resources to them. Also, they tend to receive more donations from the donors".*

These findings are related to previous on innovation adoption which highlighted that small organisations suffer resource poverty resulting in more barriers to innovation adoption when compared to large organisations whose resources are diverse (Lee and Xia, 2006).

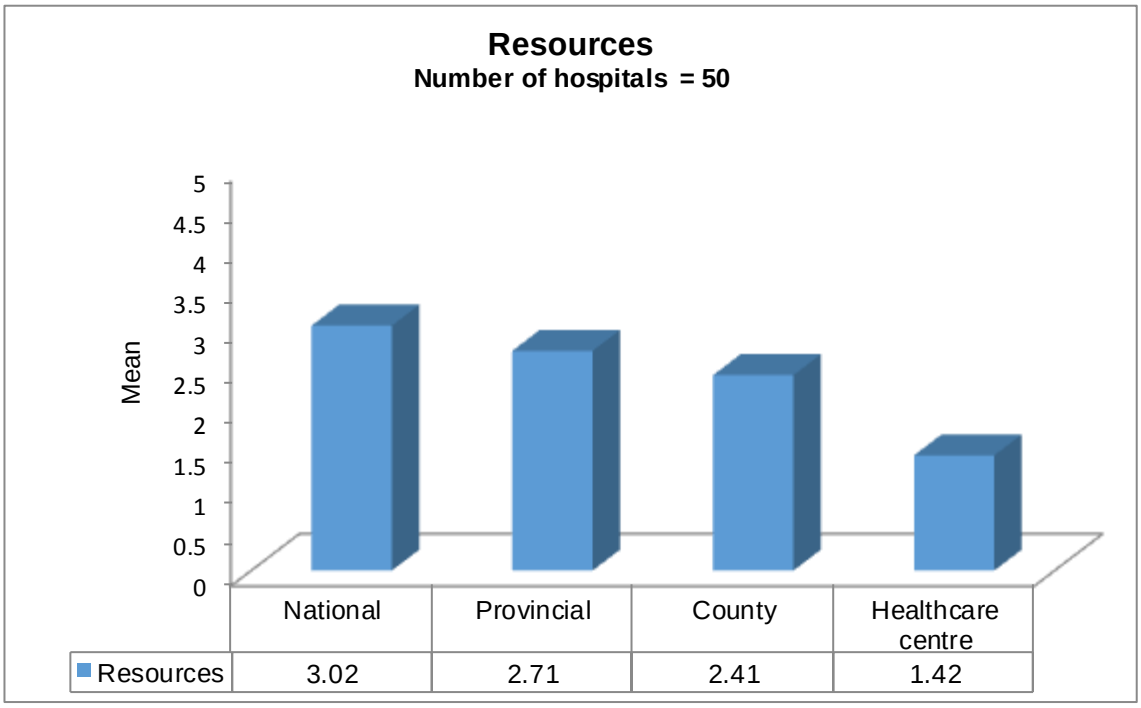


Figure 5.7: Organisation resources based on geographic coverage

5.2.4 Organisation's innovative capacities based on organisation geographic coverage

As illustrated in Figure 5.8, national hospitals are more innovative than provincial, county and healthcare centres. Healthcare centres are the least innovative. Some respondents claimed that "*national hospitals are large size organisations which have slack resources thus increasing their likeliness to innovate"*. Also, respondents from healthcare centres claimed that there is a lack of specialisation within the organisation which tends to limit innovative ideas generated within the organisations.

These findings are related to the previous findings on organisation innovativeness based on organisation size. It is argued that large size organisations can absorb technological changes rapidly because they have a wide pool of resources (Zinn and Flood, 2009).

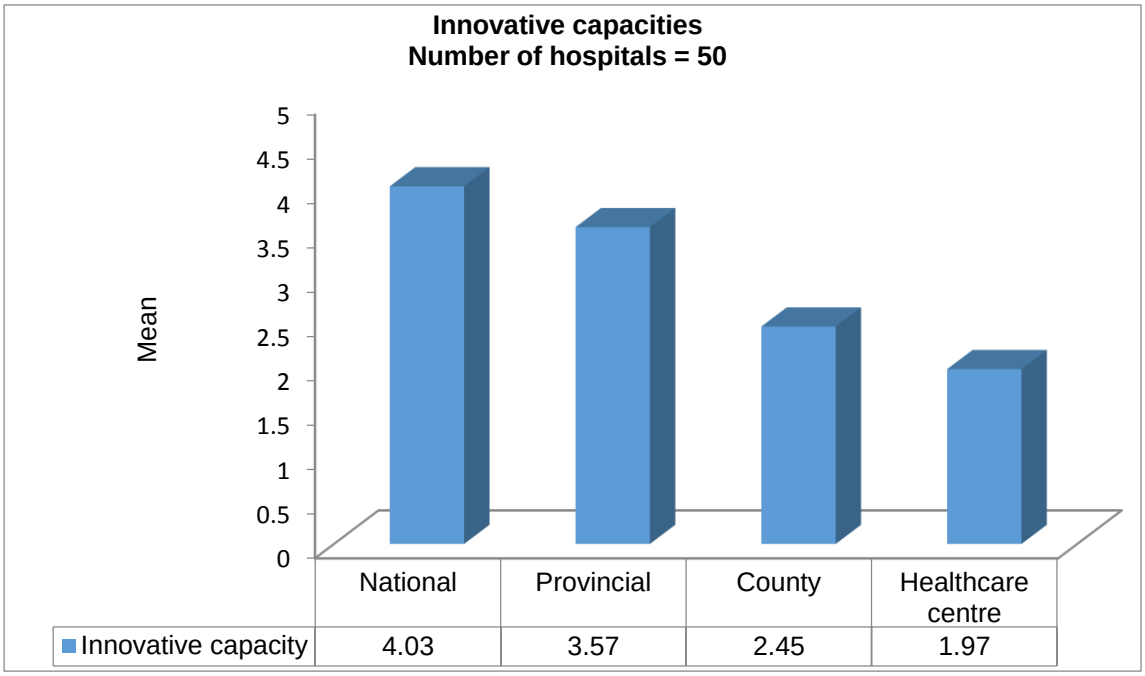


Figure 5.8: Organisation's innovative capacities based on organisation geographic coverage

5.2.5 Organisation agility based on organisation geographic coverage

Furthermore, the researcher examined the relationship existing between organisation agility and organisation geographic coverage. As shown in Figure 5.9, national hospitals are more agile than provincial, county and healthcare centres. These findings are related to organisation innovativeness findings where national hospitals were found to be the most innovative when compared to other categories. These findings can be associated with the definition of organisation agility which refers to the speed and flexibility of an organisation to respond to emerging trends and changes (Kwon et al., 2013). Some respondents stated that healthcare centres are slow in responding to healthcare changes because of limited resources and small numbers of employees. As a result, the range of innovative ideas is restricted thus slowing down the speed of responding to emerging healthcare technologies.

The results of this study aligns with previous studies where it has been observed that large organisations tend to respond to innovations faster than medium and small organisations due to availability of slack resources (Hameed et al., 2012). On the other hand, Zhu et al. (2006) claims that the flexibility of an organisation's management structure has an effect on how quickly an organisation responds to technological innovations. Organisations with centralised decision-making structure have been claimed to respond to innovations quicker than those with decentralised decision making structure (Wisdom et al. (2014).

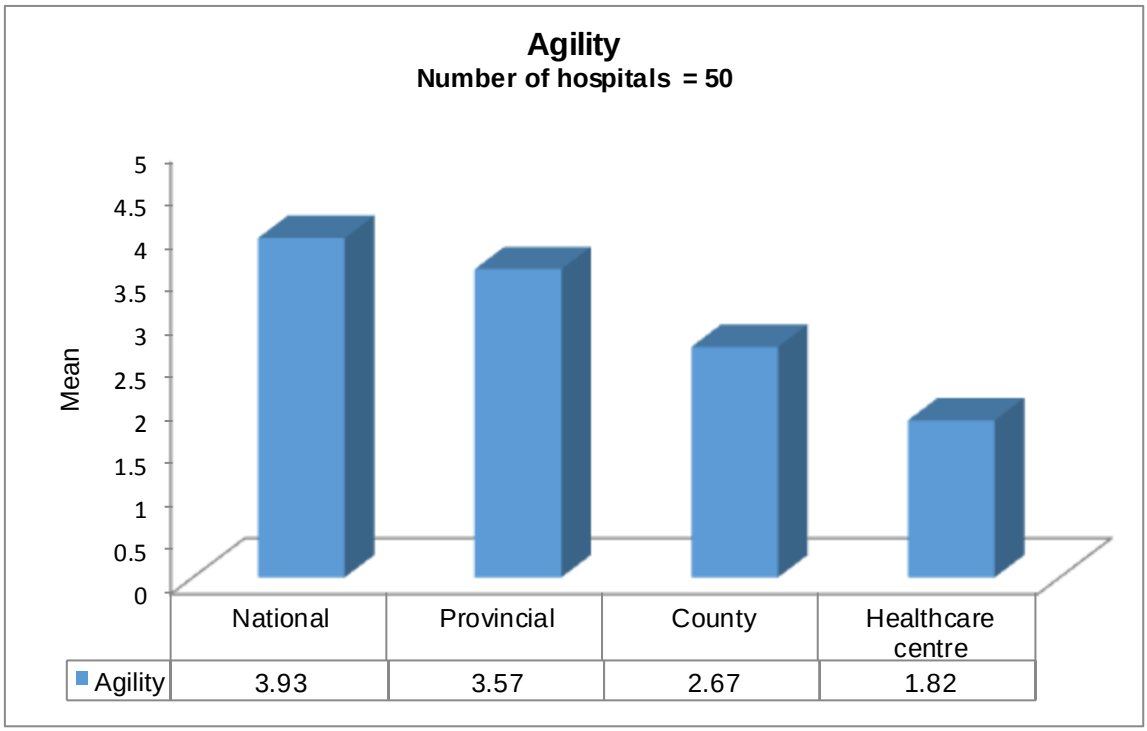
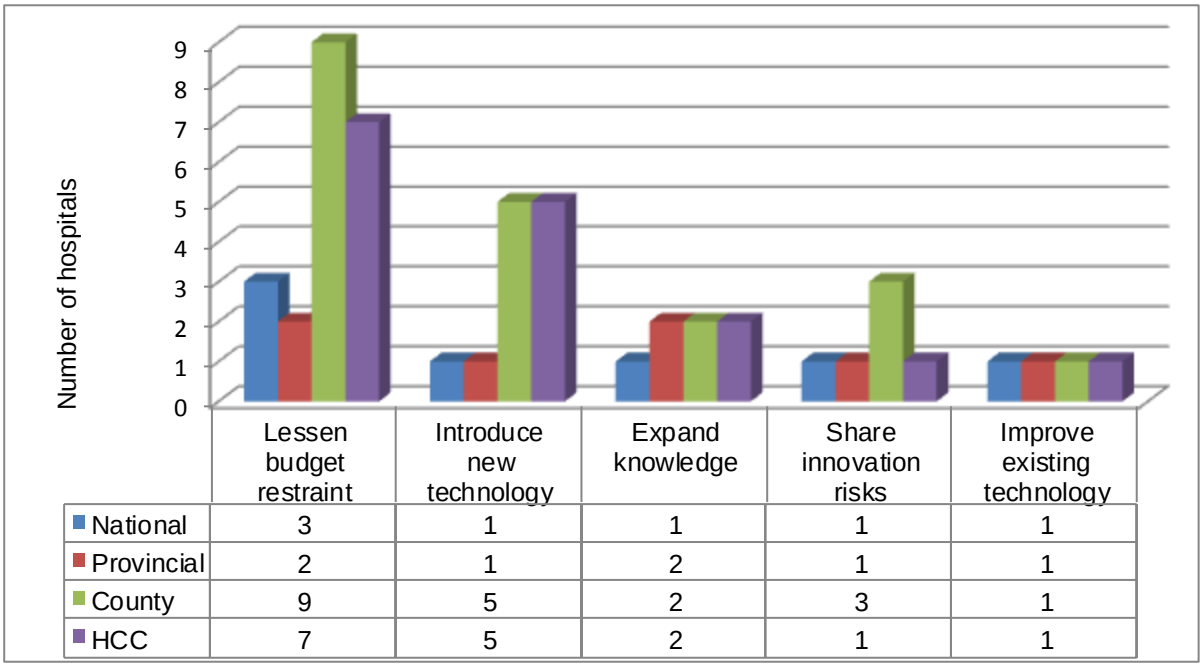


Figure 5.9: Organisation agility based on organisation geographic coverage

5.2.6 Collaborative innovation aspects based on organisation geographic coverage

In the exploratory study phase (using repertory grid), respondents were asked to express their opinions regarding reasons to collaborate with other organisations. Five main reasons were highlighted as shown in Figure 5.10. The researcher further examined why each organisation collaborate basing on its geographic coverage. The five reasons highlighted in the exploratory study were rated in a 5-point Likert scale (see section 5.1.3). The responses were categorised where scores of 4 and above were counted as 'yes' and further used to determine why Kenyan healthcare organisations undertake collaborative projects.

The survey results show that the main purpose of organisation collaboration is to lessen the budget restraint. Some respondents claimed that the money allocated to each county hospital and healthcare centre (HCC) by the government is not sufficient for an organisation to innovate individually. However, improving existing technologies exhibited less intention for organisations to collaborate. Furthermore, the respondents highlighted that national hospitals have diverse workforce in terms of education level and area of specialisation which diversifies tacit knowledge which is also termed as innovation knowledge (Cohen and Levinthal, 1994).

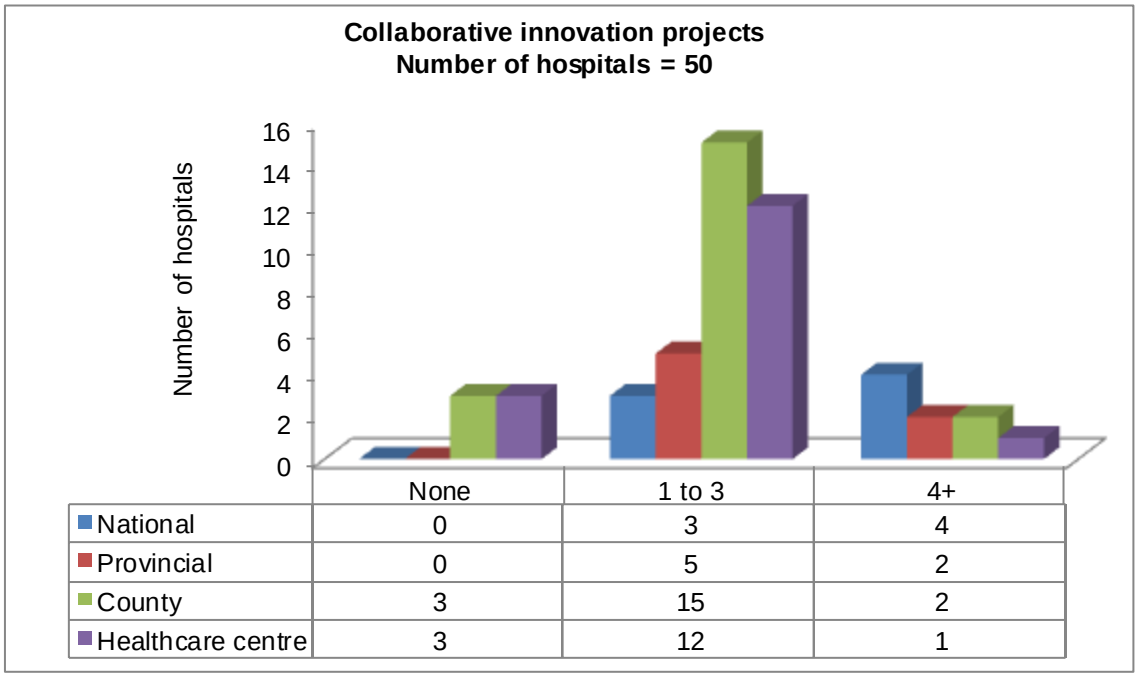


	Lessen budget restraint	Introduce new technology	Expand knowledge	Share innovation risks	Improve existing technology
National	3	1	1	1	1
Provincial	2	1	2	1	1
County	9	5	2	3	1
HCC	7	5	2	1	1

Figure 5.10**:** Collaborative innovation aspects based on organisation geographic coverage

5.2.7 Number of healthcare collaborative innovation projects based on organisation geographic coverage

Similarly, the researcher examined the relationship existing between organisation geographic coverage and the innovativeness of an organisation basing on the number of collaborative innovation projects. As shown in Figure 5.11, national hospitals were reported to be more innovative than other hospitals since they were involved in a higher number of collaborative innovation projects for example, national hospitals had the highest number of 4+ collaborative projects. On the other hand, healthcare centres were found to be the least innovative by scoring the highest in the category of hospitals which have not been involved in any collaborative innovation project. These findings also matched the previous findings on the relationship existing between organisation coverage and the level of ICT infrastructure in the previous subsection. The results of this study also show that organisations with a high level of ICT infrastructure are also highly innovative. A study on organisation agility (Lu and Ramamurthy, 2011) argued that an organisation's investment in ICT promotes its innovativeness. During the field study, a respondent working in a healthcare centre commented, *"we are very slow in adopting new technologies because most of the modern healthcare technologies require a well-established ICT infrastructure which we do not have".*



	None	1 to 3	4+
National	0	3	4
Provincial	0	5	2
County	3	15	2
Healthcare centre	3	12	1

Figure 5.11: Number of collaborative innovation projects based on geographic coverage

5.3 Effect of organisation ownership on study factors

5.3.1 Organisation ICT infrastructure based on organisation ownership

Similarly, the relationship existing between organisation ownership and ICT infrastructure was examined. Basing on the respondents feedback, privately owned organisations were found to have a well-developed ICT infrastructure compared to government owned organisations as presented in Figure 5.12. During the field study, several respondents from government owned organisations commented that, *"our organisation is lagging in responding to emerging healthcare technologies due to the lack of a reliable ICT platform".* Furthermore, several private healthcare organisations administrators informed the researcher that their organisation allocates sufficient funds for upgrading their ICT systems.

Additionally, another respondent working in national hospital commented, *"we could be much more innovative if the policy makers in the Ministry of Health (MoH) allocated more resources to upgrade the ICT infrastructure so as to match that of the private healthcare sector".* Other respondents stated, *"working jointly with private sector helps the collaborating organisations increase their resources in terms of finances, human and assets which in turn increase the innovativeness of the organisations".*

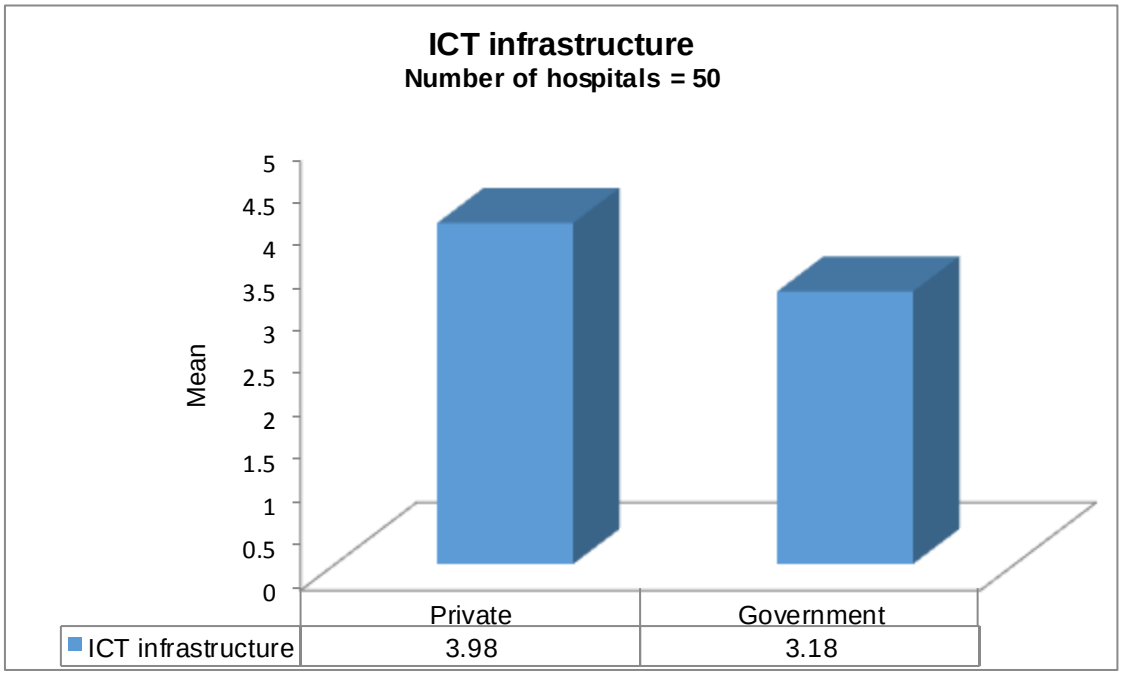


Figure 5.12: Organisation ICT infrastructure based on organisation ownership

5.3.2 Organisation affiliation based on organisation ownership

The relationship existing between organisation ownership and organisation affiliation was also examined. As shown in Figure 5.13, private owned hospitals were found to be more affiliated to other organisations when compared to government owned hospitals. Some respondents claimed that "*government owned hospitals are characterised by lengthy administrative procedures which slow down the affiliation process".* Also, privately owned organisations are for profit organisations thus requiring more expertise from other organisations to increase their responsiveness to emerging technologies. It was further explained that *"although private healthcare organisations get affiliated to other organisation more than government owned healthcare organisations, the level of affiliation is at times restricted due to lack of trust among the collaborators"*.

These results align with previous studies on organisation collaboration where public organisations have identified as slow moving organisations characterised by lengthy procedures and stalemate thus slowing the collaboration process (Sorensen and Torfing, 2012). Additionally, Krueathep et al. (2010) observed that politicians' attitude towards expansion of government organisations affect public organisation collaboration.

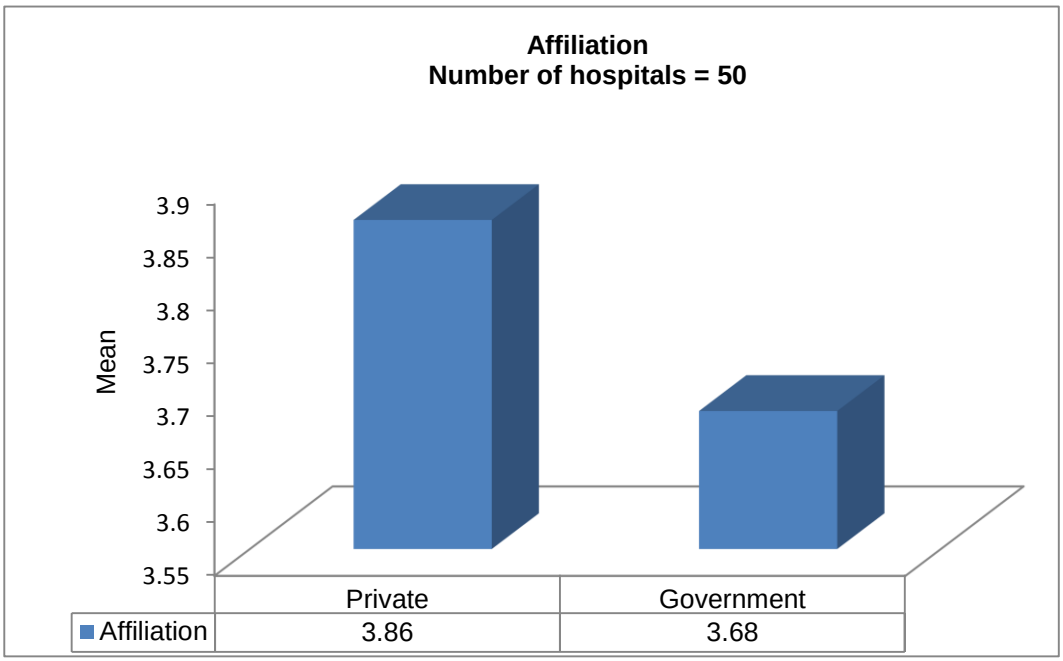


Figure 5.13: Organisation affiliation based on organisation ownership

5.3.3 Organisation resources based on organisation ownership

Additionally, the researcher explored the relationship existing between organisation ownership and organisation resources available to facilitate healthcare technology adoption. As shown in Figure 5.14, government owned organisations have fewer resources compared to private owned organisations. One possible reason for this finding may be because the government allocates insufficient funds to healthcare sector especially funds towards research and development. As a result, organisation resources such as human resources and technological resources will also be insufficient.

During the field study, a respondent working in government hospital commented, *"the amount of money set aside for our hospital in each financial year cannot cater for technological advancements needed in our organisation. As a result, the adoption of new technologies is very slow when compared to private hospitals".* According to Zinn and Flood (2009), an abundance of organisation resources provides an organisation with the capability to act strategically towards exploiting new technologies.

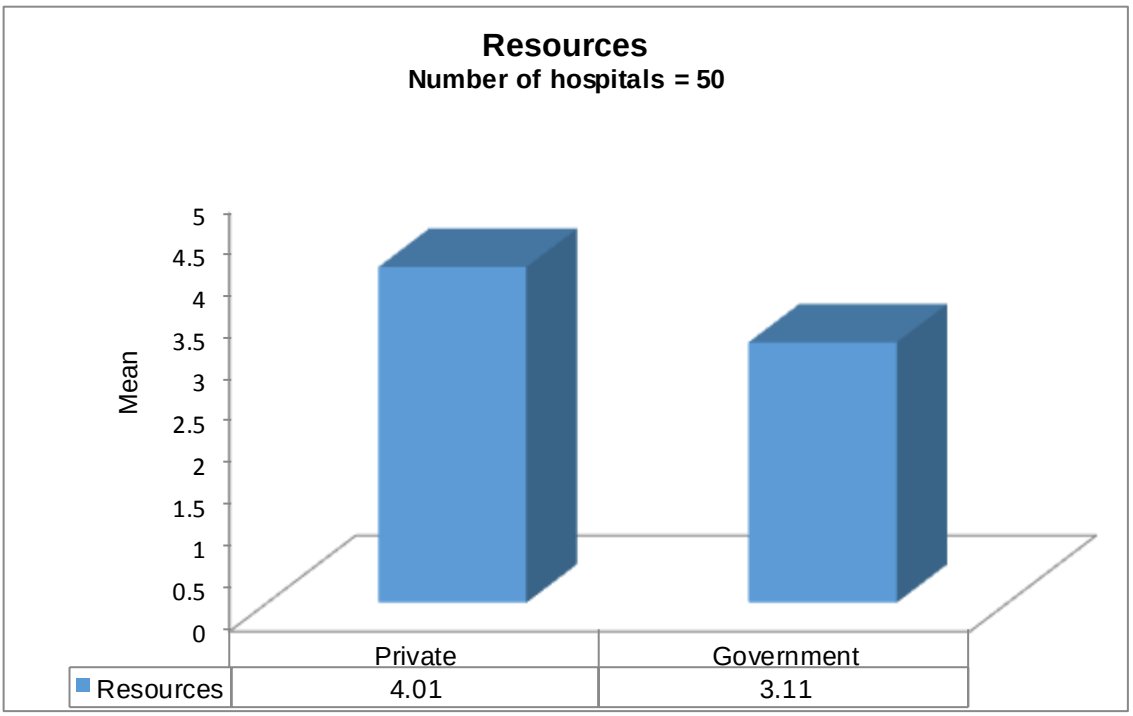


Figure 5.14: Organisation resources based on organisation ownership

5.3.4 Organisation's innovative capacities based on organisation ownership

The innovation capacity of Kenyan hospitals in the Eastern region basing on organisation ownership was also examined. As shown in Figure 5.15, privately owned hospitals are more innovative than government owned hospitals. Some respondents from private hospitals explained, *"innovation is a very important factor for private organisations especially in the healthcare sector where the development of new technologies is very dynamic. When a hospital is up to date with the current technologies, its productivity is increased which in turn increases the profitability of the hospital".* Furthermore, respondents from government owned hospitals claimed that *"resources allocated for innovation are not sufficient thus slowing down the innovativeness of the government owned hospitals".*

Additionally, there are other different reasons that can be associated to these results. Private owned organisations are mainly for profit organisations (Chanyagorn and Kungwannarongkun, 2011). As a result, these organisations attempt to have the latest technologies to remain competitive in the market. Furthermore, Damanpour (1991) observed that public organisations mission as a provider of last resort restrains their resources thus limiting their innovative capacity.

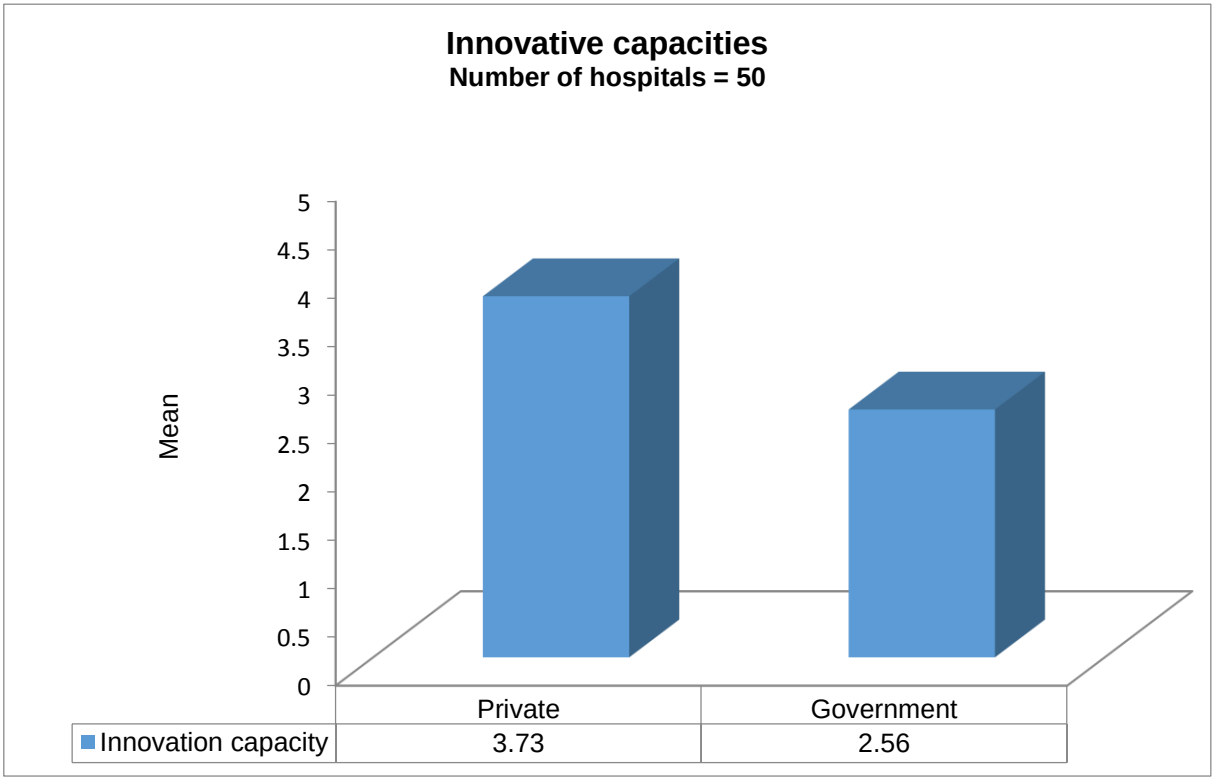


Figure 5.15: Organisation's innovative capacities based on organisation ownership

5.3.5 Organisation agility based on organisation ownership

Organisation agility is an organisation's ability to deal with changes that often arise unexpectedly through rapid and innovative responses (Lu and Ramamurthy, 2011). As shown in Figure 5.16, private owned hospitals are more likely to respond to emerging technologies more rapidly than government owned hospitals. Some respondents from government hospitals stated, *"scarcity of innovative resources within the government sector slows down the agility of government organisations".* Additionally, some respondents from private owned hospitals claimed that, *"since the hospital is for profit organisation, we have to keep in pace with the emerging healthcare technologies otherwise we will be lagging in the healthcare sector".*

Furthermore, Lemon and Sahota (2004) observed that the management style adopted by an organisation affect the technology responsiveness on an organisation. Organisations with too formal and centralised management have been observed to be slow adopters of innovations (Wisdom et al., 2014). Conversely, decentralisation of management generates the conditions for search for novel solutions and has a positive association with the agility of an organisation (Garcia et al., 2014). According to the Kenyan healthcare system, government hospital's operations are managed centrally while private hospitals operations are decentralised.

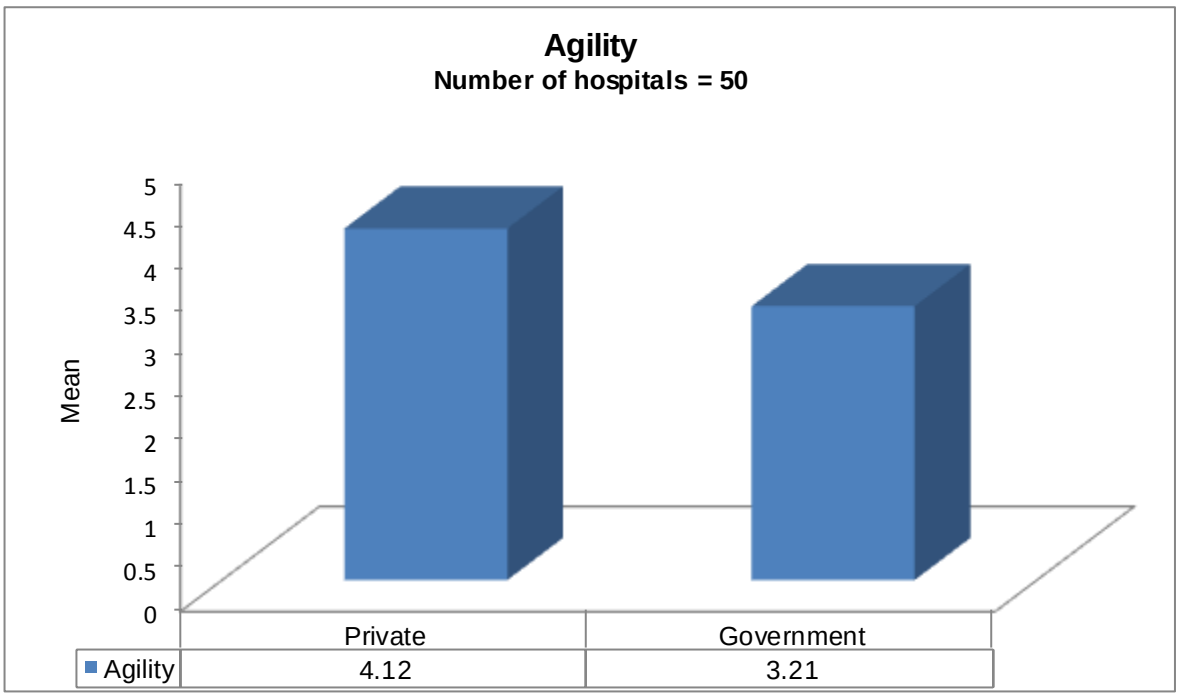


Figure 5.16: Organisation agility based on organisation ownership

5.3.6 Collaborative innovation aspects based on organisation ownership

During the exploratory study phase of this research on why organisations collaborate, five main reasons were highlighted as shown in Figure 5.17. Basing on the five reasons highlighted, the researcher further examined the five reasons highlighted basing on organisation ownership. The survey results show that private owned hospitals collaborate mainly to introduce new technologies whereas government owned hospitals collaborate mainly to lessen budget restraint.

Additionally, government hospitals have the lowest score in collaborating to improve existing technologies. Some respondents working for government hospitals commented, "*financial involvement needed to improve existing technologies is higher than that needed to introduce new technologies".* Also, some respondents explained that "*government hospitals are highly dependent on government funding for service delivery although the amount of funds dedicated to healthcare innovations by the government is not enough to cope with the dynamic technological advancements in healthcare sector".*

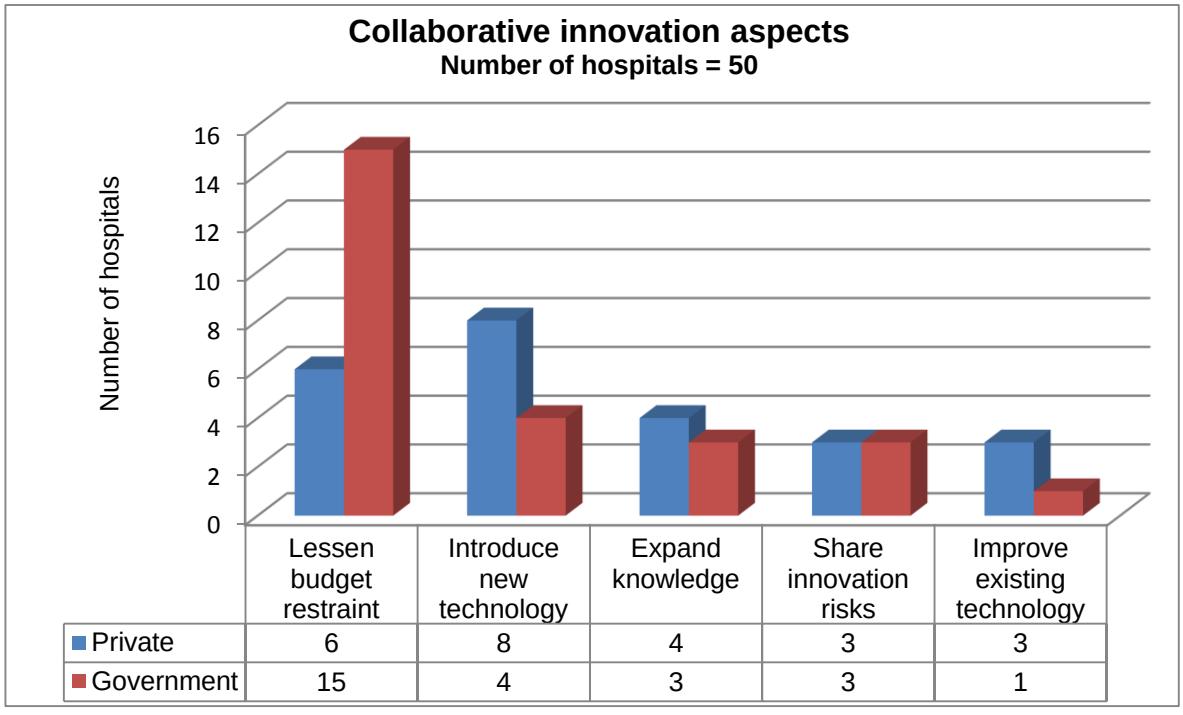


Figure 5.17: Collaborative innovation aspects based on organisation ownership

5.3.7 Number of healthcare collaborative innovation projects based on organisation ownership

Similarly, the researcher examined the relationship that exists between the number of collaborative innovation projects and organisation ownership. As shown in Figure 5.18, the majority of organisations which did not have any collaborative innovation projects are government owned hospitals. However, private hospitals reported a larger number of collaborative innovation projects. Some respondents stated that *"the ability of an organisation to collaborate with other organisations is largely influenced by organisation administrative policies".* Some respondents claimed that lengthy administrative procedures have slowed down organisation collaboration process to innovate. Additionally, it was argued that *"since private hospitals are for-profit organisations, they are always seeking new technologies so as to respond to patient demands effectively thus increasing their profitability".*

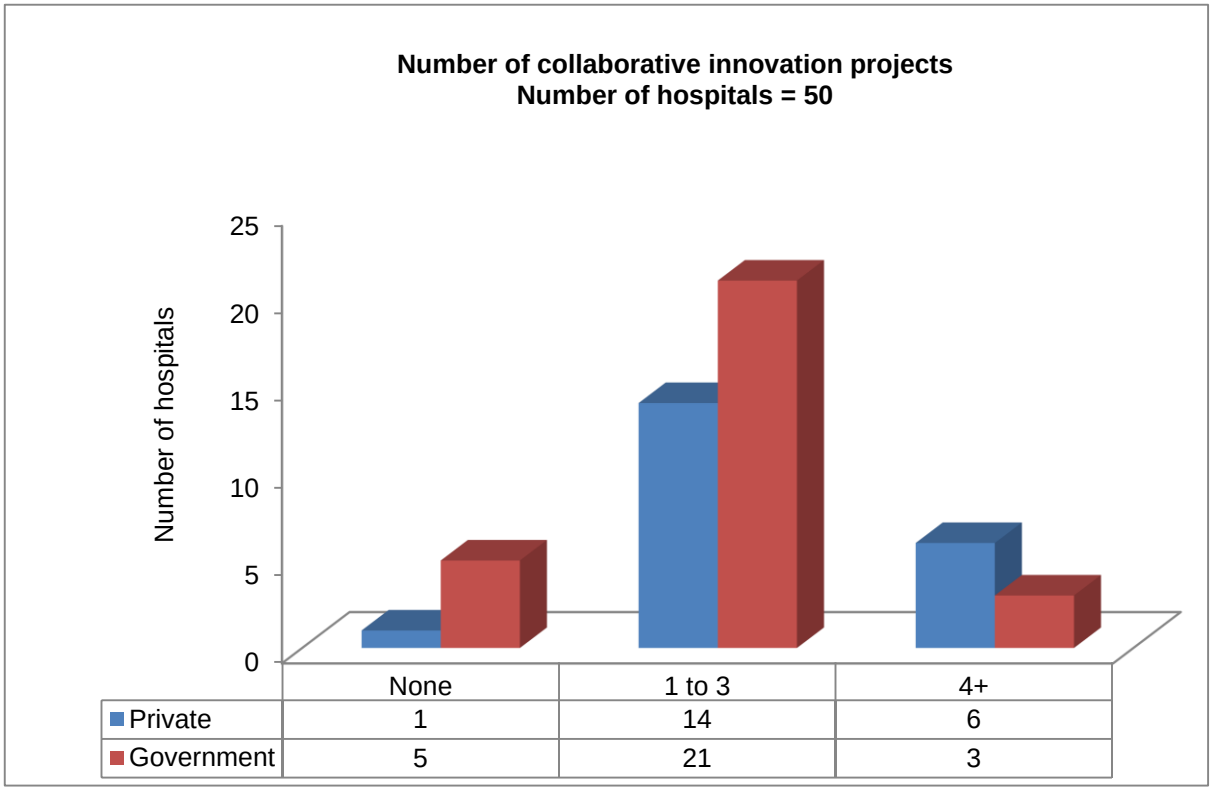


Figure 5.18: Collaborative innovation projects based on organisation ownership

5.4 Personnel ICT skills level

5.4.1 Personnel innovation acceptance based on their ICT skills level

In this study, the researcher also examined the relationship existing between personnel ICT skills level and their likelihood to accept technological innovation. Extant literature has identified the level of ICT literacy among the workforce as one determining factor to technology adoption (Menachemi et al., 2004; Kamal, 2006; Wamala and Augustine, 2013). As shown in Figure 5.19, respondents with an advanced level of ICT skills are more receptive to healthcare technological innovation compared to respondents with entry or intermediate level of ICT skills. On the other hand, healthcare personnel with intermediate level of ICT skills were more receptive to technological innovation compared to those with entry level of ICT skills. The findings are related to previous studies on information technologies where intermediate level of ICT skills was observed to be necessary to function optimally in basic computer related environments (Akoojee and Arends, 2009).

One respondent commented, *"our organisation barely organises training to advance our ICT skills which has consequently resulted to resistance to change and use the emerging technologies since we find them very complicated".* In the previous examination on the relationship existing between personnel ICT skills level and organisation ownership, the results indicated that majority of respondents who have advanced level of ICT skills are from private owned healthcare organisations. One administrative respondent from private healthcare organisation commented, "*recruiting replacement staff with advanced level of ICT is expensive for our organisation. It is much cheaper to train and retain our existing staff. Furthermore, having staff with high levels of ICT skills will facilitate the adoption rate of new technologies when they are introduced in the organisation".*

These findings are related to previous findings regarding healthcare innovation where healthcare personnel previous experience on ICT use had a positive effect on the adoption of electronic medical records in primary care (Ludwick and Doucette, 2009).

A doctor from government owned hospital claimed that *"healthcare technologies can be complex in terms of their operation. With my current intermediate level of ICT skills, I am not certain that I can run a telemedicine clinic confidently. Currently, my department has requested for ICT trainings since the ministry of health is focussing on the implementation of telemedicine in its vision 2030".*

Some respondents from private hospitals commented that *"our organisation has established ICT department which does not only deal with the hospital's ICT infrastructure but also with workforce training".*

During the survey, one respondent working in a government hospital argued that "*young healthcare personnel (those in early 50s and younger) are much more confident with the use of computers and the associated technologies when compared to the older ones".*

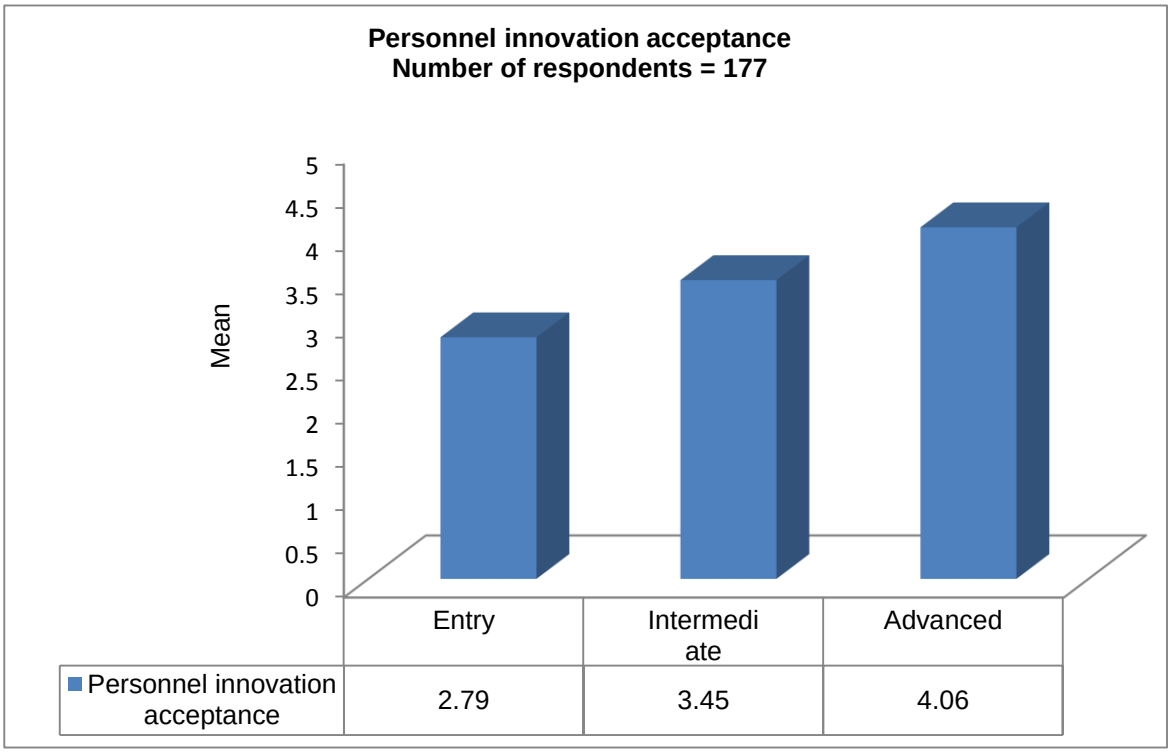


Figure 5.19: Personnel innovation acceptance based on their ICT skills level

5.5 Analysis of Variance (ANOVA) and T- test

In the previous section, survey findings presented the differences existing in the framework organisation factors basing on healthcare organisation geographic coverage and healthcare organisation ownership. In this section, the significant level of the differences presented is examined by comparing the means of different independent groups. Tabachnick and Fidell (2013); Field (2013); Bryman and Cramer (2011) and Pallant (2013) stated that ANOVA and t-test tests are appropriate to explore the statistical difference since statistical evidence is required to accept or reject research findings.

5.5.1 Analyses of variance (ANOVA)

ANOVA test is used to make comparisons of means when a variable has more than two categories (Pallant, 2013). In this study, organisation geographic coverage (organisation size) has four categories namely: national hospitals, provincial hospitals, county hospitals and healthcare centres. Additionally, personnel ICT skills have three categories namely: entry, intermediate and advanced. ANOVA test was carried out to examine the influence of organisation geographic coverage on the model factors. Similarly, the difference in the mean of personnel ICT skills level basing on personnel innovation acceptance will be examined. The subsequent sections highlight the ANOVA test carried out in this study.

5.5.1.1 Effect of organisation geographic coverage on study factors

Influence of organisation geographic coverage on organisation ICT infrastructure

ANOVA test was used to compare the difference in ICT infrastructure for various organisations basing on their geographic coverage. As shown in Table 5.1, ICT infrastructure differed significantly among the organisations basing on their geographic coverage. F value in ANOVA test is the ratio of two mean square values.

F = Variance of the group means / Mean of the within group variances (Pallant, 2013)

The numerator is computed by measuring the variance of the means and if the true means of the groups are identical then this is a function of the overall variance of the data. But if the null hypothesis is false and the means are not all equal, then this measure of variance will be larger. The denominator is an average of the sample variances for each group, which is an estimate of the overall population variance (assuming all groups have equal variances). According to Bryman and Cramer (2011), a high F value implies that the difference between the means is unlikely to be due to chance. Field (2013) claims that a significant model should have F value greater than 1.

Table 5.1: ANOVA test comparing organisation ICT infrastructure basing on organisation geographic coverage

ICT infrastructure	*df*	*Mean square*	*F*	*Sig. (p)*
Between Groups	3	32.923	9.823	.001
Within Groups	46	3.351		
Total	49			

Moreover, a post-hoc comparison test was carried out to examine to examine the differences in favour of any group. Basing on the post-hoc results shown in Table 5.2, the mean score for national hospitals (M=3.57, SD=.832) did not significantly differ from provincial hospitals (M=3.06, SD=.911). A significant difference in the mean score of all other categories was observed ($p < 0.05$).

Table 5.2: Post-hoc test comparing organisation ICT infrastructure basing on organisation geographic coverage

Geographic coverage		*Mean Difference*	*Sig. (p)*
National	Provincial	.510	.693
	County	.950	.005
	Health centre	2.041	.000
Provincial	County	.440	.031
	Health centre	1.530	.014
County	Health centre	1.090	.021

Influence of organisation geographic coverage on organisation affiliation

Similarly, ANOVA test was used to compare the difference in organisation affiliation for various organisations basing on their geographic coverage. Basing on the ANOVA test results shown in Table 5.3, the mean score for national hospitals (M=3.92, SD=.632) did not significantly differ from that of provincial hospitals

(M=3.67, SD=.723), county hospitals (M=3.43, SD=.473) and healthcare centres (M=3.38, SD=.615).

Table 5.3: ANOVA test comparing organisation affiliation basing on organisation geographic coverage

Organisation affiliation	*df*	*Mean square*	*F*	*Sig. (p)*
Between Groups	3	7.698	0.898	.104
Within Groups	46	8.572		
Total	49			

According to these results, organisation affiliation did not differ significantly across the organisations basing on their geographic coverage (organisation size).

Influence of organisation geographic coverage on organisation resources

Additionally, ANOVA test was conducted to compare the difference in organisation resources for various organisations basing on their geographic coverage. The results show that organisation resources differ significantly across various healthcare organisations basing on their geographic coverage.

A post-hoc test was further carried out to determine the specific level of differences across the organisations. According to the test results, the mean score for national hospitals (M=3.02, SD=.723) was significantly different from provincial hospitals (M=2.71, SD=.912), county hospitals (M=2.41, SD=.602) and healthcare centres (M=1.42, SD=.856). According to these results, national, provincial, county and healthcare centres differ significantly in terms of organisation resources.

Influence of organisation geographic coverage on organisation's innovation acceptance

Furthermore, one-way ANOVA test was conducted to compare the difference in organisation's innovation acceptance for various organisations basing on their geographic coverage. The results show that organisation's innovation acceptance does not differ significantly across various healthcare organisations basing on their geographic coverage (organisation size) as shown in Table 5.4.

Table 5.4: ANOVA test comparing organisation's innovation acceptance basing on organisation geographic coverage

Organisation's innovation acceptance	*df*	*Mean square*	*F*	*Sig. (p)*
Between Groups	3	20.107	0.137	.242
Within Groups	46	146.764		
Total	49			

Influence of organisation geographic coverage on personnel innovation acceptance

ANOVA test was conducted to compare the difference in personnel innovation acceptance for various organisations basing on their geographic coverage. The results show that personnel innovation acceptance differ significantly across various healthcare organisations basing on their geographic coverage.

Post-hoc test was further carried out to determine the specific level of differing across the organisations in terms of personnel innovation acceptance. A significant difference in the mean score was observed across all the organisation categories with national hospitals having a mean score for (M=4.12, SD=.456), provincial hospitals (M=3.92, SD=.655), county hospitals (M=3.01, SD=.932) and healthcare centres (M=1.99, SD=.534).

According to these results, the likeliness of healthcare personnel to accept an innovation differs significantly across various organisations basing on organisation geographic coverage (organisation size).

Influence of organisation geographic coverage on organisation's innovative capacities

ANOVA test was conducted to compare the difference in organisation's innovative capacities for various organisations basing on their geographic coverage. The results show that organisation's innovative capacities differ significantly across various healthcare organisations basing on their geographic coverage. Post-hoc test was further carried out to determine the specific level of differing across the organisations. The test results show that the mean score for national hospitals (M=4.03, SD=.565) and healthcare centres (M=1.97, SD=.421) differed the most in terms of

organisation's innovative capacities. The mean score for national and provincial hospitals (M=3.57, SD=.421) differed the least.

Influence of organisation geographic coverage on organisation agility

Similarly, ANOVA test was conducted to compare the difference in organisation agility for various organisations basing on their geographic coverage. The results show that organisation agility differs significantly across various healthcare organisations basing on their geographic coverage.

A post-hoc test was further carried out to determine the specific level of differing across the organisations. According to the results, the mean score for national hospitals (M=3.93, SD=.812) did not differ significantly with that of provincial hospitals (M=3.57, SD=.745). On the other hand, the mean score for national hospitals and provincial hospitals differed significantly with the mean score for county hospitals (M=2.67, SD=.623) and healthcare centres (M=1.82, SD=.362). The mean score for national hospitals and healthcare centres differed the most in terms of organisation agility ($p = 0.000$).

According to these results, there is no significant difference between national and provincial hospitals in terms of agility.

Influence of organisation geographic coverage on innovation outcomes

ANOVA test was carried out to explore the difference in innovation outcomes between organisations basing on their geographic coverage. The results presented a significant difference in internal innovation outcomes between national, provincial, county hospitals and healthcare centres ($p < 0.05$). On the other hand, there was no significant difference in the external innovation outcomes among the hospitals.

A post-hoc test was performed to examine the differences in favour of any of the categories. Basing on the post-hoc results, a significant difference in internal innovation outcomes was observed between national hospitals (M=4.03, SD=.521) and healthcare centres (M=3.01, SD=.723), provincial hospitals (M=3.92, SD=.802) and healthcare centres, county hospitals (M=3.87, SD=.823) and healthcare centres.

There was no significant difference in internal innovation outcomes between national and provincial hospitals, provincial hospitals and county hospitals.

5.5.1.2 Influence of personnel ICT skills level on personnel innovation acceptance

Similarly, ANOVA test was conducted to examine the relationship existing between personnel ICT skills level on personnel innovation acceptance. The test results indicate that the likeliness of personnel to accept an innovation differed significantly basing on their ICT skills level.

A post-hoc test was further carried out to examine the specific level of differing in personnel willingness to accept an innovation basing on their ICT skills level. A significant difference in personnel innovation acceptance was observed between personnel with entry ICT skills level (M=2.79, SD=.462), intermediate ICT skills level (M=3.45, SD=.378) and advanced ICT skills level (M=4.06, SD=.623).

5.5.2 T - test

T-test is used when comparing the mean score of two different groups. For this research, an independent t-test was carried out on the model factors basing on organisation ownership. Kenyan hospitals are owned by private organisations or by the government. 21 privately owned hospitals and 29 government owned hospitals located in Eastern region of Kenya were included in this study.

5.5.2.1 Effect of organisation ownership on study factors

Effect of organisation ownership on ICT infrastructure

An independent t-test was carried out to examine the effect of organisation ownership on the model factors. The mean score of private and government hospitals was compared to determine whether organisation ownership has an effect on ICT infrastructure. A significant difference in ICT infrastructure between private owned hospitals (M=3.98, SD=.932) and government owned hospitals (M=3.18, SD=.523) was detected ($p < 0.05$). These results show that organisation ICT infrastructure differs on the basis of organisation ownership as shown in Table 5.5.

Table 5.5: T-test for organisation ownership effect on ICT infrastructure

Ownership	*N*	*Mean*	*t*	*df*	*Sig. (p)*
Private	21	3.98	4.721	48	.002
Government	29	3.18			

Effect of organisation ownership on organisation affiliation

An independent t-test was carried out to examine the effect of organisation ownership on organisation affiliation. The mean score of private and government hospitals was compared. According to the test results, organisation ownership has no significant effect on the likeliness of healthcare organisations to get affiliated with other organisations, as for private owned hospitals (M=3.86, SD=.801) and government owned hospitals (M=3.68, SD=.746).

Effect of organisation ownership on organisation resources

An independent t-test was carried out to examine the effect of organisation ownership on organisation resources. The mean score of private and government hospitals was compared. A significant difference in organisation resources between private owned hospitals (M=4.01, SD=.401) and government owned hospitals (M=3.11, SD=.712) was detected.

Effect of organisation ownership on organisation's innovation acceptance

An independent t-test was carried out to examine the effect of organisation ownership on organisation's innovation acceptance. On comparing the mean score of private and government hospitals, no significant difference in organisation's innovation acceptance was detected between private owned hospitals (M=4.23, SD=.902) and government owned hospitals (M=4.16, SD=.692).

Organisation ownership effect on personnel innovation acceptance

Furthermore, an independent t-test was carried out to examine the effect of organisation ownership on personnel innovation acceptance. The mean score of private and government hospitals was compared. A significant difference in

personnel innovation acceptance was detected between private owned hospitals (M=3.72, SD=.592) and government owned hospitals (M=2.98, SD=.810).

Effect of organisation ownership on organisation's innovative capacities

Additionally, an independent t-test was carried out to examine the effect of organisation ownership on organisation's innovative capacities. The mean score of private and government owned hospitals was examined. A significant difference in organisation's innovative capacities was detected, private owned hospitals (M=3.73, SD=.602) and government owned hospitals (M=2.56, SD=.698). This results show that the innovative capacity of private owned hospitals is different from that of government owned hospitals.

Effect of organisation ownership on organisation agility

Moreover, an independent t-test was carried out to examine the effect of organisation ownership on organisation agility. The mean score of private and government hospitals was examined. A significant difference in organisation agility between private owned hospitals (M=4.12, SD=.532) and government owned hospitals (M=3.21, SD=.402) was detected. This results show that the agility of private owned hospitals is different from that of government owned hospitals.

Effect of organisation ownership on innovation outcomes

T-test was also performed on private and government owned hospitals to compare the means scores of innovation outcomes. According to the test results, no significant difference was detected on internal innovation outcomes for both private owned hospitals (M=4.17, SD=.523) and government owned hospitals (M=4.13, SD=.392). Similarly, no significant difference was detected on external innovation outcomes for both private owned hospitals (M=3.76, SD=.602) and government owned hospitals (M=3.81, SD=.437). According to these results, innovation outcomes do not differ on the basis of organisation ownership.

5.6 ANOVA test and T- tests summary

After carrying out the t-tests and ANOVA test, the results are presented in Table 5.6. The grouping criterion of the tests was based on organisation geographic coverage and organisation ownership.

Table 5.6: ANOVA test and T-test summary

Test	*Categorisation*	*Dependent variable*	*Sig. level (p)*	*Interpretation*
ANOVA	Organisation geographic coverage	ICT infrastructure	.001 ($p < 0.05$)	A significant difference between organisation geographic coverage and ICT infrastructure was detected.
ANOVA	Organisation geographic coverage	Organisation affiliation	.104 ($p > 0.05$)	No significant difference was detected.
ANOVA	Organisation geographic coverage	Organisation resources	.002 ($p < 0.05$)	A significant difference between organisation geographic coverage and organisation resources was detected.
ANOVA	Organisation geographic coverage	Organisation's innovation acceptance	.242 ($p > 0.05$)	No significant difference was detected.
ANOVA	Organisation geographic coverage	Personnel innovation acceptance	.003 ($p < 0.05$)	A significant difference between organisation geographic coverage and personnel innovation acceptance was detected.
ANOVA	Organisation geographic coverage	Organisation's innovative capacities	.021 ($p < 0.05$)	A significant difference between organisation geographic coverage and organisation's innovative capacities was detected.
ANOVA	Organisation geographic coverage	Organisation agility	.000 ($p < 0.05$)	A significant difference between organisation geographic coverage and organisation agility was detected.
ANOVA	Organisation geographic coverage	Internal innovation outcomes	.014 ($p < 0.05$)	A significant difference between organisation geographic coverage and internal innovation outcomes was detected
ANOVA	Organisation geographic coverage	External innovation outcomes	.127 ($p > 0.05$)	No significant difference was detected.

ANOVA	Personnel ICT skills level	Personnel innovation acceptance	.031 ($p < 0.05$)	A significant difference was detected for the three personnel's ICT skills levels.
T-test	Organisation ownership	ICT infrastructure	.002 ($p < 0.05$)	A significant difference between organisation ownership and ICT infrastructure was detected.
T-test	Organisation ownership	Organisation affiliation	.321 ($p > 0.05$)	No significant difference was detected.
T-test	Organisation ownership	Organisation resources	.001 ($p < 0.05$)	A significant difference between organisation ownership and organisation resources was detected.
T-test	Organisation ownership	Organisation's innovation acceptance	.232 ($p > 0.05$)	No significant difference was detected.
T-test	Organisation ownership	Personnel innovation acceptance	.036 ($p < 0.05$)	A significant difference between organisation ownership and organisation resources was detected.
T-test	Organisation ownership	Organisation's innovative capacities	.006 ($p < 0.05$)	A significant difference between organisation ownership and organisation's innovative capacities was detected.
T-test	Organisation ownership	Organisation agility	.009 ($p < 0.05$)	A significant difference between organisation ownership and organisation agility was detected.
T-test	Organisation ownership	Internal innovation outcomes	.059 ($p > 0.05$)	No significant difference was detected.
T-test	Organisation ownership	External innovation outcomes	.099 ($p > 0.05$)	No significant difference was detected.

As illustrated on the summary results above, no significant difference was detected on internal and external innovation outcomes basing on healthcare organisations ownership. However, a significant difference was detected on internal innovation outcomes basing on the geographic coverage where the post-hoc comparison results showed that the difference between national hospitals and healthcare centres was the most significant ($p=0.004$).

5.7 Chapter summary

This chapter investigated the participating hospitals profile information in terms of hospital geographic coverage and hospital ownership using SPSS descriptive analysis. Additionally, the effect of personnel ICT skills level on personnel innovation acceptance was examined. The descriptive analysis showed differences in healthcare organisation model factors and telemedicine collaborative innovation outcomes basing on hospital geographic coverage and hospital ownership. It was observed that national hospitals are more innovative than provincial, county and healthcare centres. Moreover, national hospitals were observed to be more affiliated to other organisations than provincial, county and healthcare centres.

In terms of organisation ownership, it was observed that private owned hospitals are more affiliated to other organisations when compared to government owned hospitals. Also, private hospitals were observed to be more innovative than government owned hospitals.

Additionally, a difference existed in healthcare personnel ability to accept an innovation basing on their ICT skills level where healthcare personnel with advanced level of ICT skills were more receptive to innovation compared to those with entry level of ICT skills. Furthermore, personnel ICT skills level influenced the likeliness of the personnel to accept an innovation.

Moreover, ANOVA test and t-test was used to examine the statistical differences existing between various model factors basing on hospital geographic coverage and hospital ownership. It was observed that hospital geographic coverage and hospital ownership has an influence on the model factors. However, hospital ownership did not influence innovation outcomes. Additionally, hospital geographic coverage did not influence external innovation outcomes.

In the next chapter, hypotheses formulated in this study will be tested so as to determine factors which significantly influence organisation collaborative innovation.

Chapter Six: Research model hypotheses testing

6.1 Introduction

In the previous chapter, statistical relationship between various factors was examined using ANOVA and t-test and results presented. However, the research hypotheses stated in Chapter 3 have to be investigated so as to either accept or reject them. This section aims at testing the hypotheses developed by examining the relationships between independent variables and dependent variable (innovation outcomes). The effect of the three precursors namely: ICT infrastructure, organisation affiliation and patient telemedicine adoption is also examined. SPSS statistics software, *version 20*, was used to carry out the hypotheses tests where multiple regression and single regression technique was adopted. According to Pallant (2013), multiple regressions explore the relationship between one dependent variable and a set of independent variables with a sound theoretical or conceptual reason whereas single regression explores the relationship between one dependent variable and one independent variable. According to Tabachnick and Fidell (2013), checks concerning data set distribution, missing values, outliers and multicollinearity should be made prior to regression analysis. The next section show tests carried out prior to carrying out regression analyses

6.2 Data screening prior to regression analysis

Prior to regression analysis, checking and collecting errors in a primary data set is necessary to ensure it is useable, reliable and valid for testing the conceptual model developed. Furthermore, Pallant (2013) claims that statistical analysis software such as SPSS are very sensitive to errors. According to Tabachnick and Fidell (2013), primary data can be screened for internal consistency, missing values, linearity, outliers and multicollinearity. The subsequent sub-sections focus on data screening tests that were carried out on the primary data set of this research and the outcomes.

6.2.1 Reliability test

Reliability is the extent to which a measure is consistent in the sense that its components all measure the same thing (Nunnally and Bernstein, 1994; Pallant, 2013). A test with a high reliability will show similar scores for the two tests. Cronbach alpha is the widely used approach for calculating the internal reliability of a test scale. Cronbach alpha was developed by Lee Cronbach in 1951 to provide a measure of the internal consistency of a test and it is expressed as a number between 0 and 1 (Streiner, 2003; Tavakol and Dennick, 2011).

In this study, reliability test was calculated by determining the Cronbach alpha using SPSS version 20 software. Various scholars recommend a value of 0.70 and above (Hair et al., 2010; Bryman and Cramer, 2011; DeVellis, 2012; Pallant, 2013) although .50 to .60 is acceptable for the early stages of research (Nunnally and Bernstein, 1994). However, Streiner (2003) argue that very high values may reflect unnecessary duplication of content across items and point more to redundancy than to homogeneity as they are testing the same question but in a different pretext. Therefore, a maximum Cronbach alpha value of 0.90 has been recommended. Table 6.1 shows that the reliability of each factor used in this study is more than 0.70. Also, the average reliability score is 0.81.

Table 6.1: Reliability test for test factors (n=50)

Test factors		*Cronbach alpha (α)*
P1	ICT Infrastructure (ICT)	.840
P2	Organisation Affiliations (OrgAff)	.792
P3	Patient TM Adoption (PatTMAdp)	.791
F1	Organisation Resources (OrgRes)	.813
F2	Organisation's innovation acceptance (OrgInnAcc)	.810
F3	Personnel Innovation Acceptance (PsInnAcc)	.842
F4	Organisation's innovative capacities (OrgInnCap)	.831
F5	Organisation Agility (OrgAg)	.803
F6	Collaborative Innovation (CoInno)	.782
O1	Internal Outcomes (InOut)	.824
O2	External Outcomes (ExOut)	.842

6.2.2 Missing values checks

Newman (2009) defines missing data as unanswered question(s) by the respondent. According to Tabachnick and Fidell (2007), missing data can cause statistical analysis difficulty as well as less reliable findings. Therefore, it is important to deal with missing data prior to analysis to get credible findings. Missing data can happen randomly or non-randomly (Pallant, 2013). Tabachnick and Fidell (2007) claims that non-random missing data could have a great effect on generalising the analysis results. However, Cohen et al. (2003) argue that it is important to be mindful about the percentage of the missing data. According to Kleinbaum et al. (2007), missing data should not exceed 10% otherwise, Bryman and Cramer (2011) argue that high missing data levels of more than 10% should be termed as missing for that specific participant. In this study, the missing data check was carried out prior to performing further analysis where SPSS software was used. During the field study, 186 questionnaires were distributed. However, 177 were returned. The 9 questionnaires which were not returned were ignored.

6.2.3 Normality test

Pallant (2013) defines normality as the distribution of a data set. According to Tabachnick and Fidell (2013), screening data set for normality is essential for nearly every multivariate analysis. Normality can be assessed by graphical presentations as well as statistical calculations. Two components used to assess the normality of a data set include skewness and kurtosis (Pallant, 2013; Hair et al., 2010; Tabachnick and Fidell, 2013). Skewness defines the symmetry of a distribution (Pallant 2013). Positive skew indicates that most variables are below the mean whereas a negative skew indicate that most variables are above the mean (Tabachnick and Fidell, 2013). Kurtosis defines the peakedness of a distribution (Pallant 2013).

According to Hair (2010) and Tabachnick and Fidell (2013), values of skewness and kurtosis ranging between ±1 presents a normal distribution. According to Pallant (2013), variables that exhibit a large departure from normality can be transformed by either using square root transformation, log transformation or inverse transformation. In this study, organisation's innovation acceptance was transformed using log transformation. In addition, personnel innovation acceptance was transformed using

square root transformation. Table 6.2 presents the skewness and kurtosis values of the data set used in this research after transformation of the two factors. Normality plots for all the model factors are shown in Appendix D.

Table 6.2: Research data set skewness and kurtosis values

Variable	*Skewness*	*Kurtosis*
ICT Infrastructure (ICT)	.127	.322
Organisation Affiliation (OrgAff)	-.095	-.571
Patient TM Adoption (PatTMAdp)	-.017	-.884
Organisation Resource (OrgRes)	-.318	-.593
Organisation's innovation acceptance (OrgInnAcc) *	-.181	-.723
Personnel Innovation Acceptance (PsInnAcc) **	-.017	-.901
Organisation's innovative capacities (OrgInnAcc)	-.263	-.756
Organisation Agility (OrgAg)	.097	-.815
Collaborative Innovation (CoInno)	-.238	-.683
Internal Innovation Outcomes (InOut)	-.235	-.907
External Innovation Outcomes (ExOut)	-.066	-.874

* Log transformation
** Square root transformation

Basing on normality threshold limits guidelines suggested by Hair (2010) and Tabachnick and Fidell (2013), the data set was normally distributed since all its variables had a skewness and kurtosis values ranging between ±1. Organisation affiliation, personnel innovation acceptance, organisation agility and external innovation outcomes had nearly a perfect normal distribution.

6.2.4 Outlier checks

Field (2013) defines outlier as a score that differs substantially from the rest of the data. According to Pallant (2013), outliers greatly affect data analyses parametric techniques. Additionally, outliers hinder the generalisation of analysis results (Tabachnick and Fidell, 2013). In this research, respondents rated the asked questionnaires on a 5-point Likert scale. To assess the outliers in the data set of this research, box plots were generated using SPSS software. According to Pallant (2013) and Tabachnick and Fidell (2013), values considered as outliers appear as small circles outside the minimum and maximum value of the box plot. From the box

plots shown in Appendix E, the researcher did not identify scores lying outside the minimum and maximum value of the box plots.

6.2.5 Multicollinearity checks

Multicollinearity is the existence of a high level of relationship between variables (Field, 2013; Pallant, 2013; Tabachnick and Fidell, 2013). According to Pallant (2013), multicollinearity exists when the correlation between variables is greater than 0.90 ($r > 0.90$). The presence of a high correlation between variables is claimed to make it difficult to assess the importance of each individual variable (Pallant, 2013).

Furthermore, it is difficult to treat highly correlated variables as different entities (Bryman and Cramer, 2011). Scanning across a correlation matrix of a data set can identify the Pearson correlation levels among the variables (Field, 2013). Variables with greater that a Pearson correlation of 0.90 ($r > 0.90$) are deemed to be highly correlated (Pallant, 2013; Tabachnick and Fidell, 2013). Basing on the results presented in Table 6.3, no case of multicollinearity was identified since all variables had a correlation of less than 0.90 ($r < 0.90$). The strongest correlation was observed between organisation ICT infrastructure and organisation affiliation ($r = 0.621$).

Table 6.3: Pearson's correlation matrix

Variables N = 50		*P1*	*P2*	*P3*	*F1*	*F2*	*F3*	*F4*	*F5*	*F6*	*O1*
P1	*ICT*	1									
P2	*OrgAff*	.621**	1								
P3	*PatTMAdp*	.224**	.015	1							
F1	*OrgRes*	.252**	.524**	.009	1						
F2	*OrgInnAcc*	.412**	.354**	.123*	.529**	1					
F3	*PsInnAcc*	.325**	.042	.062	.172**	.402**	1				
F4	*OrgInnCap*	.572**	.372**	.021	.459**	.442**	.342**	1			
F5	*OrgAg*	.315**	.425**	.042	.447**	.352**	.384**	.322**	1		
F6	*CoInno*	.411**	.544**	.062	.303**	.259**	.224**	.382**	.512**	1	
O1	*InOut*	.412**	.412**	.082	.487**	.421*	.346**	.295**	.452**	.314**	1
O2	*ExOut*	.392**	.522**	.102	.542**	.292**	.011	.341**	.462**	.512**	.356**

** Correlation is significant at the 0.05 level (2-tailed).*
*** Correlation is significant at the 0.01 level (2-tailed).*

6.3 Hypotheses testing

To test the model hypotheses, three separate discriminant models were developed. The first part of the model tested hypotheses concerning the influence of the model precursors namely: ICT infrastructure, organisation affiliation and patient telemedicine adoption on healthcare organisation factors. Also, the influence of organisation ICT infrastructure on organisation affiliation was examined. The second part of the model tested the influence of organisation factors namely: organisation resources, organisation's innovation acceptance, personnel innovation acceptance, organisation's innovative capacities, organisation agility and collaborative innovation aspects on internal innovation outcomes. The third part of the model tested the influence of organisation factors on external innovation outcomes. The scores used in regressions analysis were developed by computing the mean of all the measures that constitute each factor (adapted from Gagnon et al., 2012). Additionally, Bryman and Cramer (2011) recommend using mean computation since the overall index corresponds to the answers originally given by individual items. The subsequent sections of this chapter will highlight the results of each hypotheses test carried out.

6.3.1 Multiple regression analysis – Model 1

In this part of the analysis, hypotheses relating to influence of ICT infrastructure on organisation affiliation as well as the influence of model precursors (ICT infrastructure, organisation affiliation and patient telemedicine adoption) on healthcare organisation factors will be examined. Figure 6.1 shows hypotheses to be tested in this section.

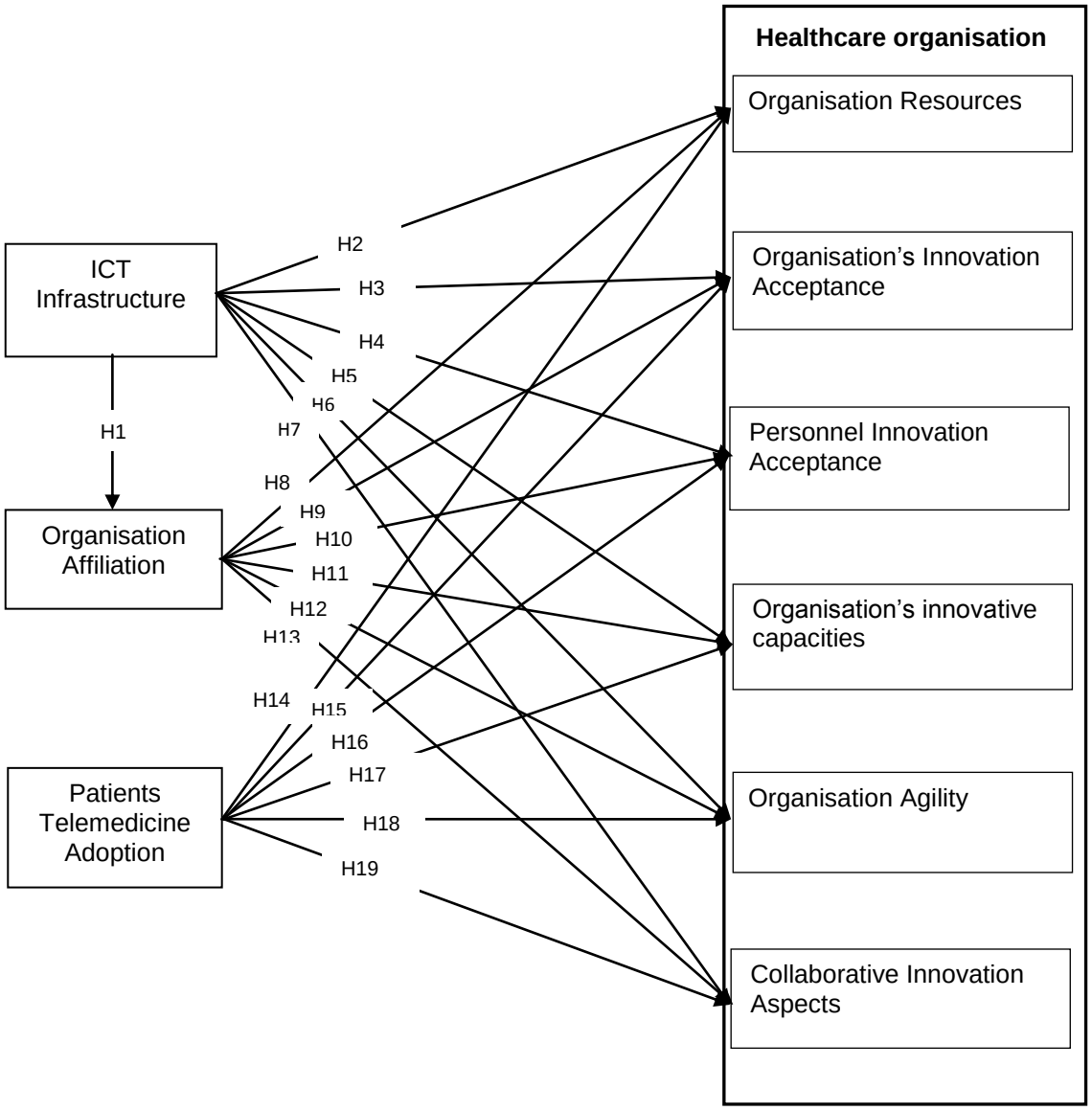


Figure 6.1: Model 1 regression analysis (influence of ICT infrastructure, organisation affiliation and patient telemedicine adoption on healthcare organisation factors)

6.3.1.1 Influence of ICT infrastructure on organisation affiliation

The first part of the analyses focused on the analyses relating to the influence of the model precursors on healthcare organisation factors. A single regression analysis was used to test hypotheses 1 (H1) since one independent variable and one dependent variable were under consideration as shown in Figure 6.2.

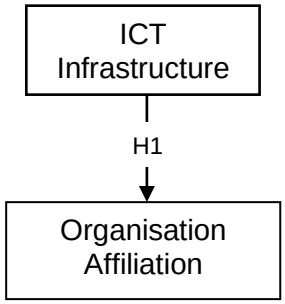


Figure 6.2: Single regression analysis for influence of ICT infrastructure on organisation affiliation

On the basis of the analyses, organisation affiliation is significantly influenced by the level of ICT infrastructure of the organisation. The results show that the model is significant ($p < 0.05$). Additionally, the coefficient of determination, R square, indicates how much of the variance in the dependent variable is explained by the model (Pallant, 2013). ICT was observed to be responsible for 38.5 % of the variance in organisation affiliation. According to Tabachnick and Fidell (2013), a better estimation of the coefficient of determination R square is provided by adjusted R square. Therefore, ICT was observed to be responsible for 38.1 % of the variance in organisation affiliation.

Additionally, Table 6.4 shows the multiple regression analyses results relating to H1. The results indicate that ICT infrastructure significantly affect organisation affiliation ($p < 0.05$). Moreover, the coefficient of the standardised Beta was determined. Beta coefficient measure how strongly each predictor or independent variable influences the dependent variable. The results indicated that ICT was responsible for 62.1 % of organisation affiliation. Therefore, basing on the set p value of 0.05, the study support hypothesis H1 since it has a significant value of 0.000.

Table 6.4: Single regression analysis – affiliation

Variable	*R*	*R Square*	*Adjusted R Square*	*Sig.*
	.621	.385	.381	.000
	Unstandardised Coefficients	*Standardised Coefficients*	*Hypothesis*	*Sig.*
	B	*Beta*		
Constant	5.727			.000
ICT	.621	.621	H1	.000

Dependent Variable: Organisation affiliation, Significant at the 0.05 level

6.3.1.2 Regression analysis for organisation resources

In this part of the analysis, the impact of organisation ICT infrastructure, organisation affiliation and patient TM adoption on organisation resources was examined as shown in Figure 6.3.

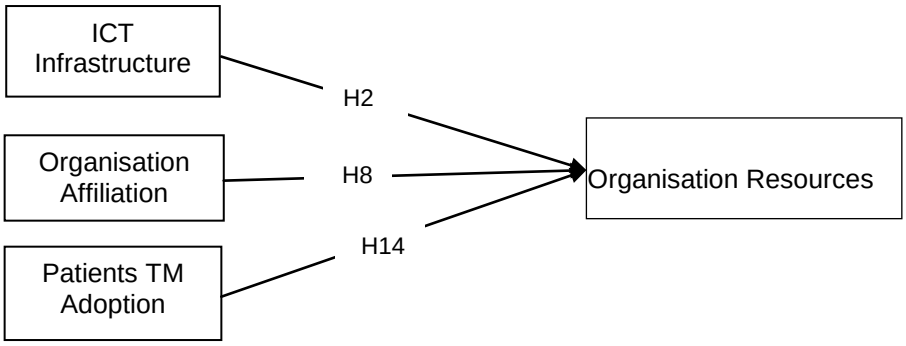


Figure 6.3: Multiple regression analysis for organisation resources

The multiple regression analyses results show that the model is statistically significant ($p < 0.05$). Additionally, this part of the analysis present coefficient of determinant, R square, where organisation ICT infrastructure, organisation affiliation and patient telemedicine adoption are responsible for 24.5% of the variance in organisation resources. The adjusted R square value of 23.1% was noted since it gives a better estimation of the coefficient of determination, R square.

Moreover, the statistical significance and standardised Beta coefficients of each model factor toward organisation resources are shown in Table 6.5. The results of the regression analyses show that ICT infrastructure and organisation affiliation significantly affected organisation resources. Patient telemedicine adoption had no significant effect on organisation resources. Moreover, the standardised Beta coefficients of the model show that organisation affiliation was the most influential factor towards organisation resources (30.5%) when compared to ICT infrastructure (24.4%).

Table 6.5: Multiple regression analysis – organisation resources

Variable	*R*	*R Square*	*Adjusted R Square*	*Sig.*
	.495	.245	.231	.000
	Unstandardised Coefficients	*Standardised Coefficients*	*Hypotheses*	*Sig.*
	B	*Beta*		
Constant	1.011			.046
ICT	.158	.244	H2	.015
OrgAff	.231	.305	H8	.002
PatTMAdp	.099	.130	H14	.065

Dependent Variable: Organisation resources, Significant at the 0.05 level

6.3.1.3 Regression analysis for organisation's innovation acceptance

This part of the analyses focuses on the effect of ICT infrastructure, organisation affiliation and patient TM adoption on organisation's innovation acceptance. Multiple regression analysis was employed to test hypotheses H3, H9 and H15 shown in Figure 6.4.

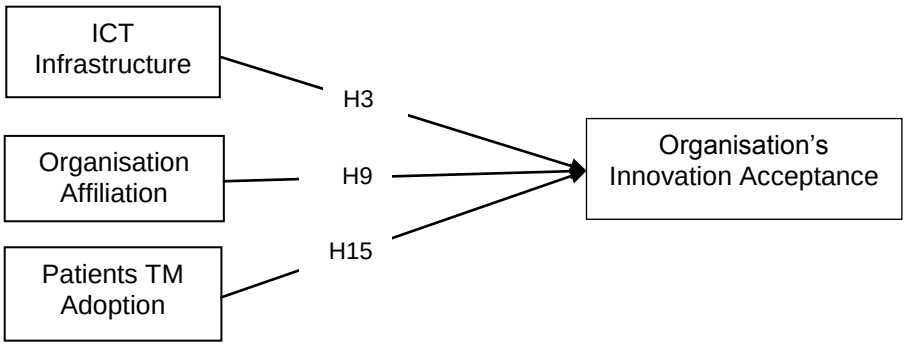


Figure 6.4: Multiple regression analysis for organisation's innovation acceptance

Basing on the multiple regression analysis results, this part of the analysis is statistically significant ($p < 0.05$). Furthermore, the test presented the coefficient of determinant, R square, where organisation ICT infrastructure, organisation affiliation and patient telemedicine adoption are responsible for 17.6% of the variance in organisation's innovation acceptance. The adjusted value of R square, 17.2%, was noted since it gives a better estimation of the coefficient of determination, R square.

Also, the statistical significance and standardised Beta coefficients of each model factor toward organisation's innovation acceptance as shown in Table 6.6. The results of the regression analyses show that ICT infrastructure, organisation affiliation and patient telemedicine adoption significantly affects organisation's innovation

acceptance. Besides, the standardised Beta coefficients of the model show that ICT infrastructure was the most influential factor towards organisation's innovation acceptance (35.8%) when compared to organisation affiliation (28.2%) and patient telemedicine adoption (16.3%).

Table 6.6: Multiple regression analysis – organisation's innovation acceptance

Variable	*R*	*R Square*	*Adjusted R Square*	*Sig.*
	.422	.176	.172	.000
	Unstandardised Coefficients	*Standardised Coefficients*	*Hypotheses*	*Sig.*
	B	*Beta*		
Constant	.433			.056
ICT	.290	.358	H3	.010
OrgAff	.192	.282	H9	.030
PatTMAdp	.112	.163	H15	.042

Dependent Variable: Organisation's innovation acceptance, Significant at the 0.05 level

6.3.1.4 Regression analysis for personnel innovation acceptance

Similarly, the effect of ICT infrastructure, organisation affiliation and patient TM adoption on personnel innovation acceptance was examined. Multiple regression analysis was employed to test hypotheses H4, H10 and H16 shown in Figure 6.5.

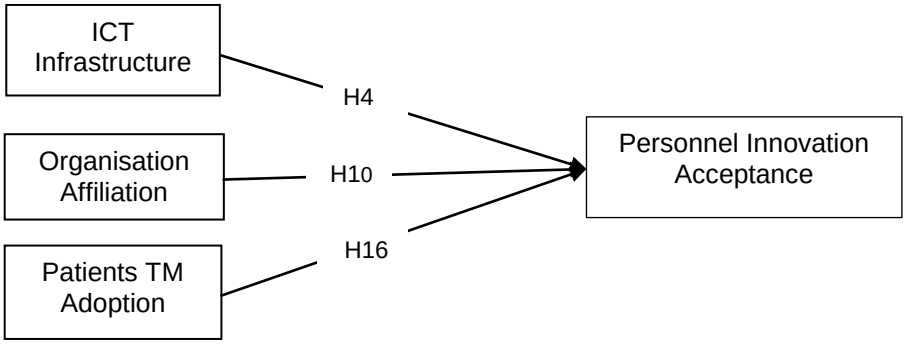


Figure 6.5: Multiple regression analysis for personnel innovation acceptance

The results show that this part of the analysis is statistically significant ($p < 0.05$). Moreover, the results presented coefficient of determinant, R square, where organisation ICT infrastructure, organisation affiliation and patient telemedicine adoption are responsible for 18.4% of the variance in personnel innovation acceptance. Adjusted value of R square of 16.8% was noted since it gives a better estimation of the coefficient of determination, R square.

Furthermore, the statistical significance and the influence of each factor towards personnel innovation acceptance is shown in Table 6.7. The results show that ICT infrastructure significantly affect personnel innovation acceptance. Organisation affiliation and patient telemedicine adoption had no significant effect on personnel innovation acceptance. Further, the standardised Beta coefficients of the model show that organisation ICT infrastructure was the most influential factor towards personnel innovation acceptance (29.3%).

Table 6.7: Multiple regression analysis – personnel innovation acceptance

Variable	*R*	*R Square*	*Adjusted R Square*	*Sig.*
	.428	.184	.168	.020
	Unstandardised Coefficients	*Standardised Coefficients*	*Hypotheses*	*Sig.*
	B	Beta		
Constant	.556			.023
ICT	.224	.293	H4	.001
OrgAff	.106	.098	H10	.062
PatTMAdp	.014	.054	H16	.074

Dependent Variable: Personnel innovation acceptance, Significant at the 0.05 level

6.3.1.5 Regression analysis for organisation's innovative capacities

Additionally, multiple regression analysis was employed to examine the impact of organisation ICT infrastructure (H5), organisation affiliation (H11) and patient TM adoption (H17) on organisation's innovative capacities as shown in Figure 6.6.

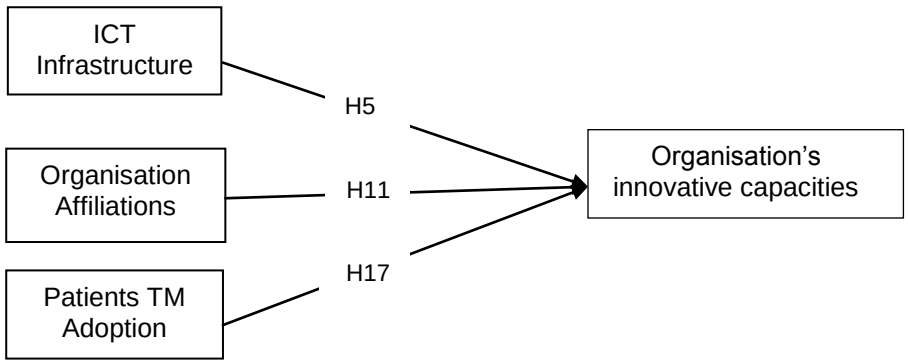


Figure 6.6: Multiple regression analysis for organisation's innovative capacities

Basing on the results, it was observed that this part of the analysis is statistically significant ($p < 0.05$). Also, the analysis presented coefficient of determinant, R square, where organisation ICT infrastructure, organisation affiliation and patient telemedicine adoption are responsible for 20.4% of the variance in organisation's

innovative capacities. Adjusted R square value of 27.5% was noted since it gives a better estimation of the coefficient of determination, R square.

In order to determine the relative importance of each of the independent variable, the standardised Beta coefficient of each variable was examined. As shown in Table 6.8, ICT infrastructure and organisation affiliation significantly affected organisation's innovative capacities. Patient telemedicine adoption had no significant effect on organisation's innovative capacities. Moreover, the standardised Beta coefficients of the model show that organisation ICT infrastructure was the most influential factor towards organisation's innovative capacities (34.5%) when compared to organisation affiliation (29.2%).

Table 6.8: Multiple regression analysis - organisation's innovative capacities

Variable	*R*	*R Square*	*Adjusted R Square*	*Sig*
	.455	.204	.275	.000
	Unstandardised Coefficients	*Standardised Coefficients*	*Hypotheses*	*Sig.*
	B	Beta		
Constant	2.468			.015
ICT	.292	.345	H5	.002
OrgAff	.234	.292	H11	.030
PatTMAdp	.014	.099	H17	.215

Dependent Variable: Organisation's innovative capacities, Significant at the 0.05 level

6.3.1.6 Regression analysis for organisation agility

The effect of ICT infrastructure, organisation affiliation and patient TM adoption on organisation agility was also examined where multiple regression analysis was used to test hypotheses H6, H12 and H18 shown in Figure 6.7.

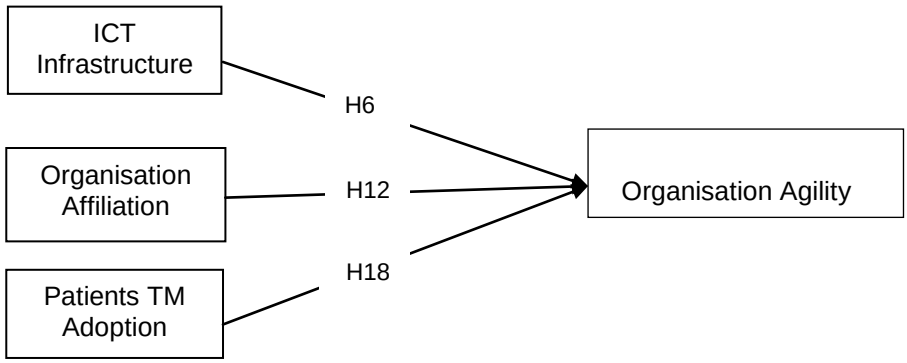


Figure 6.7: Multiple regression analysis for organisation agility

The results indicate that this part of the analysis is statistically significant ($p < 0.05$). Also, the results presented the coefficient of determinant, R square, where 12.6% of the variance in organisation agility can be explained organisation ICT infrastructure, organisation affiliation and patient telemedicine adoption. The adjusted R square value of 11.0% was noted since it gives a better estimation of the coefficient of determination, R square.

Similarly, the statistical significance of each variable and their standardised Beta coefficients toward organisation agility is highlighted in Table 6.9. Moreover, the results show that ICT infrastructure and organisation affiliation significantly affects organisation agility ($p < 0.05$). Besides, the standardised Beta coefficients of the model show that organisation affiliation was the most influential factor towards organisation agility (28.2%) when compared to organisation ICT infrastructure (22.5%) and patient telemedicine adoption (11.4%).

Table 6.9: Multiple regression analysis - organisation agility

Variable	*R*	*R Square*	*Adjusted R Square*	*Sig.*
	.355	.126	.110	.000
	Unstandardised Coefficients	*Standardised Coefficients*	*Hypotheses*	*Sig.*
	B	*Beta*		
Constant	1.537			.052
ICT	.183	.225	H6	.002
OrgAff	.252	.282	H12	.000
PatTMAdp	.096	.114	H18	.133

Dependent Variable: Organisation agility, Significant at the 0.05 level

6.3.1.7 Regression analysis for collaborative innovation aspects

In this section, the analysis focuses on the effect of ICT infrastructure, organisation affiliation and patient TM adoption on organisation collaborative innovation aspects. Multiple regression analysis was employed to test hypotheses H7, H13 and H19 shown in Figure 6.8.

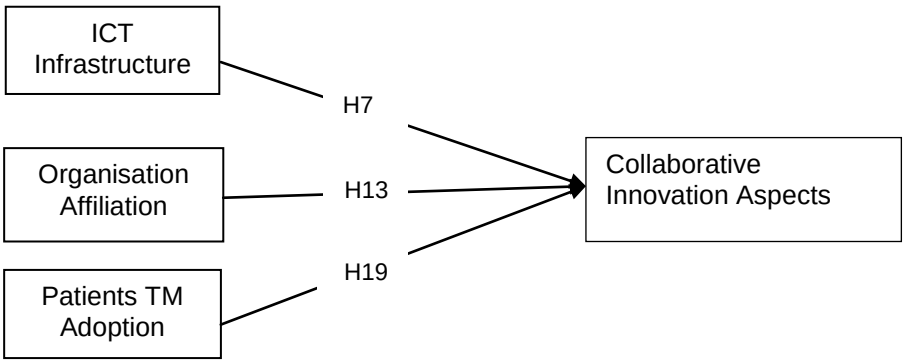


Figure 6.8: Multiple regression analysis for collaborative innovation aspects

The results indicate that this part of the regression analysis is statistically significant ($p < 0.05$). Furthermore, the results presented coefficient of determinant, R square, where 26.1% of the variance in organisation collaborative innovation can be explained organisation ICT infrastructure, organisation affiliation and patient telemedicine adoption. Adjusted value of R square value (25.2%) was noted since it gives a better estimation of the coefficient of determination, R square.

Likewise, the statistical significance of each variable and their standardised Beta coefficients toward organisation collaborative innovation is highlighted in Table 6.10. Basing on the regression analyses results, organisation ICT infrastructure and organisation affiliation significantly affects organisation collaborative innovation ($p < 0.05$). Besides, the standardised Beta coefficients of the model show that organisation affiliation was the most influential factor towards organisation collaborative innovation aspects (29.2%) when compared to organisation ICT infrastructure (24.1%).

Table 6.10: Multiple regression analysis - collaborative innovation aspects

Variable	*R*	*R Square*	*Adjusted R Square*	*Sig.*
	.512	.261	.252	.000
	Unstandardised Coefficients	*Standardised Coefficients*	*Hypotheses*	*Sig.*
	B	*Beta*		
Constant	1.104			.008
ICT	.196	.241	H7	.012
OrgAff	.262	.292	H13	.001
PatTMAdp	.064	.092	H19	.386

Dependent Variable: Collaborative innovation aspects, Significant at the 0.05 level

6.3.2 Influence of healthcare organisation factors on internal innovation outcomes (Model 2)

In this section, the analysis focuses on how the six healthcare organisation factors namely: organisation resources, organisation's innovation acceptance, personnel innovation acceptance, organisation's innovative capacities, organisation agility and organisation collaborative innovation aspects affect internal innovation outcomes. Multiple regression analysis was employed to test hypotheses H20, H22, H24, H26, H28 and H30 as shown in Figure 6.9.

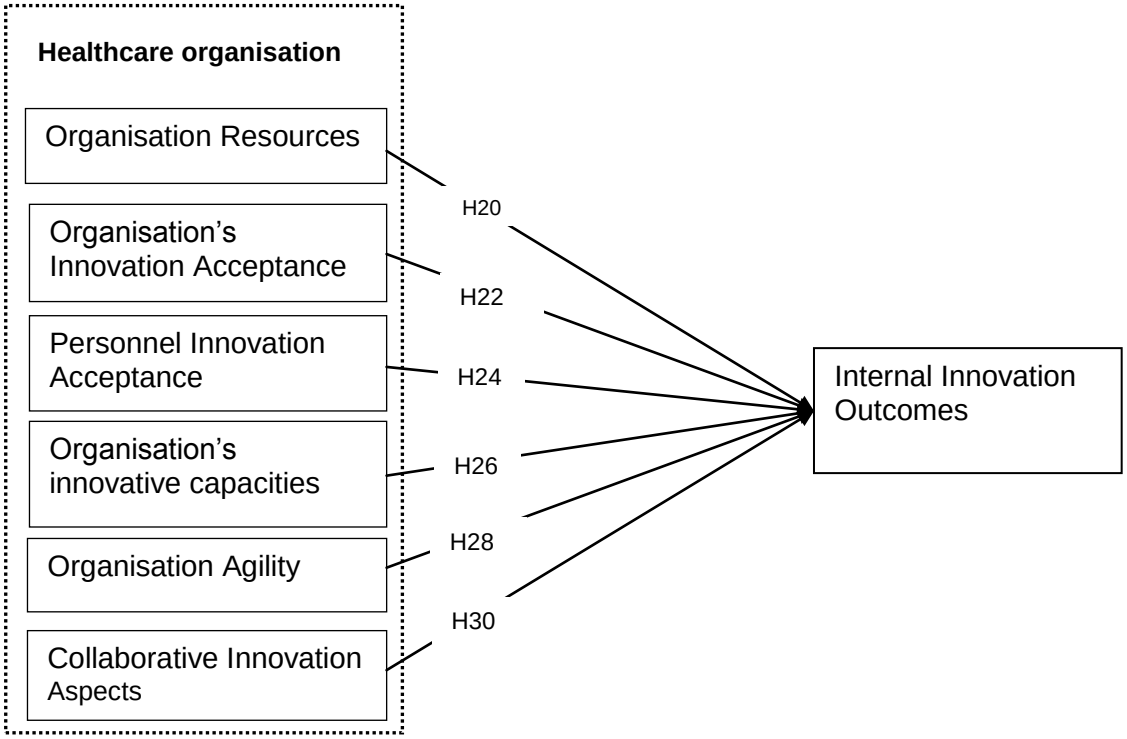


Figure 6.9: Multiple regression analysis - internal innovation outcomes

The regression analysis results show that this part of the analysis is statistically significant ($p < 0.05$). Furthermore, it was observed that the organisation factors (organisation resources, organisation's innovation acceptance, personnel innovation acceptance, organisation's innovative capacities, organisation agility and organisation collaborative innovation) are responsible for 46.8% of the variance in collaborative innovation internal outcomes. The adjusted value of R square of 46.5% was noted since it gives a better estimation of the coefficient of determination, R square.

Besides, in order to determine the relative importance of each independent factor, the statistical significance and standardised Beta coefficients was examined and shown in Table 6.11. The results of the regression analyses show that each of the model factors has a significant effect on internal innovation outcomes. Moreover, the standardised Beta coefficients of the model show that organisation's innovation acceptance was the most influential factor towards internal innovation outcomes (39.2%) followed by collaborative innovation aspects (36.5%) and organisation's innovative capacities (32.4%). On the other hand, personnel innovation acceptance was the least influential factor with a Beta value of 21.2%.

Table 6.11: Multiple regression analysis - internal innovation outcomes

Variable	*R*	*R Square*	*Adjusted R Square*	*Sig.*
	.682	.468	.465	.000
	Unstandardised Coefficients	*Standardised Coefficients*	*Hypotheses*	*Sig.*
	B	*Beta*		
Constant	17.288			.000
OrgRes	.251	.303	H20	.004
OrgInnAcc	.345	.392	H22	.001
PsnInnAcc	.106	.212	H24	.028
OrgInnCap	.284	.324	H26	.007
OrgAg	.243	.292	H28	.020
CoInno	.332	.365	H30	.004

Dependent Variable: Internal innovation outcomes, Significant at the 0.05 level

6.3.3 Influence of healthcare organisation factors on external innovation outcomes (Model 3)

In this section, the analysis focuses on how the six healthcare organisation factors namely: organisation resources, organisation's innovation acceptance, personnel innovation acceptance, organisation's innovative capacities, organisation agility and organisation collaborative innovation affect external innovation outcomes. Multiple regression analysis was employed to test hypotheses H21, H23, H25, H27, H29 and H31 as shown in Figure 6.10.

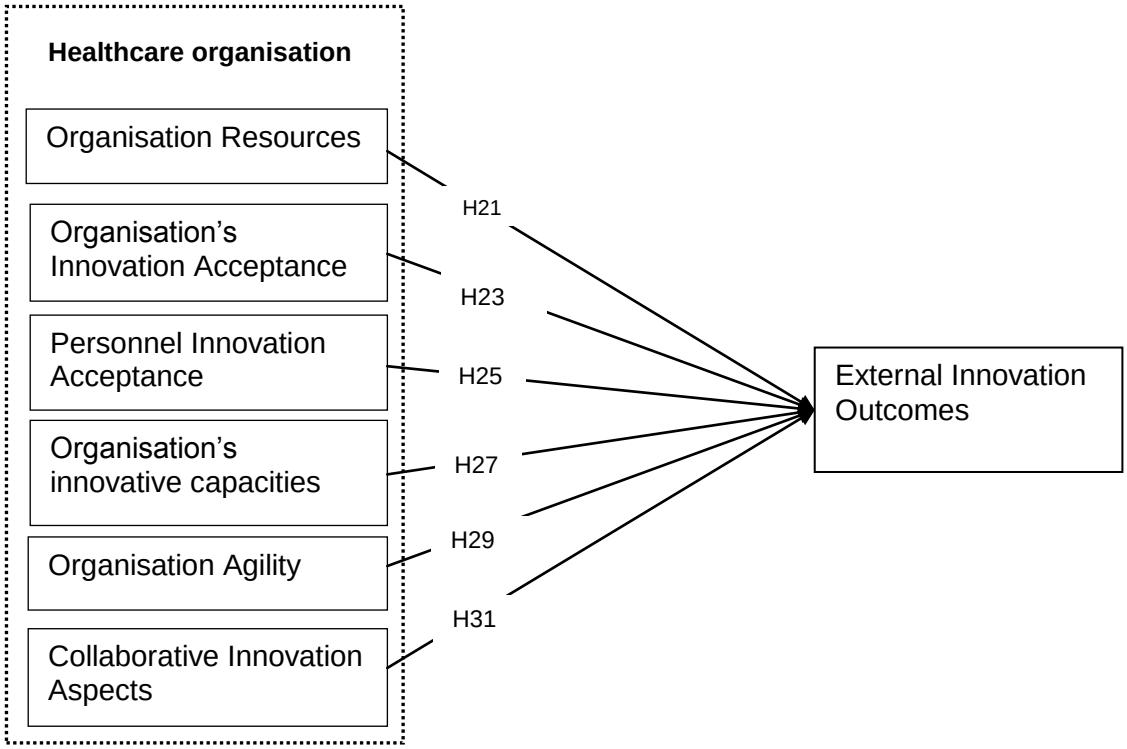


Figure 6.10: Multiple regression analysis - external innovation outcomes

Basing on the results of the regression analysis, this part of the analysis is statistically significant ($p < 0.05$). Moreover, it was observed that the organisation factors (organisation resources, organisation's innovation acceptance, personnel innovation acceptance, organisation's innovative capacities, organisation agility and organisation collaborative innovation) are responsible for 52.4% of the variance in collaborative innovation external outcomes. Nevertheless, the adjusted R square value of 53.2% was noted since it gives a better estimation of the coefficient of determination, R square.

To determine the relative importance of each independent factor, the standardised Beta coefficients was examined. As shown in Table 6.12, all the model factors except personnel innovation acceptance have a significant effect on external innovation outcomes. Moreover, the standardised Beta coefficients of the model show that organisation collaborative innovation was the most influential factor towards external innovation outcomes (39.4%) followed by organisation's innovative capacities (37.2%) and organisation's innovation acceptance (28.2%). On the other hand, personnel innovation acceptance was the least influential factor towards external innovation outcomes with a Beta value of 1.5%.

Table 6.12: Multiple regression analysis - external innovation outcomes

	R	*R Square*	*Adjusted R Square*	*Sig*
	.724	.524	.532	.000
Variable	*Unstandardised Coefficients*	*Standardised Coefficients*		
	B	*Beta*	*Hypotheses*	*Sig.*
Constant	17.546			.005
OrgRes	.190	.255	H21	.024
OrgInnAcc	.258	.282	H23	.012
PsnInnAcc	.046	.015	H24	.160
OrgInnCap	.344	.372	H27	.002
OrgAg	.283	.311	H29	.004
CoInno	.342	.394	H31	.000

Dependent Variable: External innovation outcomes, Significant at the 0.05 level

6.4 Summary of accepted and rejected hypotheses

Basing on the regression analyses results, all the research hypotheses examined are shown in Table 6.13 indicating the accepted or rejected hypotheses.

Table 6.13: Summary of accepted and rejected hypotheses as a result of regression analyses

Independent variable	*Dependent variable*	*Beta*	*Sig (P)*	*Std. deviation*	*Result*
ICT infrastructure	Org affiliation	0.621	0.000	0.324	Supported
	Org resources	0.244	0.015	0.465	Supported
	Org Inn Accept	0.358	0.010	0.612	Supported
	Personnel Inn Accept	0.293	0.001	0.392	Supported
	Org innovative capacities	0.345	0.002	0.401	Supported
	Org agility	0.225	0.002	0.620	Supported
	Collaborative innovation aspects	0.241	0.012	0.109	Supported
Organisation affiliation	Org resources	0.305	0.002	0.752	Supported
	Org Inn Accept	0.282	0.030	0.481	Supported
	Personnel Inn Accept	0.098	0.062	0.391	Not Supported
	Org innovative capacities	0.292	0.030	0.603	Supported
	Org agility	0.282	0.000	0.284	Supported
	Collaborative innovation aspects	0.292	0.001	0.432	Supported

Patient TM adoption	Org resources	0.130	0.065	0.599	Not Supported
	Org Inn Accept	0.163	0.042	0.382	Supported
	Personnel Inn Accept	0.054	0.074	0.438	Not Supported
	Org innovative capacities	0.099	0.215	0.501	Not Supported
	Org agility	0.114	0.133	0.391	Not Supported
	Collaborative innovation aspects	0.092	0.386	0.621	Not Supported
Org resources	Internal innovation outcomes	0.303	0.004	0.741	Supported
Org Inn Accept		0.392	0.001	0.242	Supported
Personnel Inn accept		0.212	0.028	0.734	Supported
Org innovative capacities		0.324	0.007	0.774	Supported
Org agility		0.292	0.020	0.372	Supported
Collaborative innovation aspects		0.365	0.004	0.507	Supported
Org resources	External innovation outcomes	0.255	0.024	0.527	Supported
Org Inn Accept		0.282	0.012	0.625	Supported
Personnel Inn accept		0.015	0.160	0.726	Not Supported
Org innovative capacities		0.372	0.002	0.899	Supported
Org agility		0.311	0.004	0.837	Supported
Collaborative innovation aspects		0.394	0.000	0.532	Supported
Total hypotheses = 31 Supported hypotheses = 24 Not supported hypotheses = 7					

Basing on the regression analyses results, organisation's innovation acceptance was observed to have the greatest contribution towards internal innovation outcomes with a Beta value of 0.392. Also, collaborative innovation aspects showed the greatest contribution towards external innovation outcomes with a Beta value of 0.394.

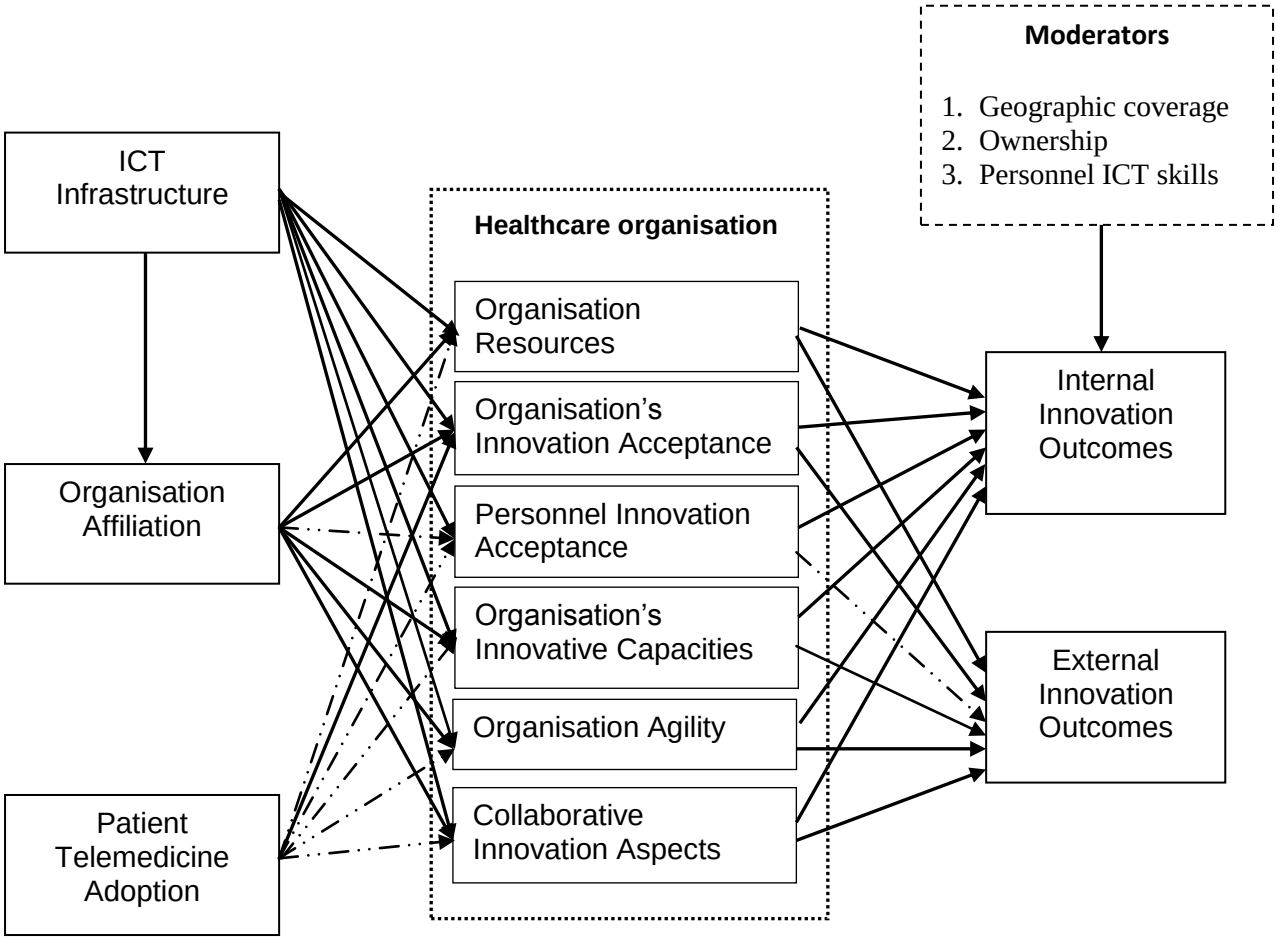


Figure 6.11: Hypotheses summary based on regression analysis results

Key:

Significant effect ($p < 0.05$):

No significant effect ($p > 0.05$):

6.5 Validation of the revised research model

A qualitative approach using interviews was used to validate the findings of this study. Face-to-face semi-structured interviews were carried out with five managers working in Kenyan healthcare sector. The interviewees selected were those who have served the Kenyan Ministry of Health (MoH) in government or private sector as healthcare administrators, minister of health, county director of health and medical superintendent (see Table 6.14). The results validation interview questions discussed the factors in the revised research model (Appendix B). Each interview took between 30 minutes to 1 hour.

Table 6.14: Validation interviewee profile

Position in MoH	*Organisation ownership*	*Years of experience in MoH*
Healthcare administrator	Government	22
Medical superintendent	Private	12
Minister of health	Government	7
County director of health	Government	9
Senior doctor	Private	14

6.5.1 ICT infrastructure

The results obtained from the field study showed that organisation's ICT infrastructure positively influences organisation affiliation, organisation resources, organisation's innovation acceptance, personnel innovation acceptance, organisation's innovative capacities, organisation agility and collaborative innovation aspects. One of the interviewee commented, *"our organisation has lagged in picking up new healthcare technologies. Lack of reliable ICT infrastructure has mainly contributed to the slow adoption because we are not in a good position to cope with the dynamic healthcare environment for example, we once tried to introduce teleradiology in radiography department but the connection speed was very slow. If fact, we lost some data in the process".*

Additionally, the interviewees from private sector argued, *"a reliable ICT infrastructure facilitates the adoption of new healthcare technologies. This is because majority of the emerging technologies require ICT technology. Establishing a reliable ICT platform to be used in healthcare is expensive. However, the benefits associated with it are enormous".* The healthcare director and minister of health added that the government is currently working on laying a reliable ICT infrastructure that will enable hospitals to adopt emerging technologies which require ICT connectivity. From one of the interviewee perspective, *"a reliable ICT Infrastructure will offer a wide range of healthcare technological innovations which will assist healthcare organisations in performing their operations efficiently. Also, working together of healthcare organisations irrespective of their geographic location will be facilitated by a reliable ICT network".*

6.5.2 Organisation affiliation

The results obtained from the survey questionnaire showed that organisation affiliation influences organisation resources, organisation's innovation acceptance, organisation's innovative capacities, organisation agility and collaborative innovative aspects. From healthcare administrator and medical superintendent perspective, *"whenever organisations work collaboratively especially in innovative projects, individual organisations become more agile mainly due to the sharing of resources and innovative tacit knowledge".* Furthermore, another interviewee highlighted that *"majority of healthcare innovations are financial and risks involving. Our organisation is slow in adopting these innovations. However, teaming up with other healthcare organisations in attempt to innovate will foster high level of innovative activities such as telemedicine uptake".* Moreover, the interviewees agreed with the survey results which highlighted that organisation affiliation has no direct effect on the willingness of the personnel to accept an innovation.

According to the interviewees, *"the personnel's likelihood to accept an innovation is mainly due to the perceived usefulness and ease of use of the innovation. Additionally, the personnel will easily reject an innovation that they think will make them redundant".* Furthermore, it was highlighted that organisation affiliation mainly introduces individuals with diverse knowledge of emerging technologies. However, how the personnel view the innovation is mainly a personal decision basing on the level of training given on the technology and its perceived usefulness.

6.5.3 Patient telemedicine adoption

Patient telemedicine adoption was observed to have a significant effect on organisation's innovation acceptance. From the interviewees' perspective, *"an organisation is receptive to an innovation when the end users of the innovation show interest on the innovation".* In an example given by one of the interviewee, a vacuum dresser machine introduced by their hospital was rejected by the patients because the patients claimed that the procedures involved when using the machine were many when compared to the traditional vacuum dresser. However, the survey results showed that patient telemedicine adoption had no significant effect on organisation resources, personnel innovation acceptance, organisation's innovative capacities,

organisation agility and collaborative innovation aspects. One interviewee commented that, *"the availability of innovation resources such as knowledgeable workforce and funds greatly influence the innovativeness of our organisation"*. Another interviewee claimed that, *"the patients do not define the innovativeness of our organisation. Mainly, our organisation's research and development department effort to explore new technologies in healthcare sector has a great impact on the innovativeness of our organisation".*

6.5.4 Internal innovation outcomes

The survey results revealed the importance of organisation's innovation acceptance, personnel innovation acceptance, organisation's innovative capacities, organisation agility and collaborative innovation aspects on internal innovation benefits. Organisation's innovation acceptance was observed to be the most influential factor towards organisation internal innovation benefits (β = 39.2). According to the interviewees, the above mentioned factors greatly influenced the internal innovation operations of their organisation. From the ministry of health management perspective, *"the technological innovativeness of the healthcare sector is an important driver for providing efficient healthcare systems. For example, emerging innovative medical technologies can save lives by providing sustainable healthcare".*

Furthermore, the interviewees confirmed that providing the hospital departments with the current technologies streamlined their operations which in turn increased the responsiveness the hospital personnel. Furthermore, the interviewees stated that healthcare personnel greatly influence the likeliness of an organisation to accept an innovation which in turn improves organisation's operations. According to the hospital management point of view; if a new technology is introduced and the healthcare personnel decline to use it, then its intended benefits will not be realised. The likeliness of our personnel to adopt a new technology is mainly based on the knowledge they have about the technology and the perceived ease of use. Furthermore, one interviewee claimed that any innovation that poses a threat of redundancy will be rejected by the personnel.

However, the interviewees believed that organisation resources have no direct effect on internal innovation benefits. It was argued that several managerial factors largely

influence the internal innovation benefits. One of the interviewees reported that although his organisation has resources needed to technologically innovate, at times the innovation benefits are not realised because the management does not motivate the personnel to use the innovation. During the main field study, a medical doctor commented, *"when a new technological which supersede the traditional method previously used is introduced, the personnel may need some motivation from the management in order to use the new technology otherwise they will prefer using the technology they are used to".*

6.5.5 External innovation outcomes

According to the interviewees, healthcare innovations do not only benefit the internal operations of an organisation. The interviewees believed that organisation resources, organisation's innovation acceptance, organisation's innovative capacities, organisation agility and collaborative innovation aspects influenced the external innovation operations of their organisation. Additionally, collaborative innovation aspect was identified to be the most influential factor towards organisation external innovation benefits (β = 0.394). One interviewee commented, *"when an organisation is determined to work in partnership with another organisation in attempt to innovate, the outcome of the partnership is likely to be accepted by all the partnering organisations".*

However, the interviewees stated that they are not surprised to notice that the healthcare personnel likeliness to accept an innovation has no effect on the external innovation benefits of an organisation. One interviewee commented, *"the external benefit we receive from any innovation is not influenced by our personnel in anyway. Mainly, our personnel influence the acceptance of an innovation by our organisation and the internal operations associated with it".*

6.5.6 Validation interviews summary

The purpose of the interviews was to verify the results from the main field study by interviewing the senior management of the Kenyan healthcare sector located in the Eastern region of Kenya. The results gathered from the interviews supported the revised model where it was confirmed that organisation resources, organisation's innovation acceptance, personnel innovation acceptance, organisation's innovative

capacities, organisation agility and collaborative innovation aspects have a direct effect on healthcare organisation internal innovation benefits where organisation's innovation acceptance was identified as the most influential factor. Also, the interviewees confirmed that organisation resources, organisation's innovation acceptance, organisation's innovative capacities, organisation agility and collaborative innovation aspect influenced the external innovation operations of healthcare organisations where collaborative innovation aspect was the most influential factor. Generally, no concerns were highlighted in the interviews regarding the revised model.

6.6 Chapter summary

In this chapter, the conceptual framework developed in Chapter 3 was tested. 31 hypotheses were formulated and further tested using single and multiple regression analysis. Basing on the level of significance ($p < 0.05$), 24 hypotheses were accepted and 7 hypotheses rejected. Additionally, the regression analysis tests results highlighted the importance of each model factor towards organisation collaborative innovation. It was observed that the healthcare organisation factors namely: organisation resources, organisation's innovation acceptance, personnel innovation acceptance, organisation's innovative capacities, organisation agility and collaborative innovation aspect are responsible for 46.5% of the variance in collaborative innovation internal benefits with organisation's innovation acceptance being the most influential factor ($\beta = 39.2$). Furthermore, it was observed that organisation resources, organisation's innovation acceptance, organisation's innovative capacities, organisation agility and collaborative innovation aspects are responsible for 53.2% of the variance in collaborative innovation external benefits with collaborative innovation aspect being the most influential factor ($\beta = 39.4$).

In the next chapter, the researcher reports the key findings of this research and aligns the findings with those from extant literature.

Chapter Seven: Discussion

7.1 Organisation adoption factors of e-Health systems

Managerial support plays a pivotal role in facilitating organisation collaboration (D'Amour et al., 2008). In a study on organisation collaboration in public sector (Bommert, 2010), it was noted that collaborative innovation in public sector is faced with scepticism regarding capacity to innovate public policies, organisations and services. Previous study results are in line with the current study results where the interviewees pointed out that government owned healthcare organisations lack a strategic approach when it comes to organisation collaboration to facilitate innovation. Furthermore, excessive control of public owned hospitals operations by politicians was claimed to be a barrier to organisation collaboration.

According to the survey results of this study, the level of healthcare personnel's ICT skills level influenced telemedicine acceptance by the personnel. Healthcare personnel ICT skills level was grouped into three categories namely: entry, intermediate and advanced where 32% of the respondents have entry level, 30% intermediate and 38% have advanced level. It was observed that personnel with advanced level of ICT skills are more receptive to telemedicine deployment compared to those with entry level of ICT skills (see Figure 5.19). These study results back up a study on healthcare organisations decision to adopt healthcare technologies in Malaysia where it was observed that the workforce level of competency on information and communication technologies influenced the adoption of healthcare innovations (Ahmadi et al., 2015). Additionally, Menachemi et al. (2004) argued that the lack of ICT literacy to use telemedicine approaches effectively has a negative effect on the speed of adoption of telemedicine technology. Also, the degree to which the physicians use ICT outside work can have an effect towards the adoption new technologies within a workplace.

According to Hollingworth (2013), one of the most common skills thought to be lacking in the adoption of emerging technologies is advanced IT or software skills. Similarly, healthcare personnel as well as patients' previous experience on ICT use has been observed to have a positive effect on the adoption of healthcare innovations (Ludwick and Doucette, 2009). Furthermore, Sheng et al. (2013)

highlighted the importance of ICT skills in healthcare organisations in Taiwan in facilitating innovation competitive advantage. Basing on the survey results, healthcare practitioners with entry level of ICT skills reported that they are not ready to adopt telemedicine technology until they are given the relevant training to use the technology. These results verify earlier studies on healthcare innovations where it was observed that previous experience of healthcare professionals with computers and associated computer skills should be taken into account when developing a telemedicine service (Broens et al., 2007). In the same vein, Chau and Hu (2002) highlighted that providing intense training to the physicians to increase their ICT competency will positively influence their decision to adopt telemedicine technology.

7.2 The relationship between organisation resources and innovation performance basing on geographic coverage

According to Damanpour (1992), different types of organisations use different measures of organisation size. As for the Kenyan healthcare system, healthcare organisation size is defined by its geographic coverage. Four main sizes of hospitals exist in the Kenyan healthcare system namely: national, provincial, county and healthcare centres. National hospitals have the largest geographic coverage followed by provincial hospitals, county hospitals and finally healthcare centres. In this research which covered 50 hospitals located in the Eastern region of Kenya, the portion of national hospitals included in the research is 14%, provincial hospitals is 14%, county hospitals 40% and healthcare centres 32%.

On examining the organisation agility of the hospitals examined in this study, it was noted that national hospitals, which are also classified as a large hospital basing on Kenyan healthcare system, were the most agile when compared to the other three categories (as shown in Figure 5.9). Healthcare centres were the least agile by having only one very agile healthcare centre. Kwon et al. (2013) divides organisation agility into the ability to sense and the ability to respond to market trends and changes. The ability to sense involves perceiving end users' needs, market changes and technologies developments whereas ability to respond refers to fulfilling the perceived needs with customised products and services that are delivered quickly.

The researcher further dichotomised the measure of organisation's innovative capacities into two categorises namely: less innovative and highly innovative. Score

dichotomisation was done using SPSS median split. Score dichotomisation is where a variable is split at the median to form high and low groups (MacCallum et al., 2002). Using SPSS median split, it was observed that the median for organisation's innovative capacities is 2.7. Therefore, scores of 2.7 and below were counted as 'less innovative' and scores of 2.8 and above were counted as 'highly innovative'. Additionally, score dichotomisation was done on organisation resources. It was observed that the median for organisation resources was 2.5. Therefore, scores of 2.5 and below were counted as 'limited resources' and those of 2.6 and above were counted as 'abundant resources'. It was observed that organisations with abundant resources are more innovative than those with limited resources as shown in Figure 7.1. These results align with results from previous studies where Perez et al. (2004) observed that the adoption of teleworking technology was influenced by the availability of resources such as funds, human resources and technology.

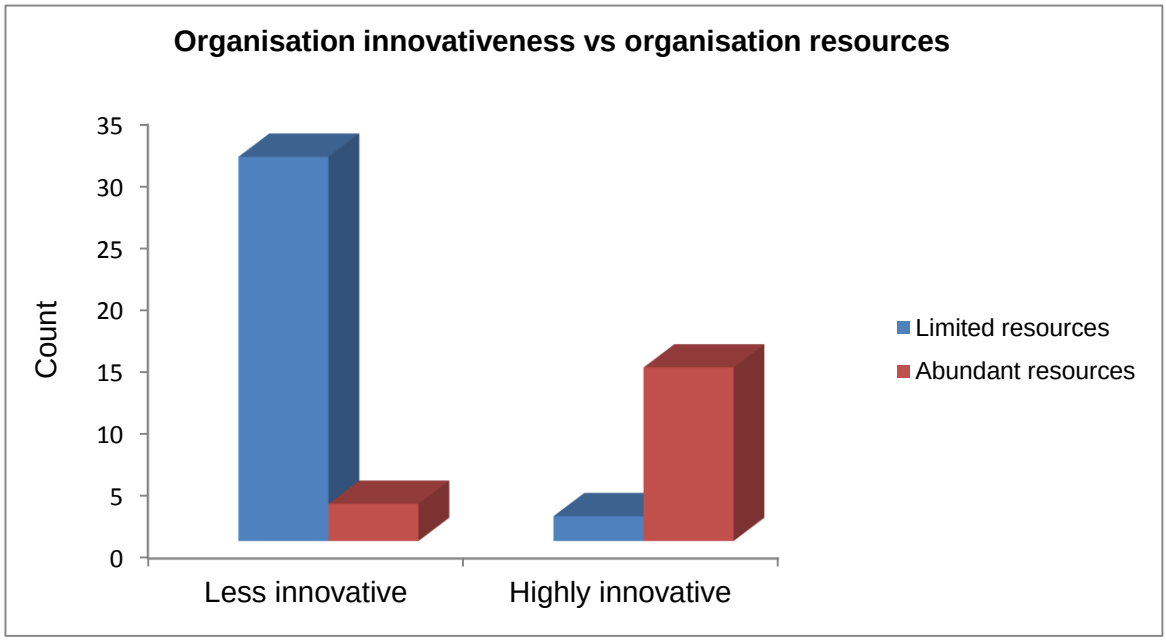


Figure 7.1: Organisation's innovativeness based on organisation resources

Additionally, a study on the relationship between organisation characteristics and its innovativeness (Hameed et al., 2012) found that large organisations are typically more innovative than small organisations. One possible explanation provided in a study on organisation issues influencing the implementation and adoption of health information technology innovations (Cresswell and Sheikh, 2013) is that large organisations have slack resources and a greater division of labour. This also aligns

with the findings of this study where national hospitals, also categorised as large size hospitals, were observed to have slack resources when opposed to healthcare centres which are categorised as small medical centres as shown in Figure 7.2.

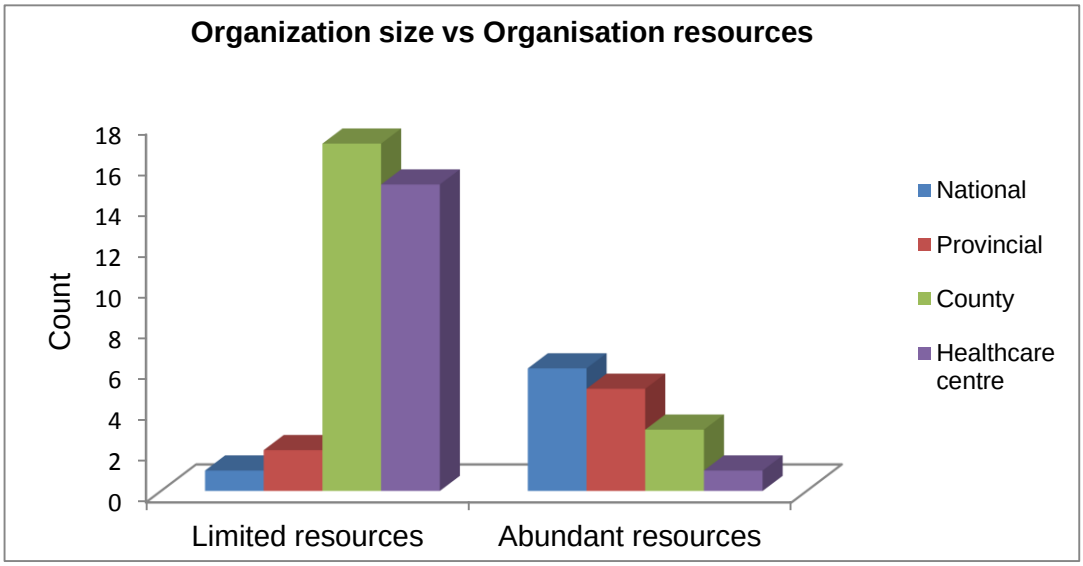


Figure 7.2: Relationship between organisation size and organisation resource level

These results validate earlier research work of Damanpour, (1992) whose results showed that organisation size is related to organisation resources. Similarly, Lee and Xia (2006) found that large size organisations have high input and output volumes which allow them to accumulate resources that can be used in technological developments.

Furthermore, the status of ICT infrastructure varied across various healthcare organisations based on their geographic coverage which in turn influenced the innovativeness of these organisations. Based on the field study results, national hospitals which are also termed as large healthcare organisations according to Kenyan healthcare system have a higher level of ICT infrastructure when compared to provincial hospitals. Healthcare centres were seen to have a low level of ICT infrastructure (Figure 5.5). These results align with findings of Fabiani et al. (2005) that a positive correlation exists between organisation size and ICT investment. In the same vein, Bayo-Moriones and Lera-López (2007) examined the determinants of ICT adoption in an organisation and it was observed that organisation size plays an important role where large organisations are able to allocate more resources to face ICT adoption expenses when compared to medium and small size organisations.

7.3 Collaborative innovation for e-Health systems

The survey demonstrated that the partnering of healthcare organisations influenced the technological innovativeness of the organisations examined in this study. According to Patel et al. (2012), partnering of organisations enables sharing of expertise, reduction of innovation costs, improved decision making and success in pursuing organisation innovation goals. Additionally, a study conducted by Michaelides et al. (2013) on understanding collaborative technologies showed that collaborative innovation is one of the ways of decreasing the risk of innovation failure thus increasing the possibility of an organisation to accept the innovation. The findings from previous studies are in line with the results of this study where the participants highlighted that organisation collaboration increases the ability of their organisation to innovate successfully.

Additionally, sharing of innovation costs was pointed out as the key driver to organisation collaboration during this study. Moreover, the survey results showed that the majority of organisations collaborate in an attempt to adopt new technologies rather than improve existing technologies. These results are similar to previous study findings conducted by Kazakci et al. (2008), Baldwin and Von Hippel (2011) and Durugbo and Riedel (2013) on organisation collaboration. Table 7.1 highlights the five reasons highlighted during the exploratory field study which were later examined during the main field study.

Table 7.1: Reasons for organisation collaboration

Collaboration objective	*Number of healthcare organisations*
Lessen budget restraint	21
Introduce new technologies	12
Expand technological knowledge	7
Share innovation risk	6
Improve existing technologies	4

Furthermore, it was observed that in order for healthcare organisations to facilitate the deployment of healthcare innovations, integration of various factors is essential. Organisation inputs which include human factors, technological factors and environmental factors in addition to organisation processes which include organisation collaboration, ICT infrastructure reliability and organisation leadership

and governance were observed to improve the performance of healthcare organisations as shown in Figure 7.3.

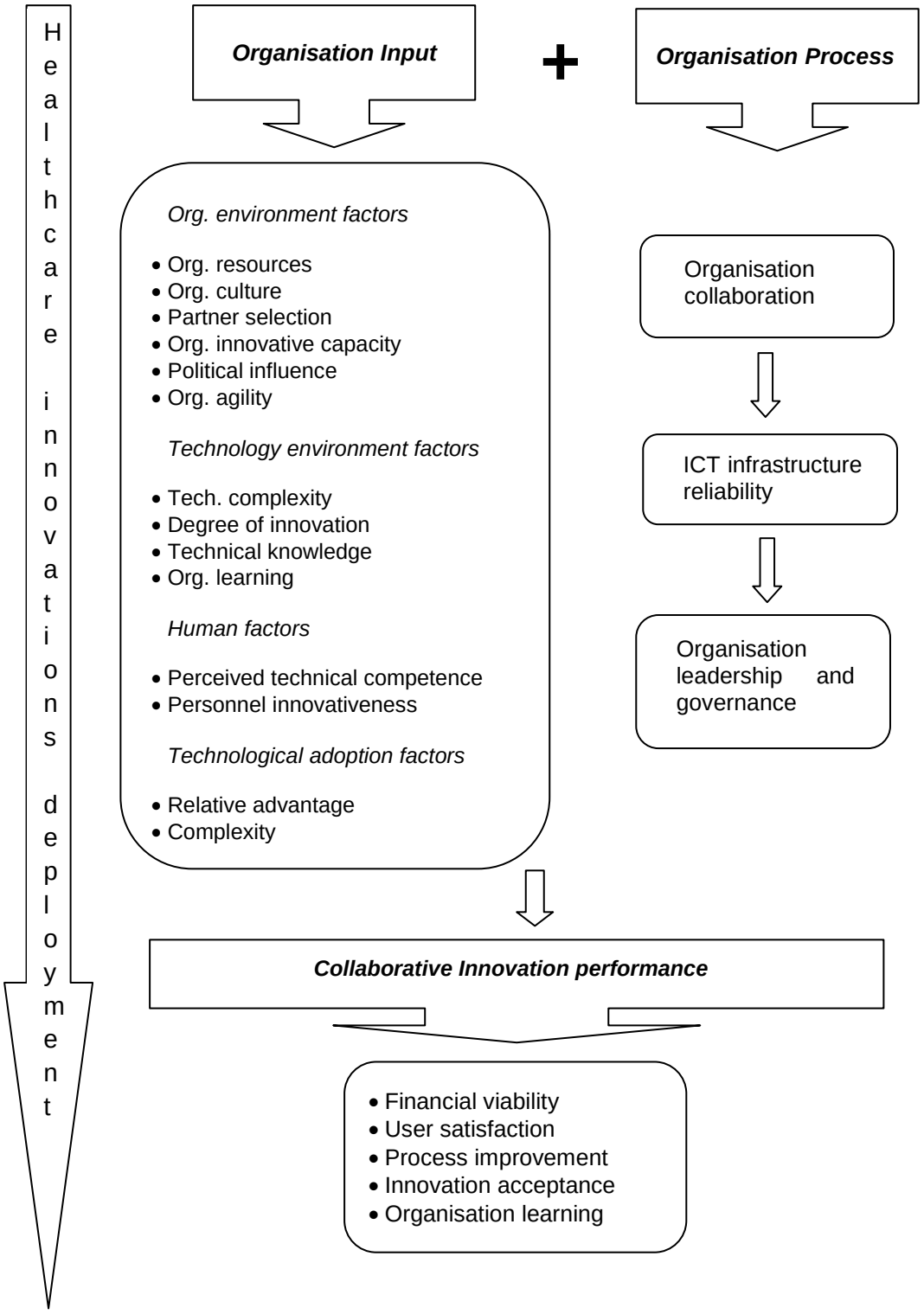


Figure 7.3: Organisation collaboration factors proposed and examined in this study

7.4 Impact of organisation characteristics on organisation innovation performance

In this study, various organisation characteristics were examined in terms of their influence on organisation innovation performance. They included: organisation resources, organisation's innovation acceptance, personnel innovation acceptance, organisation's innovative capacities, organisation agility and collaborative innovation aspects. In this study, organisation innovation performance was examined from two dimensions: internal innovation outcomes within the organisation and external innovation outcomes when focussing on healthcare sector. The results of the regression analysis of this study show that organisation likeliness to accept an innovation greatly influences the innovation performance of an organisation. These results are supported by previous studies where it was observed that the compatibility of an innovation with organisation culture and organisation's operating systems facilitated the speed of adoption of telehealth innovations (Gagnon et al., 2005).

It was also observed that organisation collaborative innovation has a great impact on organisation innovation performance. When organisations decide to collaborate, they enter into contracts with each other and agree on the distribution of innovation costs and the revenues. The results of this study are in-line with previous studies where it was observed that organisations engaging in collaborative innovation projects combine the best skills or core competencies and resources from other organisations (Romero and Molina, 2011). This enables them to have the capacity of executing sophisticated innovations that could not be executed by an individual organisation.

Survey results further illustrated that personnel innovation acceptance did not significantly influence innovation performance outside the healthcare organisation. However, personnel innovation acceptance influenced innovation performance within an organisation. These results corroborate with past studies where it was highlighted that the perceived usefulness of a healthcare innovation by healthcare personnel greatly influenced the acceptance of telemedicine technology (Zanaboni and Wootton, 2012).

7.5 Organisation ownership

Kenyan healthcare organisations may be owned by private organisation such as churches, learning institutions, companies, armed forces or by the government. In this study, 42% of the organisations are owned by private organisations whereas 58% are owned by the government. It was observed that the innovativeness of private owned healthcare organisations differed from that of government owned healthcare organisations. The results from this survey show that private owned healthcare organisations are more innovative than government owned healthcare organisations as shown in Figure 5.15. Additionally, T-test results show that significant difference exist between organisation ownership and organisation agility. These results align with the work of Damanpour (1991) who highlighted that private and public sectors have different levels of innovativeness. It was observed that private organisations are more likely to innovate than public organisations since public organisations mission as a provider of last resort restrains their resources thus limiting their innovative capacity.

Further, Boyne (2002) highlights that innovation in government organisations is mainly constrained by political forces as opposed to that of private sector which is controlled by market forces. This was also highlighted by the American Telemedicine Association (ATA) chief executive officer that *"the government is a lagging partner and one of the biggest barriers to new technology adoption in healthcare sector for over decades"* (Fierce health IT, 2013). Similarly, the findings of this research show that private owned healthcare organisations are highly collaborative as opposed to government owned healthcare organisations as shown in Figure 5.13. These results align with the findings of Sorensen and Torfing (2012) that highlighted that public organisations are characterised by slow moving administrations which results to lack of technological responsiveness and collaborative processes. Also, Donahue and Zeckhauser (2006) reported that excessive regulations governing public organisations impede the collaborative innovativeness of public organisations.

Also, this study highlights that organisation ownership influences the development of an organisation's ICT readiness. Private healthcare organisations have been found to have a well-developed ICT infrastructure compared to government healthcare organisations. This aligns with previous studies that have highlighted that private

owned organisations commit more resources towards ICT readiness. In a study on ICT readiness of Saudi healthcare organisations (Abdallah, 2010), it was reported that the government needs to allocate more resources towards the development of ICT infrastructure so as to facilitate the utilisation of e-Health.

7.6 ICT infrastructure

Previous studies have highlighted that the level of ICT infrastructure can make a substantial contribution to improving healthcare in developing countries. According to WHO (1997), the availability and sustainability of ICT is a facilitator to the adoption of new healthcare technologies such as telemedicine. On the other hand, private healthcare organisations are claimed to invest in ICT on the basis that the payback period is short (Lucas, 2008).

In light of the results of this study, organisation's ICT infrastructure was observed to be a facilitating condition for telemedicine deployment. Venkatesh et al. (2003) defines facilitating condition as the degree to which an organisation or technical infrastructure exists to support the use of a system. As shown in chapter 6, the status of the surveyed organisation's ICT infrastructure had a significant effect on organisation affiliation as well on the entire six healthcare organisation factors namely: organisation resources, organisation's innovation acceptance, personnel innovation acceptance, organisation's innovative capacities, organisation agility and collaborative innovation aspects.

Since telemedicine technology relies highly on ICT technology (WHO, 1997), the researcher further dichotomised ICT infrastructure into two categories: low level of ICT infrastructure and high level of ICT infrastructure. The dichotomisation was done using SPSS median split (median = 2.6) where scores of 2.6 and below were categorised as 'low level of ICT infrastructure' while score of 2.7 and above were categorised as 'high level of ICT infrastructure'. The results show that in order to enhance the innovativeness of a healthcare organisation, the status of the ICT infrastructure should be given some consideration. This is because organisations with a high level of ICT infrastructure were observed to be more innovative than those with a low level of ICT infrastructure (as shown in Figure 7.4). The result of this study verifies earlier results where a reliable ICT infrastructure has been claimed to

play a pivotal role in telemedicine deployment within the healthcare sector (WHO, 1997; Herzlinger, 2006). However, it was noted that one organisation was highly innovative despite the fact that its ICT infrastructure is low. On examining the raw data, it was a remotely located healthcare centre owned by Roman Catholic missionaries. During the validation interviews, it was highlighted that the clinic imports healthcare technologies from the founders located in Italy.

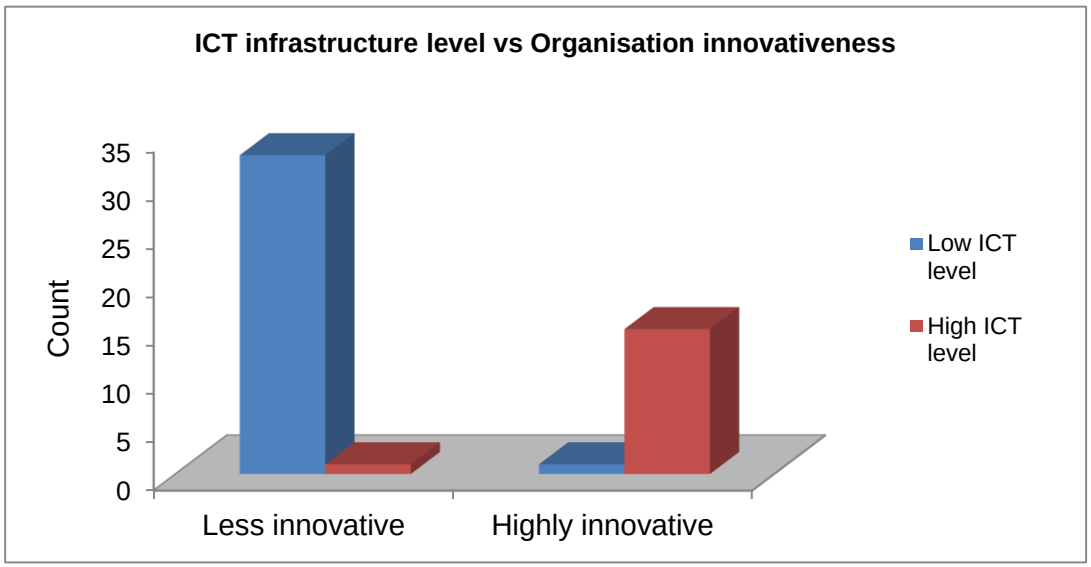


Figure 7.4: Effect of organisation ICT infrastructure level on organisation innovativeness

The researcher further examined the relationship existing between the number of collaborative innovation projects and organisation ICT infrastructure levels. As shown in Figure 7.5, healthcare organisations with a high level of ICT infrastructure were involved in a higher number of collaborative projects when compared to those with a low level of ICT infrastructure. These results align with the arguments of Swink (2006) and Silva et al. (2014) who revealed that ICT helps an organisation to overcome organisation barriers when collaborating to develop new technologies since it facilitates the exchange of superior and timely information.

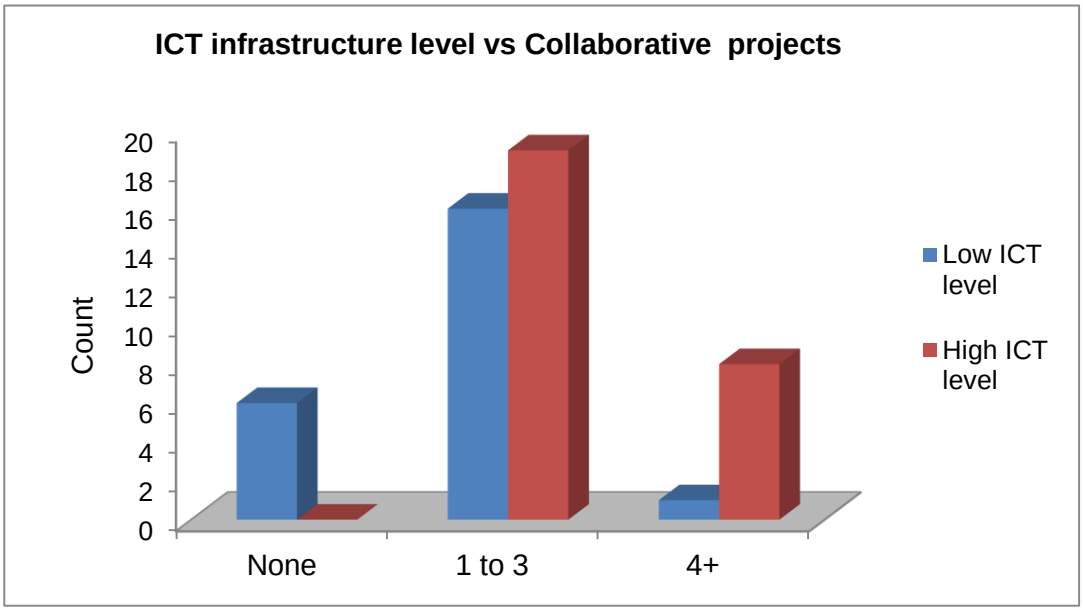


Figure 7.5: Number of collaborative projects based on ICT infrastructure level

7.7 Chapter summary

In this chapter, research data analysed using ANOVA test, t-test and regression was discussed. It was observed that the hospital's geographic coverage and the ownership significantly influenced the innovativeness of Kenyan hospitals. Moreover, hospitals reason to collaborate varied across the hospitals basing on geographic coverage and the ownership. However, hospitals reason to collaborate did not significantly vary between national and provincial hospitals. Additionally, no variation was observed between county hospitals and healthcare centres in terms of hospitals reasons to collaborate.

Furthermore, the findings highlighted that the model factors have a significant effect on Kenyan hospitals collaborative innovation benefits. However, personnel innovation acceptance had no significant effect on Kenyan hospitals external collaborative innovation benefits. Moreover, the findings of this survey suggest that organisation's innovation acceptance and collaborative innovation aspects have the greatest contribution towards organisation collaborative innovation benefits.

In the next chapter, this research will be concluded by highlighting academic and practical implications, limitations, and suggestions for future studies.

Chapter Eight: Conclusion

8.1 Introduction

The aim of this research is to examine healthcare organisation factors and innovation practices that influence organisation collaboration in facilitating telemedicine deployment in Kenya. In order to achieve the study aim, an extensive study of the extant literature was conducted. Three main areas were reviewed: telemedicine literature, technology innovation literature and organisation collaborative innovation literature.

Additionally, an exploratory study was carried out to develop a clearer understanding on organisation collaboration where repertory grid was used. The information gathered using repertory grid was used to design the collaborative innovation aspects section of the questionnaire. Other measures of the questionnaire were gathered from extant literature. Self-administered questionnaires were used to collect data from hospitals located in the Eastern region of Kenya where the questionnaires were distributed to healthcare practitioners working in those hospitals.

8.2 Summary of research findings

The regression analysis of the survey results showed that the majority of the Kenyan hospitals are willing to collaborate with other organisations so as to lessen budget restraint during innovative procedures. Fewer hospitals were willing to collaborate so as to improve existing technologies when compared to those collaborating so as to introduce new technologies. Hospital geographic coverage is an important factor when examining hospital's willingness to collaborate with other hospitals. National hospitals collaborate more than other hospitals. On the other hand, it was observed that government owned hospitals mainly collaborate so as to lessen budget restraint whereas private owned hospitals mainly collaborate in attempt to introduce new healthcare technologies.

The geographic coverage of a healthcare organisation is very important when examining the level of affiliation of an organisation. National hospitals are more affiliated to other hospitals when compared to provincial, county and healthcare centres. Furthermore, the amount of resources also differentiates Kenyan hospitals.

National hospitals are observed to have more resources when compared to other hospitals. This influences the innovativeness of the hospitals where national hospitals are observed to be more innovative. In terms of telemedicine collaborative innovation outcomes, internal innovation outcomes differed between national hospitals and county hospitals as well as between healthcare centres. All examined hospitals, basing on their geographic coverage, have similar findings when it concerns external innovation outcomes.

In terms of hospital ownership, it was observed that privately owned hospitals collaborate more than government owned hospitals although the difference is not significant. However, when it comes to the ICT infrastructure, private owned hospitals have a well-developed ICT infrastructure when compared to government owned hospitals. Also, a wide gap exists between private and government hospitals in terms of resources. Since private hospitals are much concerned about increasing the efficiency which in turn increases the financial performance of the organisation, more emphasises on innovation is needed which in turn requires sufficient resources. In terms of telemedicine collaborative innovation outcomes, all hospitals examined, basing on ownership, have similar views when it concerns internal and external innovation outcomes.

Furthermore, the results from regression analyses showed that an organisation affiliation has a strong positive relationship with organisation resources (52.4%), organisation collaboration innovation aspects (54.4%) and external innovation outcomes (52.2%). Additionally, organisation collaborative innovation aspects were observed to have a strong positive relationship with organisation agility (51.2%).
Also, the standardised Beta coefficients results show that:

Organisation affiliation is the most influential factor towards organisation resources (30.5%).
Organisation ICT infrastructure is the most influential factor towards organisation's innovation acceptance (35.8%).
Organisation ICT infrastructure is the most influential factor towards personnel innovation acceptance (29.3%).
Organisation ICT infrastructure is the most influential factor towards organisation's innovative capacities (34.5%).

Organisation affiliation is the most influential factor towards organisation agility (28.2%).

Organisation affiliation is the most influential factor towards organisation collaborative innovation aspects (29.2%).

Organisation's innovation acceptance is the most influential factor towards internal innovation outcomes (39.2%) followed by collaborative innovation aspects (36.5%) and organisation's innovative capacities (32.4%).

Organisation collaborative innovation aspects is the most influential factor towards external innovation outcomes (39.4%) followed by organisation's innovative capacities (37.2%) and organisation's innovation acceptance (28.2%).

Personnel innovation acceptance did not play a significant role towards external innovation outcomes (1.5%).

8.3 Research contribution to knowledge

This research made the following contributions to knowledge:

1. To the best of the researcher's knowledge, this study is the first study to examine telemedicine deployment through organisation collaboration in developing countries. It contributes to the body of knowledge about facilitating telemedicine deployment in developing countries.

2. This study has brought some valuable insights to the existing literature concerning telemedicine deployment by identifying organisation factors and innovation practices influencing organisation collaboration in facilitating telemedicine deployment in developing countries.

3. With its focus on developing countries, this study has developed an organisation framework for telemedicine deployment. This can aid healthcare policy makers within the healthcare sector to understand which healthcare organisation factors make the greatest contribution towards telemedicine collaborative innovation outcomes.

4. This study has contributed to knowledge through publications which have been exposed to double-blind peer review. The publications are available online to future researchers.

5. This study has contributed to methodology where repertory grid (RepGrid) was used to examine why Kenyan healthcare organisations would like to get involved in collaborative projects. To the best of researcher's knowledge, this method has not been previously used in the context of organisation collaborative innovation.

8.4 Academic contribution

The findings of this study provide several implications for academicians concerning healthcare organisation factors and innovation practices that influence organisation collaboration in facilitating telemedicine deployment in developing countries.

Firstly, the results of this study concerning the influence of healthcare organisation collaboration on organisation innovativeness have been published in International Journal of e-Healthcare Information Systems (IJe-HIS), Volume 2, Issue 2, ISSN 2046-3332 which can be accessed online. This article will be used by future researchers to expand their understanding on telemedicine deployment and organisation collaboration.

Secondly, the exploratory study of this research provided empirical evidence on why healthcare organisations in developing countries collaborate.

Thirdly, in terms of existing literature on telemedicine deployment and organisation collaboration, this research highlighted the importance of organisation affiliation in healthcare organisations in developing countries.

Fourthly, the results of this research narrows the gap highlighted by: WHO (1997), Bommert (2010) and Jakobsen et al. (2014) in their study on telemedicine deployment in developing countries. They stress that there is a lack of empirical studies on organisation collaboration to promote telemedicine deployment in developing countries.

Lastly, this study has supported and approved extant literature on the importance of a well-developed ICT infrastructure in facilitating telemedicine deployment.

8.5 Managerial implications

This study provides healthcare decision makers with important views on how to facilitate the adoption of telemedicine technology. The study has developed a guideline framework for healthcare decision makers in Kenya that can be used to expedite the adoption of telemedicine through organisation collaboration. The findings help healthcare decision makers to understand which healthcare organisation factors make the greatest contribution towards collaborative innovation performance. Organisation affiliation in this research has been found to be the most influential factor towards the agility of healthcare organisations as well as towards collaborative innovation aspects.

The results also revealed that national hospitals have more resources when compared to provincial, county hospitals and healthcare centres which explains why national hospitals are more innovative and agile. Also, the results suggest that the majority of hospitals affiliate with other organisations to lessen budget restraints during the innovation process. On the other hand, the results revealed that few organisations collaborate with other organisations in an attempt to improve existing healthcare technologies. In this research, it was revealed that majority of the hospitals collaborate to introduce new technologies.

Additionally, this research offers healthcare decision makers with significant factors that increase the innovativeness of a hospital. As far as hospital ownership is concerned, the results revealed that private owned hospitals are more innovative than the government owned hospitals. This could be as a result of a well-developed ICT infrastructure and sufficient resources present in private hospitals as the respondents stated that *"government hospitals are highly dependent on government funding for service delivery although the amount of funds dedicated to healthcare innovations by the government is not enough to cope with the dynamic technological advancements in healthcare sector".*

As a result, the researcher makes the following suggestions to the policy makers in an attempt to facilitate the adoption of telemedicine technology in healthcare sector:

- Organisation collaboration: Public organisations' working jointly with private organisations has been highlighted to greatly influence the adoption of

healthcare technologies. As far as organisation collaboration is concerned, organisation innovation resources in terms of finances, human and organisation assets are increased which in turn increases the innovativeness of healthcare organisations. Healthcare policy makers can promote organisation collaboration by mainly shortening bureaucratic procedures that was highlighted as one of the key barriers to organisation collaboration especially in the public sector. Additionally, healthcare organisations policies and culture should allow collaboration with other organisations in attempt to facilitate the adoption of technologies.

- ICT infrastructure: In relation to the results of this study, ICT infrastructure was observed to be one of the key requirements in the implementation of telemedicine. A reliable ICT infrastructure is a necessity to every organisation attempting to adopt telemedicine. As a result, healthcare policy makers should ensure that the ICT infrastructure is compatible with healthcare organisation's telemedicine devices and integrates well with the healthcare organisation's culture. Additionally, it is recommended that the bandwidth for a telemedicine link should be greater than 50Mbps to optimise the delivery of healthcare through telemedicine. Furthermore, the fear of patient medical data security was highlighted to be a hindrance to telemedicine deployment. Therefore, healthcare policy makers should ensure data security policies are specified.
- Healthcare personnel training: Healthcare innovations such as telemedicine require expatriates in order to use the technology effectively. During the field study, it was highlighted that healthcare personnel may shy from accepting a technology due to the lack the technical knowledge required. Respondents with advanced level of ICT skills (which is one of the requirements for telemedicine technology use) were observed to be readily willing to adopt emerging healthcare technologies. Therefore, healthcare policy makers should focus on organising trainings to advance the ICT skills for the healthcare personnel.

Furthermore, the results of this study can be applied by healthcare policy makers in other developing countries with similar economic circumstances attempting to adopt telemedicine.

8.6 Achieving research objectives

The aim of this study is to examine healthcare organisation factors and innovation practices which influence organisation collaboration in facilitating telemedicine deployment in Kenya. In order to meet the aim of this study, the following objectives were proposed:

1. To identify the issues that affects the adoption of telemedicine technology in developing countries.
2. To develop a conceptual framework for telemedicine deployment through organisation collaboration to promote a guideline framework for the Kenyan healthcare sector and policy makers.
3. To demonstrate that the framework on the adoption of telemedicine devised during these research can support the analysis of healthcare collaborative innovation performance.
4. To validate the conceptual framework developed by evaluating it in the context of the deployment of telemedicine deployment by conducting interviews.

In order to achieve these objectives, three approaches were used. Firstly, extant literature related to telemedicine, organisation technology innovation and organisation collaborative innovation was extensively reviewed. Secondly, an exploratory study to examine why UK and Kenyan hospitals collaborate was conducted using repertory grid. Thirdly, field study was carried out where questionnaires were self-administered to healthcare practitioners located in Eastern Kenya. The field data was analysed quantitatively using SPSS.

1st objective: To achieve the first objective, an extensive study of the extant literature on telemedicine and technology innovation was carried out. This is presented in chapter 2.

2nd objective: The second objective was achieved by identifying the key factors that influence organisation collaboration from extant literature coupled with the key factors highlighted at the exploratory study phase. This is presented in chapters 2, 3 and 4.

3rd objective: The third objective was achieved by conducting the main field study where the raw data was statistically analysed to test the hypotheses formulated in chapter 3. Reliability test, correlation test, ANOVA test, T-test and multiple regression tests was carried out. This is presented in chapters 5 and 6.

4th objective: To achieve the fourth objective, interviews were carried out with senior healthcare practitioners and policy makers. This is presented in chapters 6.

8.7 Answering research questions

The following research questions were formulated so as to examine the factors influencing organisation collaborative innovation performance of Kenyan healthcare organisations:

Research question 1: What factors affect telemedicine deployment in developing countries?

A comprehensive background study was carried out to identify potential factors influencing telemedicine deployment in developing countries which were then tested empirically.

Research question 2: What is the status of the key infrastructural technologies affecting telemedicine deployment in Kenya?

A field study was carried out in Kenyan healthcare organisations to examine the key infrastructural technologies affecting telemedicine deployment. The raw data was quantitatively and statistically analysed using SPSS. The results are presented in chapter 5, 6 and 7.

Research question 3: To what extent does organisation collaboration influence healthcare innovation performance?

A field study was carried out in Kenyan healthcare organisations to examine the impact of organisation collaboration in facilitating healthcare innovations in Kenya. The raw data was quantitatively and statistically analysed using SPSS. The results are presented in chapter 5, 6 and 7.

8.8 Research limitations

In this research, effort has been made to develop a comprehensive research framework, employ reliable and valid measures of study variables and analyse the data using robust statistical techniques. Additionally, a research design that maximises the generalisability of the research findings has been developed. However, as with any study of this nature, it is important to recognise and understand the study limitations.

Firstly, this study employed a cross-sectional survey design. A cross-sectional survey is carried out within a single point of time and does not provide definite information about cause and effect relationship existing between the study factors (Bryman, 2012). Cross-sectional survey design is commonly preferred when the researcher has time and resource restriction (Collis and Hussey, 2013).

Secondly, hospitals located in the rural areas have fewer healthcare practitioners hence less opportunities for data sample. Further, due to their limited experience of telemedicine in practices, issues and barriers which are currently un-identified may arise.

Further, some of healthcare practitioners located in rural areas were not well informed about telemedicine technology. As a result, they could not participate in the survey thus decreasing the number of respondents from the rural areas.

Finally, this study focussed on the Kenyan healthcare system and its applications of telemedicine around eClinics. However, the structure of the Kenyan healthcare system might not fit the healthcare structure of some other developing countries hence providing difficulties in generalising the results of this study.

8.9 Recommendation for future research

The findings from this study and the limitations have paved the way for future research directions and investigations. Several future research recommendations and suggestions are thus presented which might be of interest to future researchers.

1. The researcher suggests the need to carry out quantitative study incorporating other potential collaborators such as telecommunication companies, healthcare product manufacturers, research organisations and academic institutions. This is because the needs, wants and expectations of healthcare stakeholders vary.

2. Since this study focussed on the Kenyan healthcare system, it would be interesting to use the research model developed to further examine whether the model can be adopted by other developing countries having difficulties in the attempt to adopt telemedicine.

3. Other researchers may use a longitudinal research design approach to examine cause and effect relationship existing between the model factors as well as to detect organisation changes that may affect the outcomes of this research over a period of time.

4. A study to examine the future of funding given that organisation collaboration has the potential to facilitate temedicine adoption in developing countries is also needed.

8.10 Chapter summary

Despite the limitations faced in this research, the research makes a substantial contribution in the field of healthcare technology adoption and organisation collaboration. The study proposed a conceptual model to understand how organisation collaboration expedites telemedicine deployment in developing countries.

Since telemedicine is an evolving healthcare technology, it is believed that the findings obtained in this study will be beneficial in providing the necessary guidance for healthcare organisations wishing to adopt the technology.

To this end, this study has fulfilled its goals and expectations and has answered all research questions initially set at the beginning of the study. The findings of this study are beneficial to academicians and future researchers, healthcare technology innovation literature and to healthcare policy makers.

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APPENDIX A: SURVEY QUESTIONNAIRE

Collaborative innovation as a facilitator to Telemedicine deployment

Information for respondents

Study Purpose:

The purpose of this study is to examine how organisations can facilitate the implementation of Telemedicine *(TM)* in Kenya through Collaborative Innovation (*Collaborative innovation*).

- ***Telemedicine (TM):*** The use of electronic and telecommunications technologies to provide and support health care when distance separates the participants.
- ***Collaborative Innovation (Collaborative innovation):*** An innovation that necessitates co-operation among various organisations, actors, levels or segments

Confidentiality:

The raw information provided in this questionnaire will be strictly treated as confidential. The statistically processed information can be used by the majority of developing countries in their attempt to implement telemedicine. This information will be made available to all developing countries who wish to implement telemedicine through government of Kenya portal as well as Brunel University Research Achieves *(BURA).*

Assistance

If you require any assistance during the completion of this questionnaire, please contact me on:

Name: Janerose Nyamu
Email: empgjkn@brunel.ac.uk

Thank you very much for your cooperation

Profile Information

Organisation name ….....

Organisation ownership: Private ☐ Government ☐ Other ….....

Geographic coverage: National ☐ Provincial ☐ County ☐

Community health centre ☐

Departmental speciality …….

Job role……

Number of years in the organisation.....

ICT skills level: Entry ☐ Intermediate ☐ Advanced ☐

Have you ever used any telemedicine application before? Yes ☐ No ☐

How many collaborative healthcare innovative projects has your department been involved in?

☐

Using the scale below, please rate your level of agreement with the following statements (1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree)

1. Collaborative Innovation aspects:

What were your objectives for undertaking healthcare collaborative projects?

	Strongly Disagree	**2**	**3**	**4**	**Strongly Agree**
F) Introduce new healthcare technologies.	☐	☐	☐	☐	☐
G) Improve the existing technologies.	☐	☐	☐	☐	☐
H) Solve the problem of innovation budget restraint.	☐	☐	☐	☐	☐
I) Share innovation risks with collaborators.	☐	☐	☐	☐	☐
J) Expand technological knowledge.	☐	☐	☐	☐	☐

Any comments:

……..**.....**

……

2. Patient's TM Adoption aspects:

	Strongly Disagree	2	3	4	Strongly Agree
A) Patients will adopt TM assuming they have access to it.	☐	☐	☐	☐	☐
B) Patients will easily adopt TM if trained on how it is used.	☐	☐	☐	☐	☐
C) Patients will fully adopt TM if they first see its benefits.	☐	☐	☐	☐	☐
D) Patients will be willing to discuss their health issues via TM	☐	☐	☐	☐	☐
E) Patients will prefer using TM for diagnosis.	☐	☐	☐	☐	☐

3. Information and Communication Technology (ICT):

	Strongly Disagree	2	3	4	Strongly Agree
A) ICT infrastructure needed for supporting healthcare innovation is present.	☐	☐	☐	☐	☐
B) Our ICT is reliable (readily available).	☐	☐	☐	☐	☐
C) Our ICT infrastructure integrates well with organisation practices.	☐	☐	☐	☐	☐
D) Our ICT infrastructure is ready for TM adoption.	☐	☐	☐	☐	☐
E) TM will improve access to patient's data.	☐	☐	☐	☐	☐

4. Organisation Resources:

	Strongly Disagree	2	3	4	Strongly Agree
A) We have expertise to introduce healthcare innovations.	☐	☐	☐	☐	☐
B) We have expertise to implement healthcare innovations.	☐	☐	☐	☐	☐
C) We have funds to support innovation.	☐	☐	☐	☐	☐
D) We can use renowned expertise to train our staff in using TM.	☐	☐	☐	☐	☐

5. Organisation Affiliations:

	Strongly Disagree	2	3	4	Strongly Agree
A) We have a climate that fosters collaborative innovation.	☐	☐	☐	☐	☐
B) Collaboration has enabled introduction of new healthcare innovations	☐	☐	☐	☐	☐
C) The current collaborations are useful to our organisation.	☐	☐	☐	☐	☐
D) Future collaborations will increase our organisation's productivity.	☐	☐	☐	☐	☐
E) TM will facilitate collaborative working.	☐	☐	☐	☐	☐
F) TM will facilitate consultation with specialists.	☐	☐	☐	☐	☐

6. Personnel Innovation Acceptance:

	Strongly Disagree	2	3	4	Strongly Agree
A) I am confident in my ability to use TM.	☐	☐	☐	☐	☐
B) My colleagues will be willing to adopt TM.	☐	☐	☐	☐	☐
C) TM can be integrated within the existing practices.	☐	☐	☐	☐	☐
D) TM will improve healthcare provision in the organisation.	☐	☐	☐	☐	☐
E) TM will enable live consultations with specialists.	☐	☐	☐	☐	☐

Do you have any concerns on the future use of TM?

……

……

7. Internal healthcare Innovation Outcomes:

In your opinion, TM has the potential to:	**Strongly Disagree**	**2**	**3**	**4**	**Strongly Agree**
A) Be a solution for handling current organisation issues.	☐	☐	☐	☐	☐
B) Enable the organisation to achieve its strategic objectives.	☐	☐	☐	☐	☐
C) Improve information exchange across departments.	☐	☐	☐	☐	☐
D) Improve storing patients' information.	☐	☐	☐	☐	☐
E) Improve retrieving patient's data.	☐	☐	☐	☐	☐

8. External healthcare Innovation Outcomes:

In your opinion, TM has the potential to:	**Strongly Disagree**	**2**	**3**	**4**	**Strongly Agree**
A) Improve communication across organisations.	☐	☐	☐	☐	☐
B) Improve the speed of delivery of healthcare services.	☐	☐	☐	☐	☐
C) Increase range of healthcare services to patients.	☐	☐	☐	☐	☐
D) Improve healthcare services access to patients.	☐	☐	☐	☐	☐
E) Reduce patient waiting time.	☐	☐	☐	☐	☐

In your opinion, how does TM improve healthcare operational efficiency?

.....

.....

9. To what extent do you agree that the organisation has the ability to transform individual knowledge into organisation knowledge?

Strongly Disagree ☐ Disagree ☐ Neither agree nor disagree ☐ Agree ☐ Strongly agree ☐

10. To what extent do you agree that your department is fast in responding to new healthcare demand changes?

Strongly Disagree ☐ Disagree ☐ Neither agree nor disagree ☐ Agree ☐ Strongly agree ☐

Any comments:

……

.....

11. Organisation's Innovative Capacities:

	Strongly Disagree	22	3 3	4 4	Strongly Agree
A) We have successfully introduced technological innovations in the past.	☐	☐	☐	☐	☐
B) Our organisation has well laid policies supporting innovation.	☐	☐	☐	☐	☐
C) We commit human resources to facilitate innovation.	☐	☐	☐	☐	☐
D) Innovation is part of our organisation's long term strategic plan.	☐	☐	☐	☐	☐

12. Organisation's Innovation Acceptance:

	Strongly Disagree				Strongly Agree
A) We take chances on good technological ideas.	☐	☐	☐	☐	☐
B) We have a clear plan for TM adoption in near future.	☐	☐	☐	☐	☐
C) We highly consider the relative advantage of an innovation.	☐	☐	☐	☐	☐
D) We consider the level of an innovation's compatibility with the existing technologies.	☐	☐	☐	☐	☐
E) We consider the level of complexity of an innovation.	☐	☐	☐	☐	☐

Additional comments

……
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……

Thank you for your contribution to this research.

PARTICIPANT CONSENT FORM

The participant should complete the whole of this sheet him/herself

Please tick the appropriate box

	YES	*NO*
Have you read the Research Participant Information Sheet?	☐	☐
Have you had an opportunity to ask questions and discuss this study?	☐	☐
Have you received satisfactory answers to all your questions?	☐	☐
Who have you spoken to? ----------		
Do you understand that you will not be referred to by name in any report concerning the study?	☐	☐
Do you understand that you are free to withdraw from the study:		
• At any time	☐	☐
• Without having to give a reason for withdrawing?	☐	☐
I agree to the use of non-attributable direct quotes when the study is written up or published.	☐	☐
Do you agree to take part in this study?	☐	☐

Signature of Research Participant:

Name in capitals: **Date:**

Thank you for your support

APPENDIX B: VALIDATION INTERVIEW

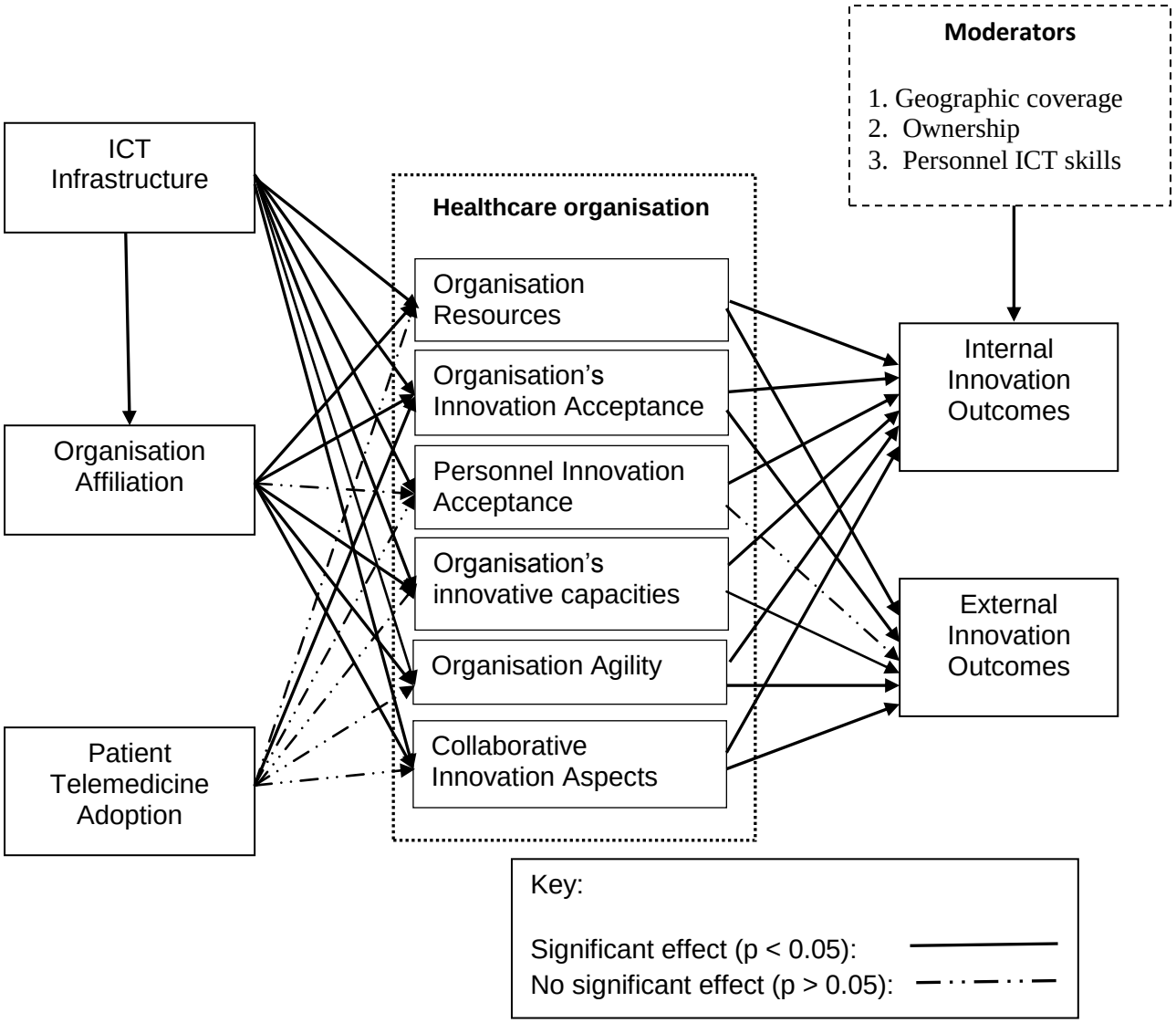
Dear Sir / Madam,

This interview is part of my research at Brunel University, London. It is designed to understand the influence of organisation collaboration on telemedicine deployment in developing countries. The interview is designed to take approximately 30 minutes. Your participation is voluntary and all the information provided will only be used for this research.

Thank you.

Janerose Nyamu
Brunel University, London
College of Engineering, Design and Physical Sciences
Janerose.Nyamu@brunel.ac.uk

Proposed framework



Job role:……..

1. What is your opinion on the proposed framework?

2. What is your opinion on the following: There is a positive relationship between ICT and:
   a) Organisation affiliations……..
   b) Organisation resources……..
   c) Organisation's innovation acceptance……..
   d) Personnel innovation acceptance…….
   e) Organisation's innovative capacities…….
   f) Organisation agility……..
   g) Collaborative innovation aspects…….....

3. What is your opinion on the following: There is a positive relationship between organisation affiliation and:
   a) Organisation resources……
   b) Organisation's innovation acceptance……..
   c) Organisation's innovative capacities…….
   d) Organisation agility……
   e) Collaborative innovation aspects……

4. What is your opinion on the following: There is a negative relationship between organisation affiliation and personnel innovation acceptance.

5. What is your opinion on the following: There is a positive relationship between patient telemedicine adoption and organisation's innovation acceptance.

6. What is your opinion on the following: There is a negative relationship between patient telemedicine adoption and:
   a) Organisation resources…….
   b) Personnel innovation acceptance……...
   c) Organisation's innovative capacities……..
   d) Organisation agility……
   e) Collaborative innovation aspects…….

7. What is your opinion on the following: There is a positive relationship between collaborative innovation internal outcomes and:
   a) Organisation's innovation acceptance……
   b) Personnel innovation acceptance……...
   c) Organisation's innovative capacities……
   d) Organisation agility……
   e) Collaborative innovation aspects……

8. What is your opinion on the following: There is a negative relationship between collaborative innovation internal outcomes and organisation resources.

9. What is your opinion on the following: There is a positive relationship between collaborative innovation external outcomes and:
   a) Organisation resources……
   b) Organisation's innovation acceptance……
   c) Organisation's innovative capacities……
   d) Organisation agility…….....
   e) Collaborative innovation aspects……

10. What is your opinion on the following: There is a negative relationship between collaborative innovation external outcomes and personnel innovation acceptance.

APPENDIX C: ETHICAL APPROVAL DOCUMENTS

Brunel University ethical approval

Brunel University London
Uxbridge UB8 3PH
United Kingdom

www.brunel.ac.uk

17 December 2014

STATEMENT OF ETHICS APPROVAL

Proposer : Janerose Nyamu

Project Title: Collaborative innovation as a facilitator to Telemedicine adoption

Under delegated authority from the College Research Ethics Committee I have considered the proposal recently submitted by you. I am satisfied that there is no objection on ethical grounds to the proposed study.

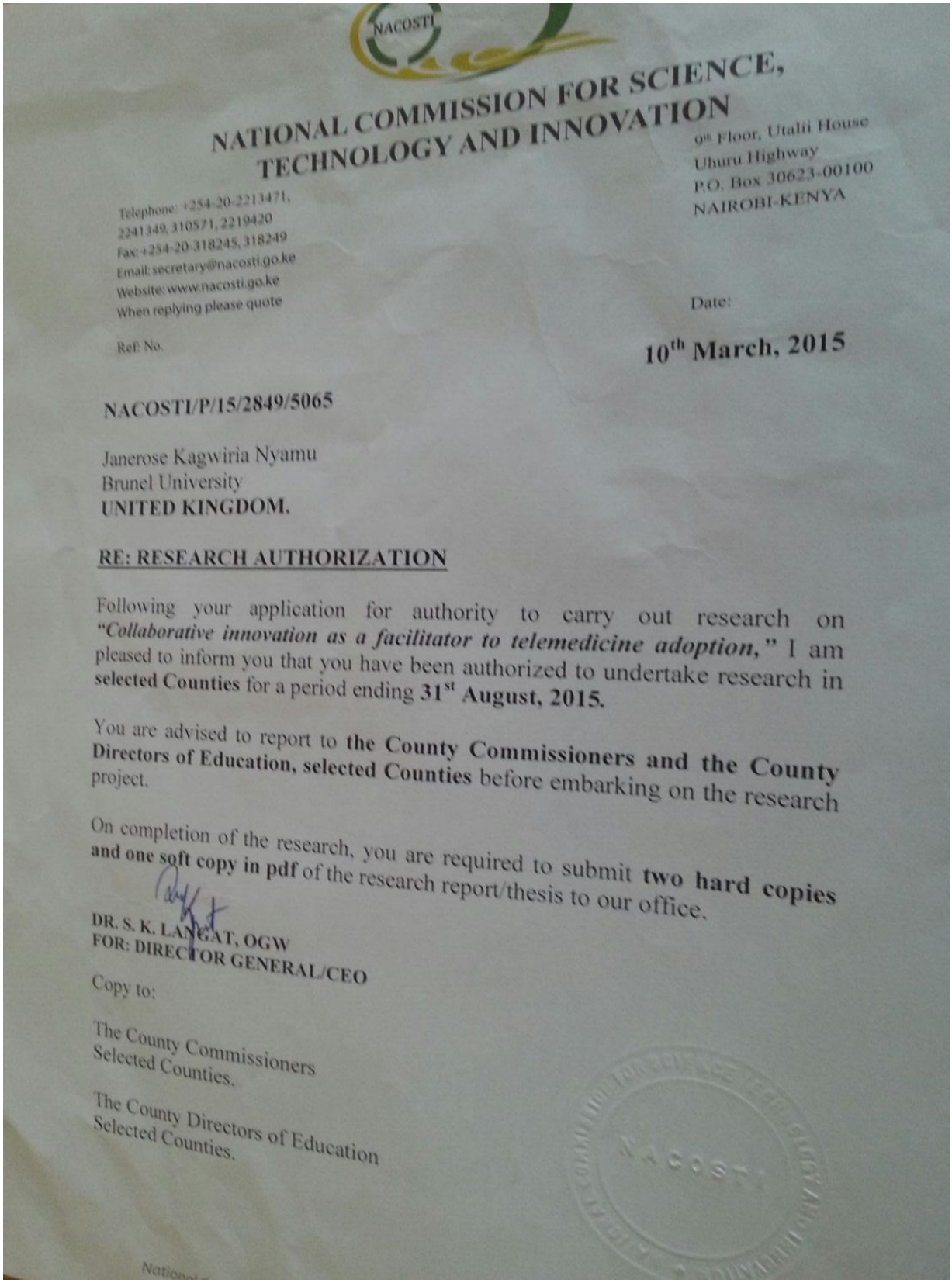
Approval is given on the understanding that you will adhere to the terms agreed with participants and to inform me of any change of plans in relation to the information provided in the application form.

Yours sincerely,

John Park
College Research Manager
T +44(0)1895 266057| E John.Park@brunel.ac.uk

Brunel University London
College of Engineering, Design and Physical Sciences

Kenya NACOSTI research approval



NACOSTI

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

9th Floor, Utalii House
Uhuru Highway
P.O. Box 30623-00100
NAIROBI-KENYA

Telephone: +254-20-2213471,
2241349, 310571, 2219420
Fax: +254-20-318245, 318249
Email: secretary@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

Ref: No.

Date:

10th March, 2015

NACOSTI/P/15/2849/5065

Janerose Kagwiria Nyamu
Brunel University
UNITED KINGDOM.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Collaborative innovation as a facilitator to telemedicine adoption,"*** I am pleased to inform you that you have been authorized to undertake research in **selected Counties** for a period ending **31st August, 2015.**

You are advised to report to **the County Commissioners and the County Directors of Education, selected Counties** before embarking on the research project.

On completion of the research, you are required to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

DR. S. K. LANGAT, OGW
FOR: DIRECTOR GENERAL/CEO

Copy to:

The County Commissioners
Selected Counties.

The County Directors of Education
Selected Counties.

CONDITIONS

1. You must report to the County Commissioner and the County Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit
2. Government Officers will not be interviewed without prior appointment.
3. No questionnaire will be used unless it has been approved.
4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.
5. You are required to submit at least two(2) hard copies and one(1) soft copy of your final report.
6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice

REPUBLIC OF KENYA

NACOSTI

National Commission for Science, Technology and Innovation

RESEARCH CLEARANCE PERMIT

Serial No. A 4396

CONDITIONS: see back page

THIS IS TO CERTIFY THAT:
MS. JANEROSE KAGWIRIA NYAMU
of BRUNEL UNIVERSITY , 3-0 BEACONSFIELD,has been permitted to conduct research in Embu , Isiolo , Machakos , Makueni , Meru , Tharaka-Nithi Counties

on the topic: COLLABORATIVE INNOVATION AS A FACILITATOR TO TELEMEDICINE ADOPTION

for the period ending:
31st August,2015

Permit No : NACOSTI/P/15/2849/5065
Date Of Issue : 10th March,2015
Fee Recieved :Ksh. 2000

Applicant's Signature

Director General
National Commission for Science, Technology & Innovation

APPENDIX D: NORMALITY PLOTS

Regression: Organisation resources

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.542[a]	.292	.284	.741

a. Predictors: (Constant), OrgRes

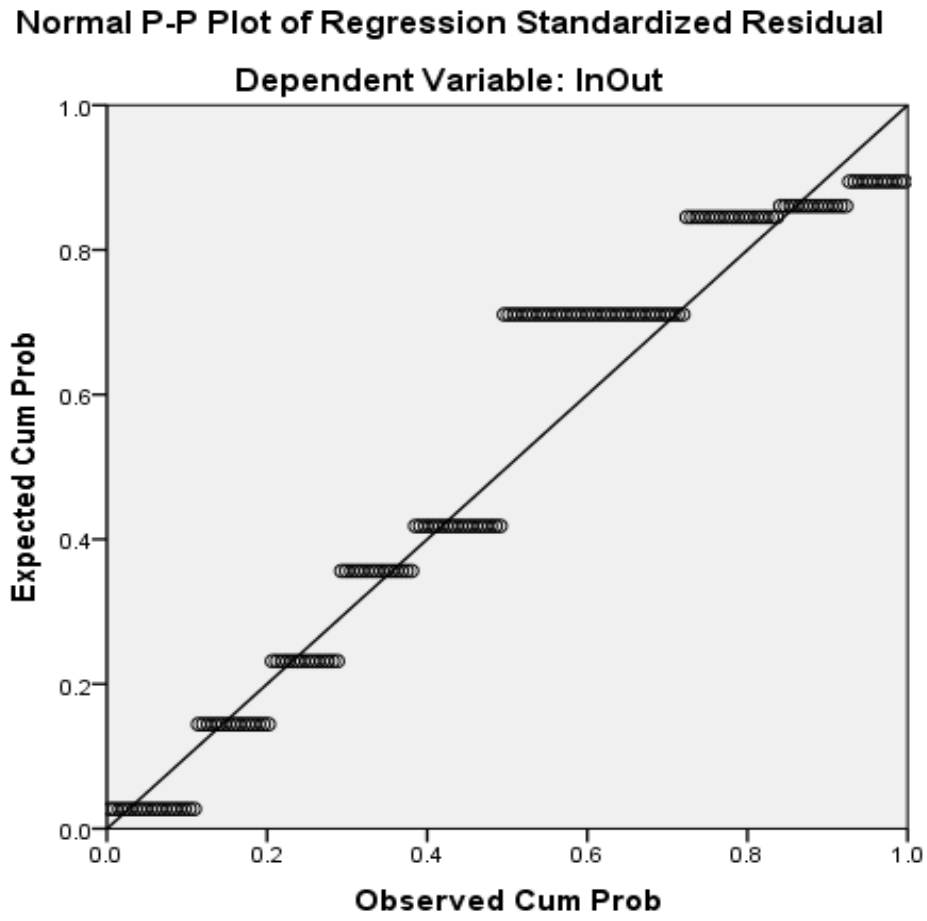
b. Dependent Variable: InOut

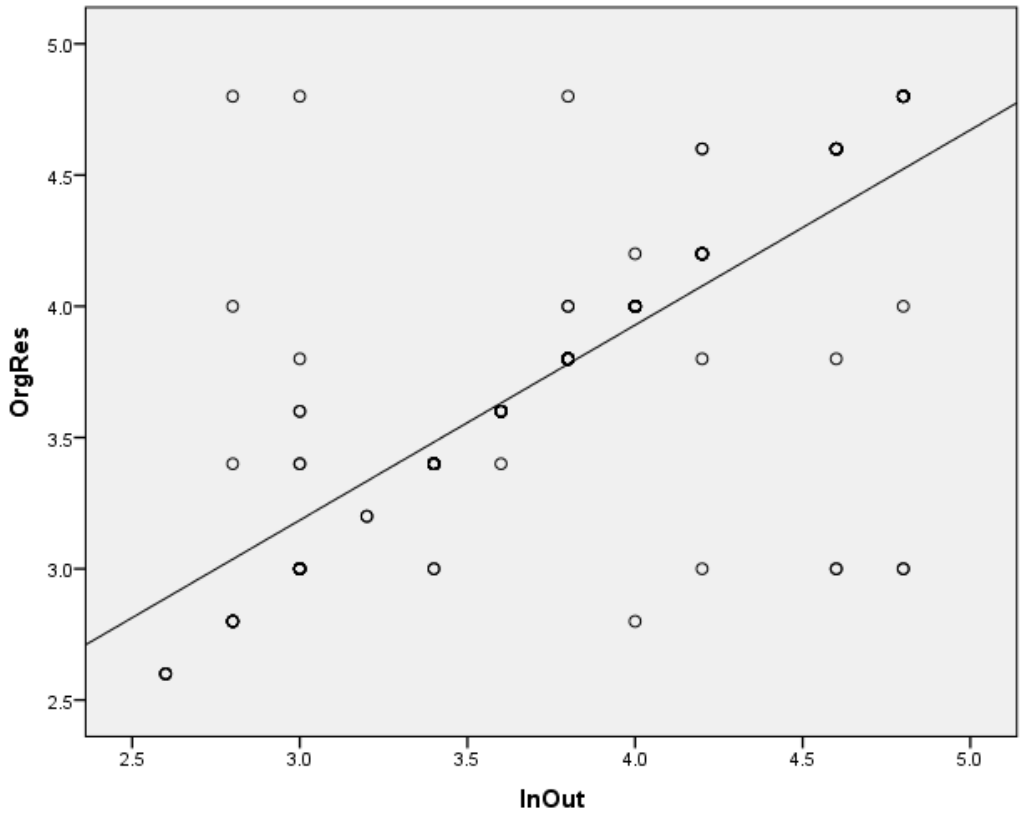
Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.314	.208		20.768	.000
	OrgRes	.251	.741	.303	2.296	.004

a. Dependent Variable: InOut

Charts





Regression: Organisation's innovation acceptance

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.369[a]	.130	.121	.242

a. Predictors: (Constant), OrgInnAcc

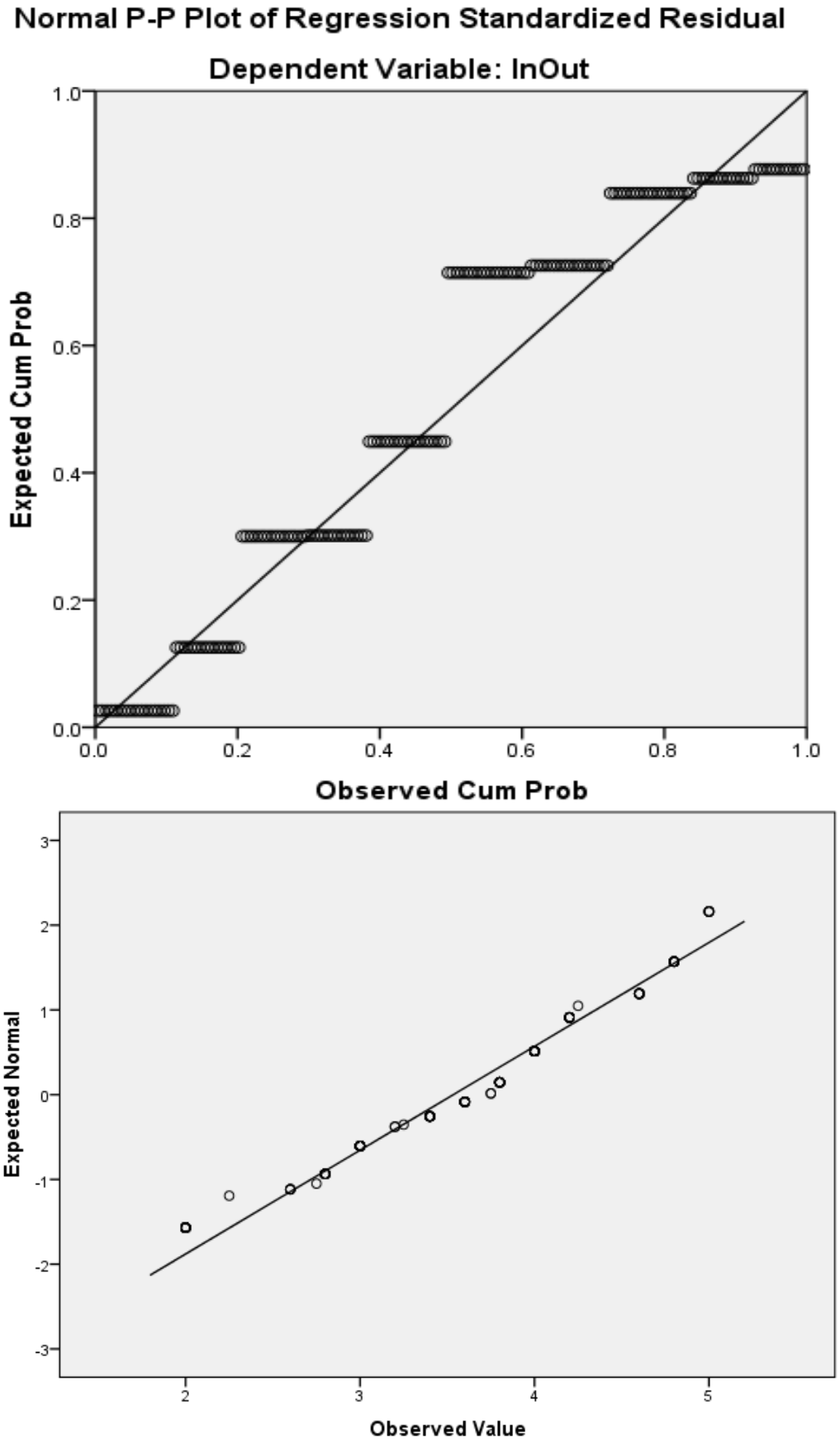
b. Dependent Variable: InOut

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.532	.437		6.358	.000
	OrgInnAcc	.345	.242	.393	2.581	.002

a. Dependent Variable: InOut

Charts


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: lnOut
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0
Expected Normal
Observed Value
-3
-2
-1
0
1
2
3
2
3
4
5

Regression: Personnel innovation acceptance

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.370[a]	.212	.200	.734

a. Predictors: (Constant), PsnInnAcc

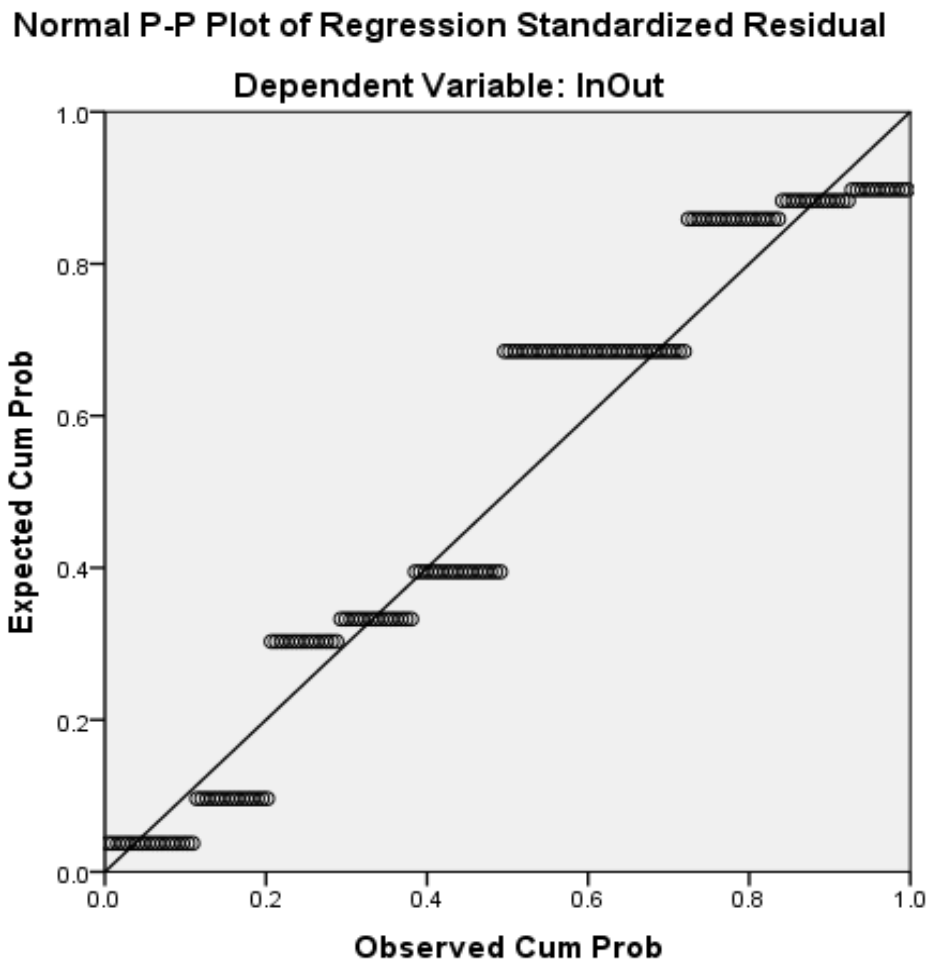
b. Dependent Variable: InOut

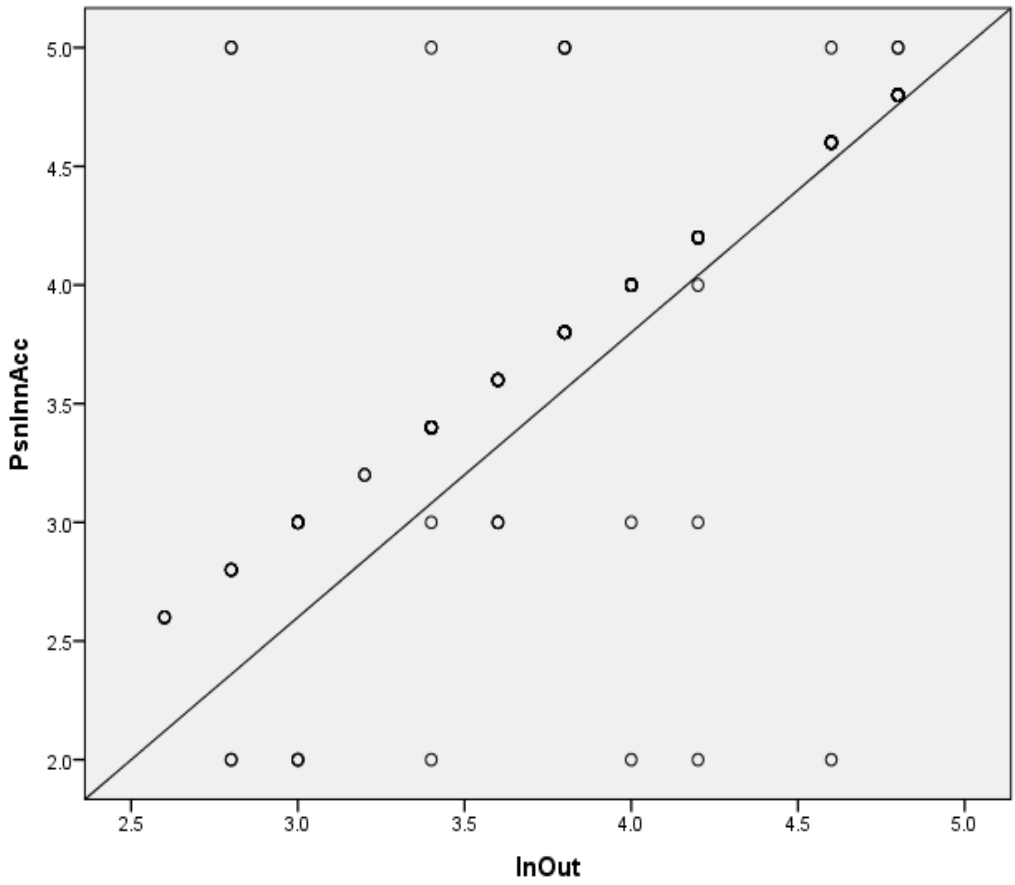
Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.709	.520		9.049	.000
	PsnInnAcc	.106	.734	.212	.875	.028

a. Dependent Variable: InOut

Charts





Regression: Organisation's innovative capacities

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.401[a]	.161	.156	.774

a. Predictors: (Constant), OrgInnCap

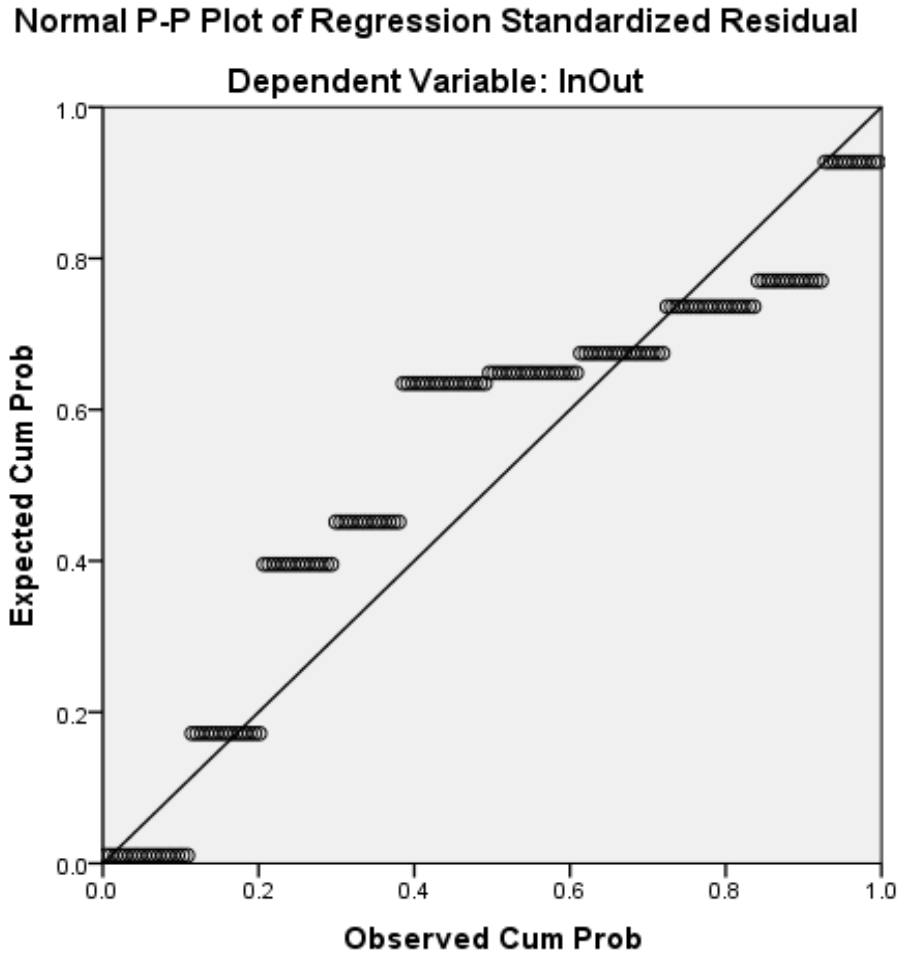
b. Dependent Variable: InOut

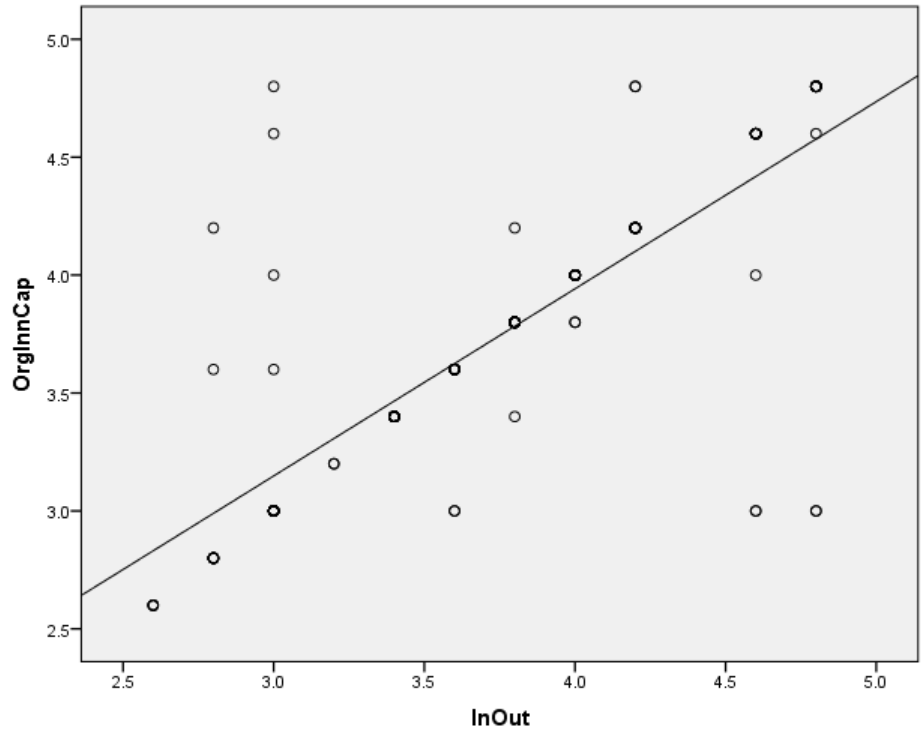
Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.953	.347		17.144	.000
	OrgInnCap	.284	.100	.324	1.259	.007

a. Dependent Variable: InOut

Charts


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: lnOut
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0


OrgInnCap
lnOut
2.5
3.0
3.5
4.0
4.5
5.0

Regression: Organisation agility

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.378[a]	.137	.140	.372

a. Predictors: (Constant), OrgAg

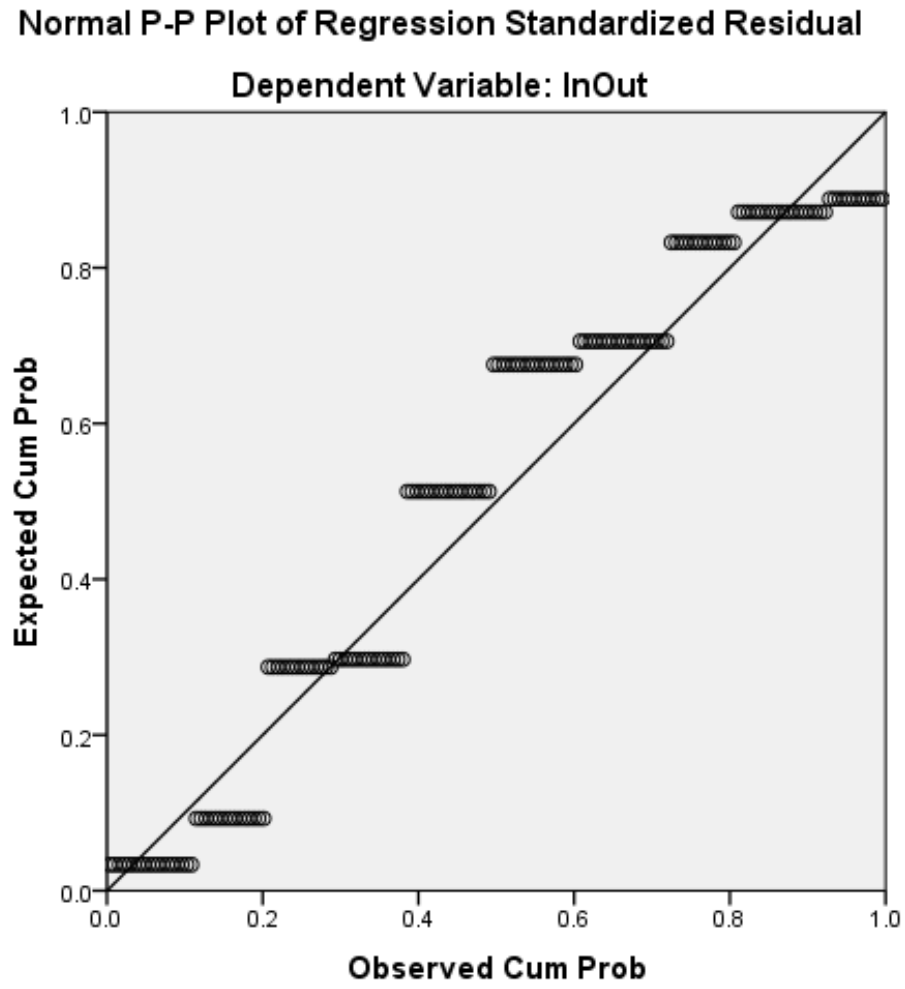
b. Dependent Variable: InOut

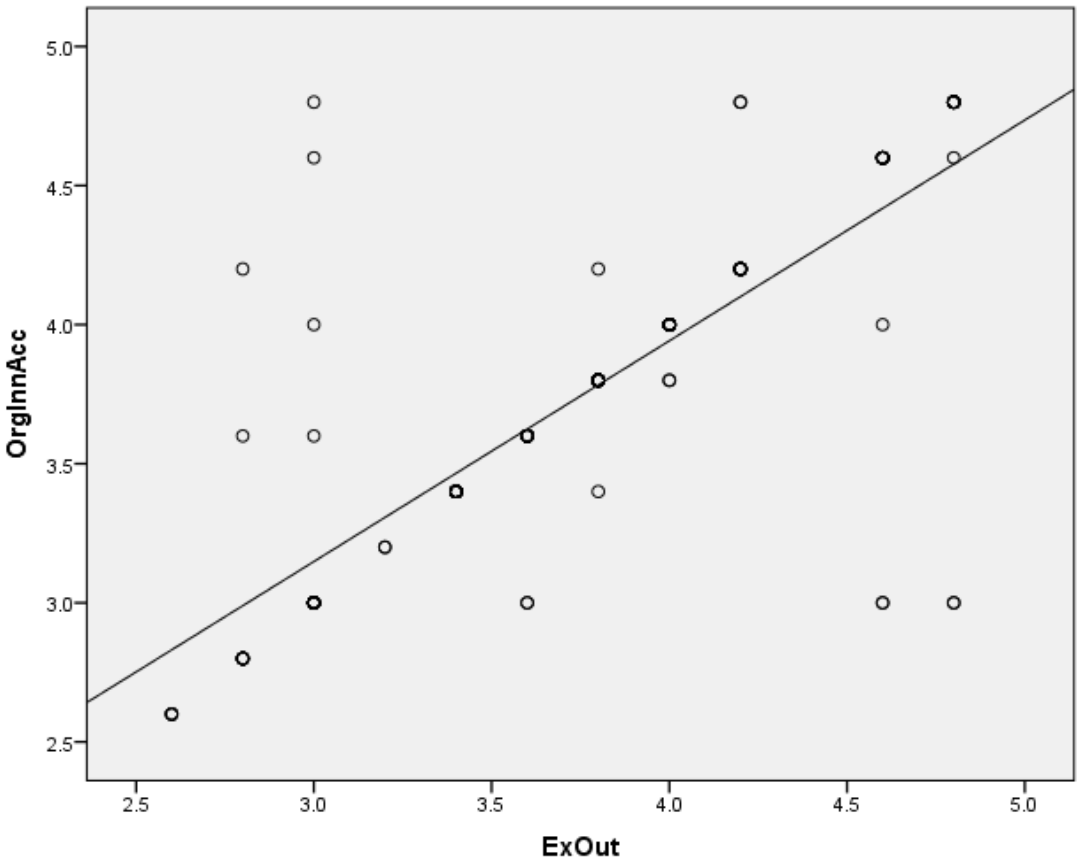
Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.330	.277		15.619	.000
	OrgAg	.243	.372	.293	.925	.020

a. Dependent Variable: InOut

Charts





Regression: Collaborative innovation aspects

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.484[a]	.230	.221	.507

a. Predictors: (Constant), CoInno

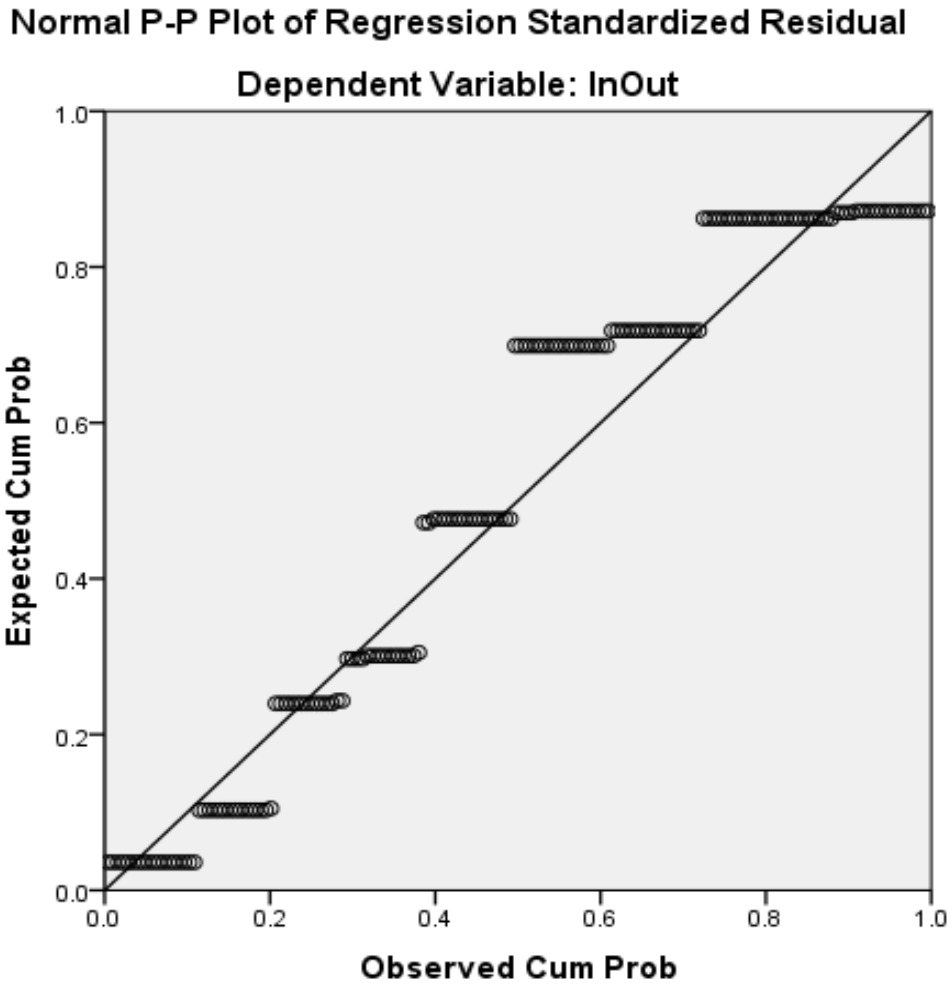
b. Dependent Variable: InOut

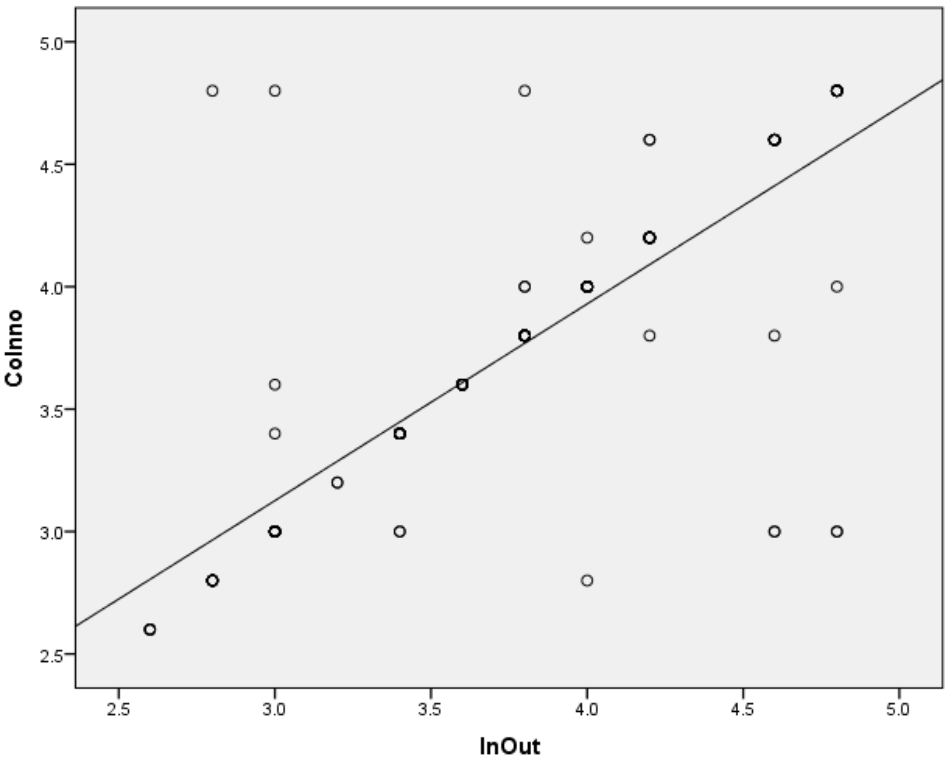
Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.241	.414		10.235	.000
	CoInno	.332	.507	.365	2.352	.004

a. Dependent Variable: InOut

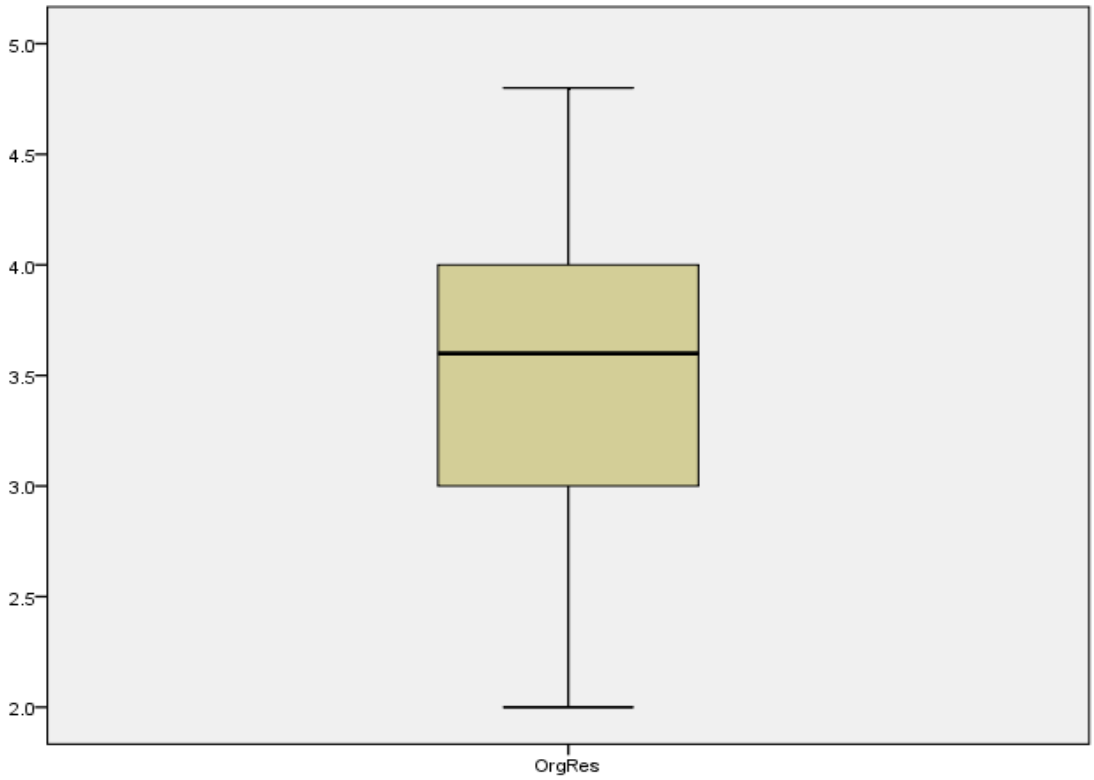
Charts


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: lnOut
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

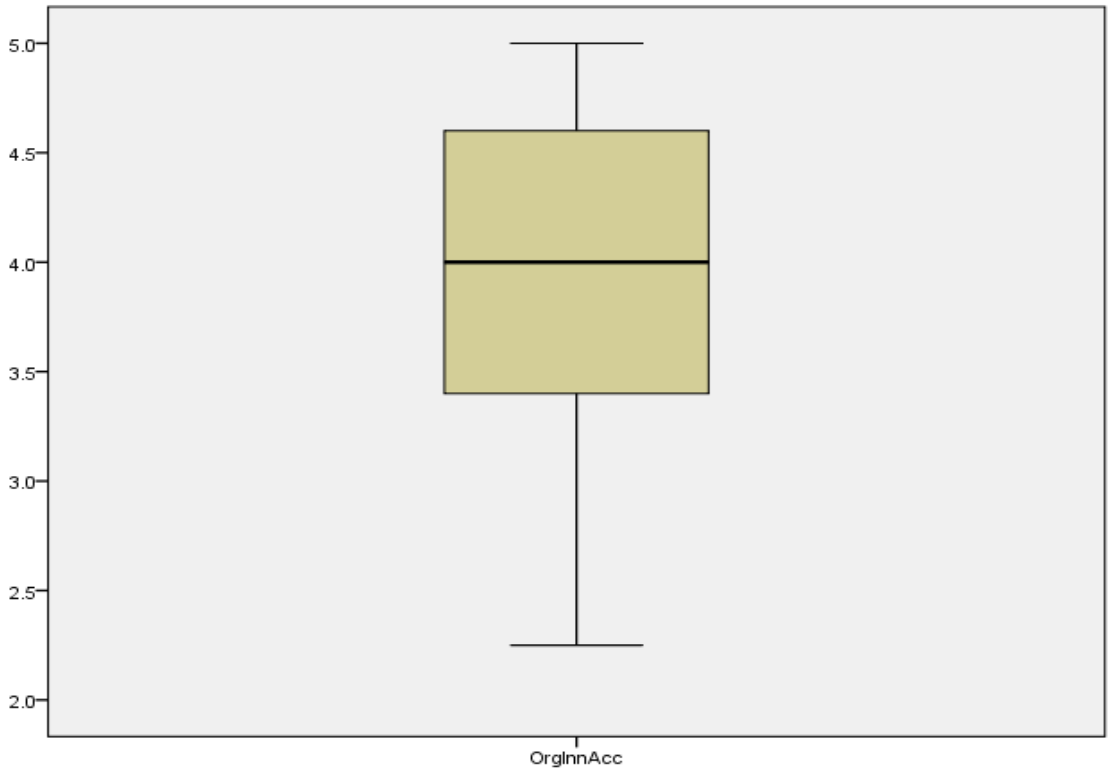

Colnno
lnOut
2.5
3.0
3.5
4.0
4.5
5.0

APPENDIX E: OUTLIER BOX PLOTS

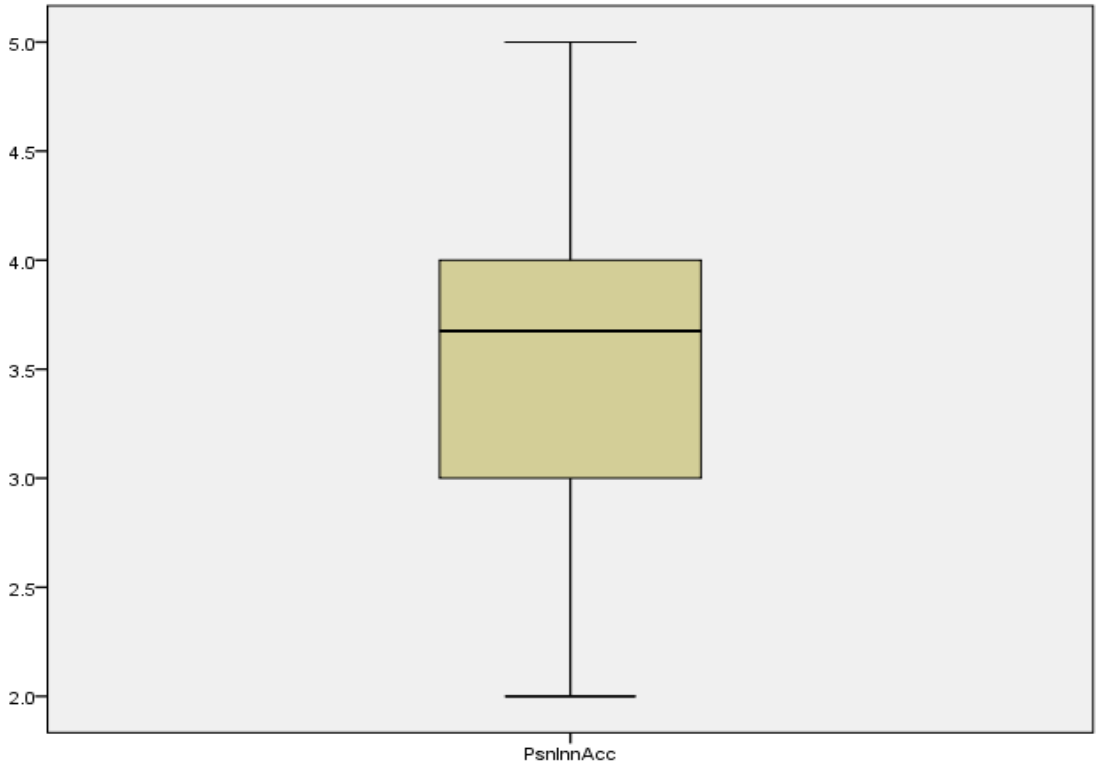
Organisation resources



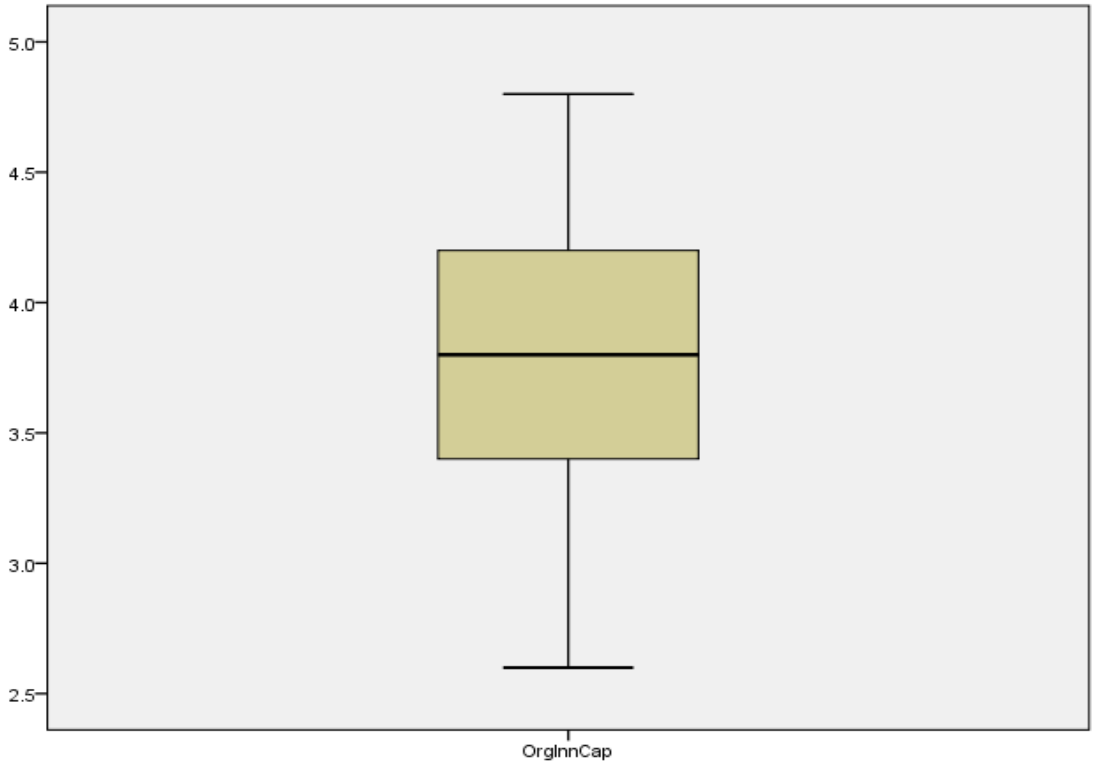
Organisation's innovation acceptance



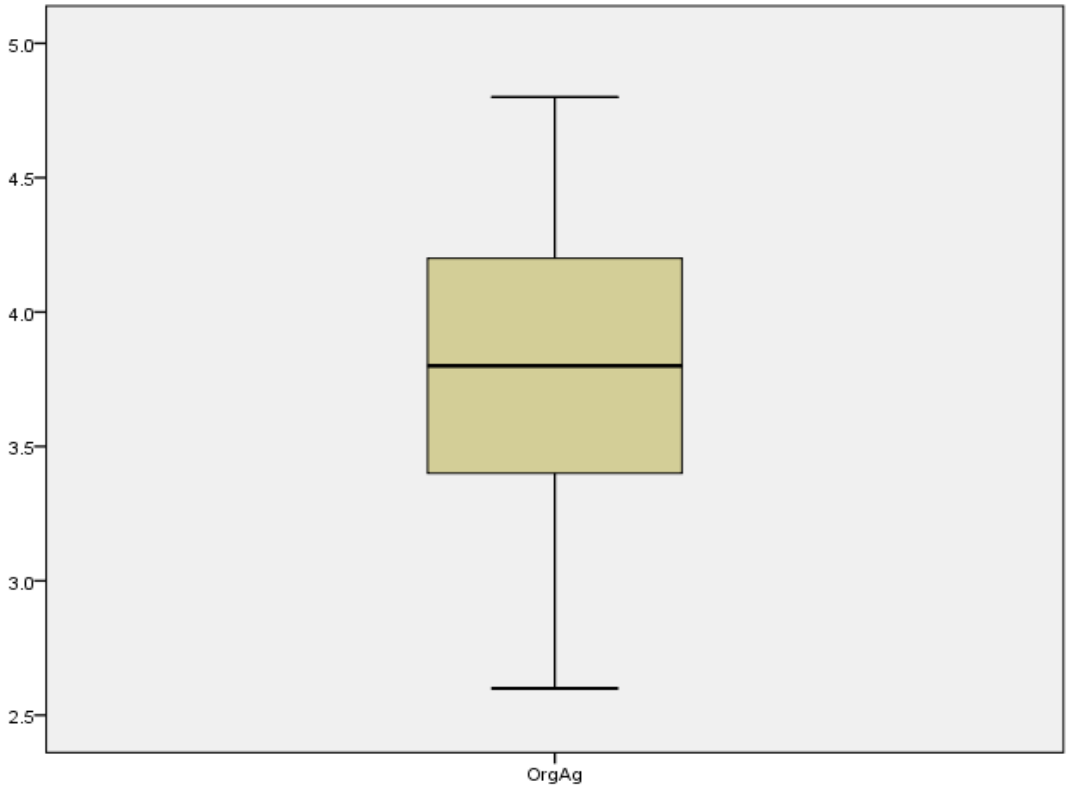
Personnel innovation acceptance



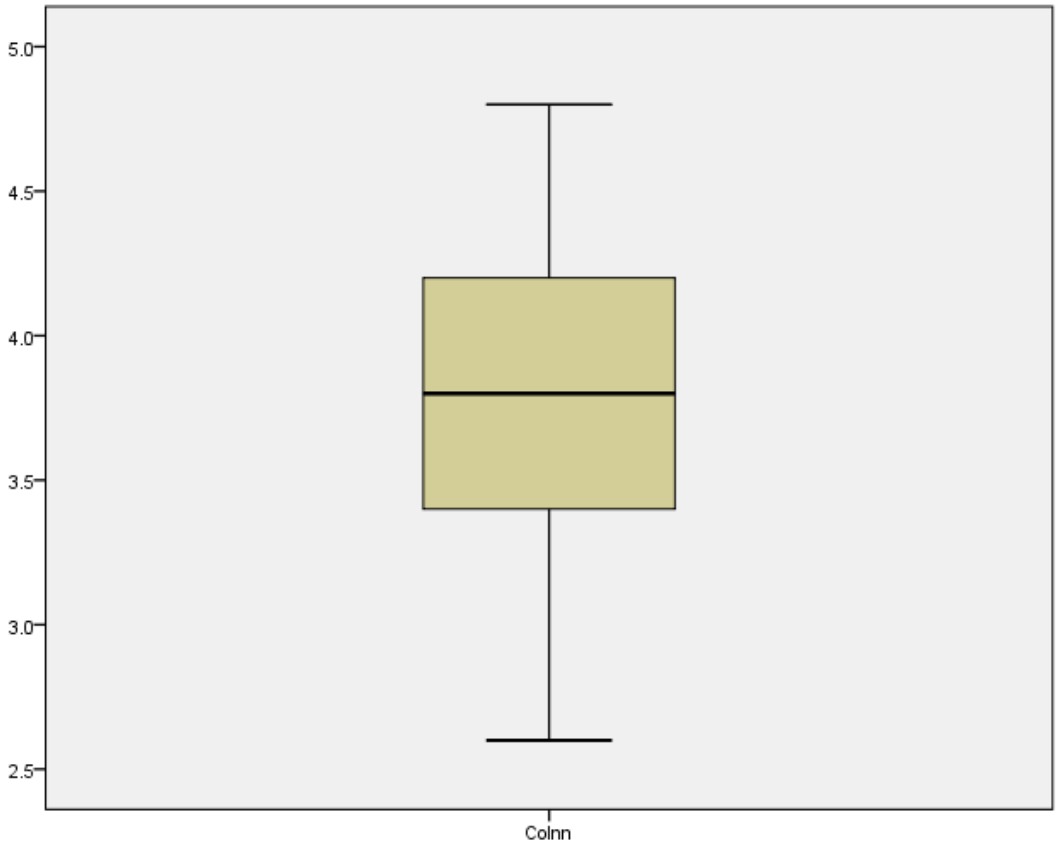
Organisation's innovative capacities



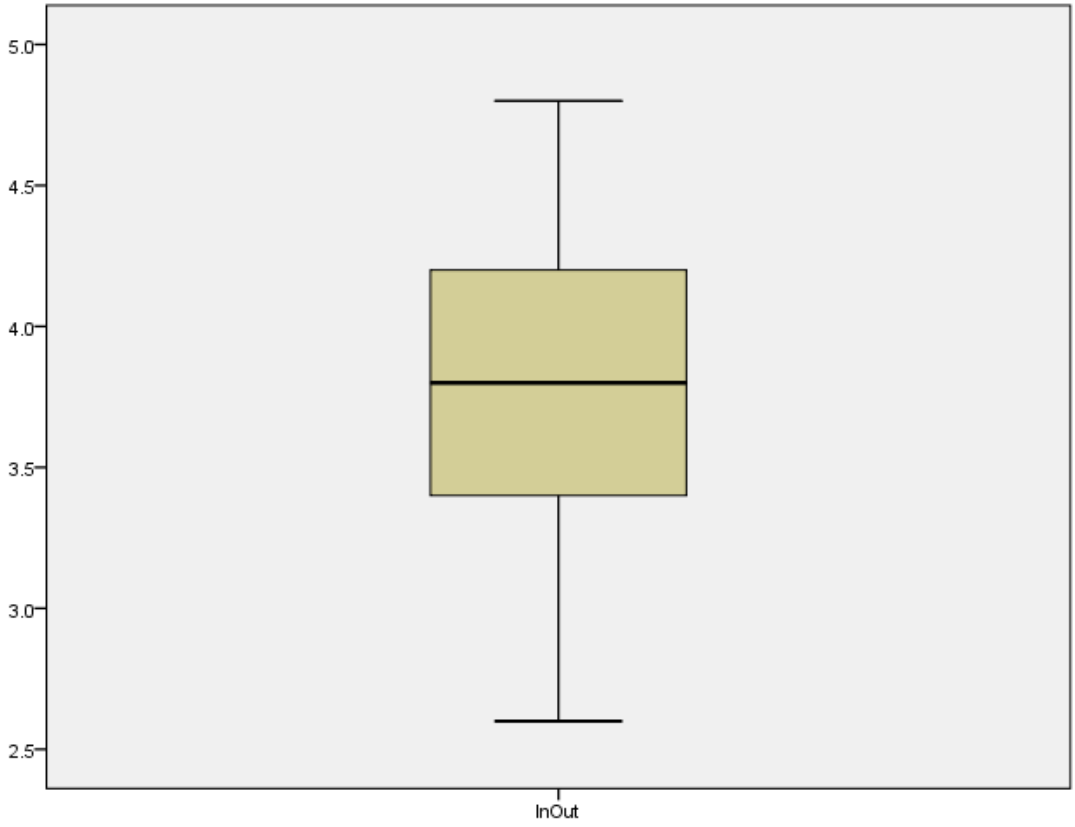
Organisation agility



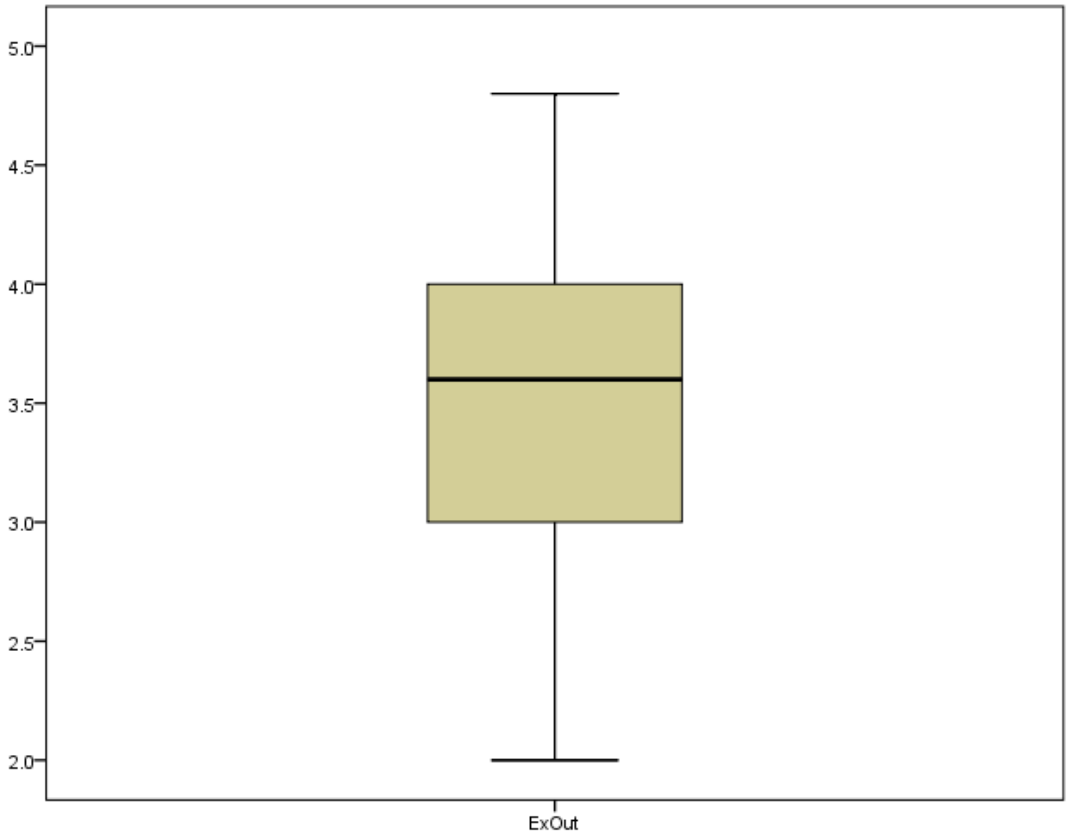
Collaborative innovative aspects



Internal innovation outcomes



External innovation outcomes



Appendix F: ANOVA tests

Descriptive data

Factor	Geographic coverage	N	Mean	Std deviation
ICT Infrastructure	National	7	3.57	0.832
	Provincial	7	3.06	0.911
	County	20	2.62	0.734
	Healthcare centre	16	1.53	0.523
Organisation Affiliation	National	7	3.92	0.632
	Provincial	7	3.67	0.723
	County	20	3.43	0.473
	Healthcare centre	16	3.38	0.615
Organisation Resource	National	7	3.02	0.723
	Provincial	7	2.71	0.912
	County	20	2.41	0.602
	Healthcare centre	16	1.42	0.856
Organisation's innovation acceptance	National	7	4.12	0.454
	Provincial	7	4.05	0.265
	County	20	3.93	0.361
	Healthcare centre	16	3.91	0.218
Personnel Innovation Acceptance	National	7	4.12	0.456
	Provincial	7	3.92	0.655
	County	20	3.01	0.932
	Healthcare centre	16	1.99	0.534
Organisation's innovative capacities	National	7	4.03	0.565
	Provincial	7	3.57	0.421
	County	20	2.45	0.391
	Healthcare centre	16	1.97	0.421
Organisation Agility	National	7	3.93	0.812
	Provincial	7	3.57	0.745
	County	20	2.67	0.623
	Healthcare centre	16	1.82	0.362
Internal Innovation Outcomes	National	7	4.03	0.521
	Provincial	7	3.92	0.802
	County	20	3.87	0.823
	Healthcare centre	16	3.01	0.723
External Innovation Outcomes	National	7	4.31	0.572
	Provincial	7	4.25	0.492
	County	20	4.23	0.294
	Healthcare centre	16	4.12	0.448

ANOVA test comparing ICT means for national, provincial, county and healthcare centres

ICT	df	Mean square	F	Sig.
Between Groups	3	32.923	9.823	.001
Within Groups	46	3.351		
Total	49			

Post hoc comparison

Dependent Variable: ICT
Tukey HSD

(I) Geographic coverage		Mean Difference	Sig.
National	Provincial	.510	.693
	County	.950	.005
	Health centre	2.041	.000
Provincial	County	.440	.031
	Health centre	1.530	.014
County	Health centre	1.090	.021

ANOVA test comparing organisation affiliation means for national, provincial, county and healthcare centres

Affiliation	df	Mean square	F	Sig.
Between Groups	3	7.698	.898	.104
Within Groups	46	8.572		
Total	49			

ANOVA test comparing organisation resource means for national, provincial, county and healthcare centres

Resources	df	Mean square	F	Sig.
Between Groups	3	10.234	7.435	.002
Within Groups	46	1.376		
Total	49			

Dependent Variable: Organisation resource

(I) Geographic coverage		*Mean Difference*	*Sig.*
National	Provincial	.310	.035
	County	.610	.010
	Health centre	1.600	.000
Provincial	County	.300	.042
	Health centre	1.290	.005
County	Health centre	.990	.045

ANOVA test comparing organisation's innovation acceptance means for national, provincial, county and healthcare centres

Organisation's innovation acceptance	*df*	*Mean square*	*F*	*Sig.*
Between Groups	3	20.107	.137	.242
Within Groups	46	146.764		
Total	49			

ANOVA test comparing organisation's innovative capacities means for national, provincial, county and healthcare centres

Innovative capacity	*df*	*Mean square*	*F*	*Sig.*
Between Groups	3	45.234	3.834	.021
Within Groups	46	11.798		
Total	49			

Post Hoc Multiple Comparisons

Dependent Variable: Organisation's innovative capacities

(I) Geographic coverage		*Mean Difference*	*Sig.*
National	Provincial	.460	.042
	County	1.580	.003
	Health centre	2.060	.000
Provincial	County	1.120	.036
	Health centre	1.600	.001
County	Health centre	.480	.040

ANOVA test comparing organisation agility means for national, provincial, county and healthcare centres

Agility	*df*	*Mean square*	*F*	*Sig.*
Between Groups	3	11.234	8.019	.000
Within Groups	46	2.238		
Total	49			

Post Hoc comparison

Dependent Variable: Organisation agility

(I) Geographic coverage		*Mean Difference*	*Sig.*
National	Provincial	.360	.144
	County	1.260	.009
	Health centre	2.110	.000
Provincial	County	.900	.013
	Health centre	1.750	.001
County	Health centre	.850	.063

ANOVA test comparing innovation outcomes means for national, provincial, county and healthcare centres

Innovation outcomes		*df*	*Mean square*	*F*	*Sig.*
InOut	Between Groups	3	9.000	4.534	.014
	Within Groups	46	2.452		
	Total	49			
ExOut	Between Groups	3	0.704	.317	.127
	Within Groups	46	2.219		
	Total	49			

Post Hoc comparison

Dependent Variable: Internal Innovation Outcomes

(I) Geographic coverage			*Mean Difference*	*Sig.*
Internal Innovation Outcomes	National	Provincial	.111	.080
		County	.160	.010
		Health centre	1.020	.000
	Provincial	County	.050	.061
		Health centre	.910	.010
	County	Health centre	.860	.031

APPENDIX G: T-TESTS

ICT infrastructure for private and government organisations

Group Statistics

Organisation ownership		*N*	*Mean*	*Std. Deviation*	*df*	*Sig (p)*
ICT	Private	21	3.98	.932	48	.002
	Government	29	3.18	.523		

Organisation affiliation based on organisation ownership

Group Statistics

Organisation Ownership		*N*	*Mean*	*Std. Deviation*	*df*	*Sig (p)*
Affiliation	Private	21	3.86	.801	48	.321
	Government	29	3.68	.746		

Organisation resources based on organisation ownership

Group Statistics

Organisation ownership		*N*	*Mean*	*Std. Deviation*	*df*	*Sig (p)*
Resources	Private	21	4.01	.401	48	.001
	Government	29	3.11	.712		

Organisation's innovation acceptance based on organisation ownership

Group Statistics

Organisation ownership		*N*	*Mean*	*Std. Deviation*	*df*	*Sig (p)*
Organisation's innovation acceptance	Private	21	4.23	.902	48	.232
	Government	29	4.16	.692		

Personnel innovation acceptance based on organisation ownership

Group Statistics

Organisation ownership		*N*	*Mean*	*Std. Deviation*	*df*	*Sig (p)*
Personnel innovation acceptance	Private	21	3.72	.592	48	.036
	Government	29	2.98	.810		

Organisation's innovative capacities based on organisation ownership

Group Statistics

Organisation ownership		*N*	*Mean*	*Std. Deviation*	*df*	*Sig (p)*
Innovation capacity	Private	21	3.73	.602	48	.006
	Government	29	2.56	.698		

Organisation agility based on organisation ownership

Group Statistics

Organisation ownership		*N*	*Mean*	*Std. Deviation*	*df*	*Sig (p)*
Agility	Private	21	4.12	.532	48	.009
	Government	29	3.21	.402		

Innovation outcomes based on organisation ownership

Group Statistics

Organisation ownership		*N*	*Mean*	*Std. Deviation*	*df*	*Sig (p)*
Internal innovation outcomes	Private	21	4.17	.523	48	.059
	Government	29	4.13	.392		
External innovation outcomes	Private	21	3.76	.602	48	.099
	Government	29	3.81	.437		